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STRESS TEST EXERCISES
II Course on Financial Stability - CEMLA

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Digital meeting
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DG FINANCIAL STABILITIY, REGULATION AND RESOLUTION

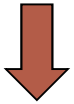
CONTENT

1. **Introduction to macroprudential stress tests**
2. **Stress test methodologies and scenarios**
3. **Architecture of the Bank of Spain Stress Test**
4. **Spanish Experience during the COVID-19 Crisis**
5. **Climate change and stress test**

CONTENT

- The origin of the stress tests lies in the interest of the banks themselves to improve the management of their risks.

EXERCISES CARRIED OUT BY BANKS THEMSELVES



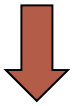
STRATEGIC PURPOSES

- ✓ Pursue of management policies more attuned to bank risks
- ✓ Better allocation of the funds raised by banks
- ✓ Improvement of the quality of their business in anticipation of possible unfavorable shocks

The extension of the VAR techniques to manage the risks of financial firms through the late 80s and early 90s exemplifies the private sector search for stress testing tools. The **collapse of the New York Stock Exchange in 1987 and the turbulence in the European monetary market in the early 90s** provided strong incentives for more sophisticated risk management tools such as **Value at Risk (VAR**).

- Stress tests become a very useful tool for competent authorities responsible for evaluating the strength of the financial system:

MACROPRUDENCIAL AUTHORITIES



PURPOSE

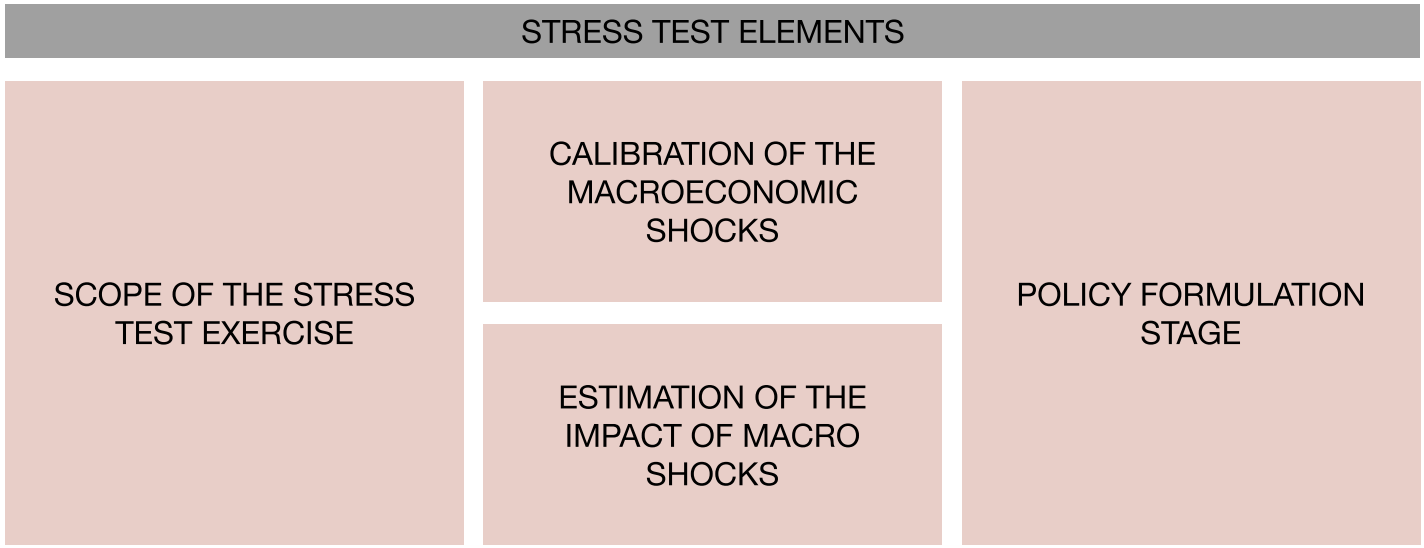
The stress test aim to identify vulnerabilities while assessing and evaluating the loss-absorption capacity of a given banking system when these vulnerabilities crystallise and become real shocks

En **2009 la EBA** llevó a cabo el primer stress test a nivel europeo y **desde 2014**, la realización de este tipo de ejercicios forma parte de los requisitos del programa supervisor del **Banco de España.**

- The top-down stress test framework can be applied to support **the design of macroprudencial policy**:
  - The **macrofinancial scenarios** used for FLESB allow to combine consistently the risks identified in **macroprudential indicators**
  - The distance between baseline and adverse scenarios can be calibrated to capture **countercyclical concerns**
  - The measurement of the solvency impact in FLESB can thus be used to guide the **calibration capital buffers**
  - The FLESB framework also allows for **sensitivity analysis**, isolating the impact of the materialization of specific risks, which is also useful for the **calibration of macroprudential capital buffers**
  - The FLESB framework can also provide useful information for the calibration of **microprudential** requirements (P2G)

CONTENT

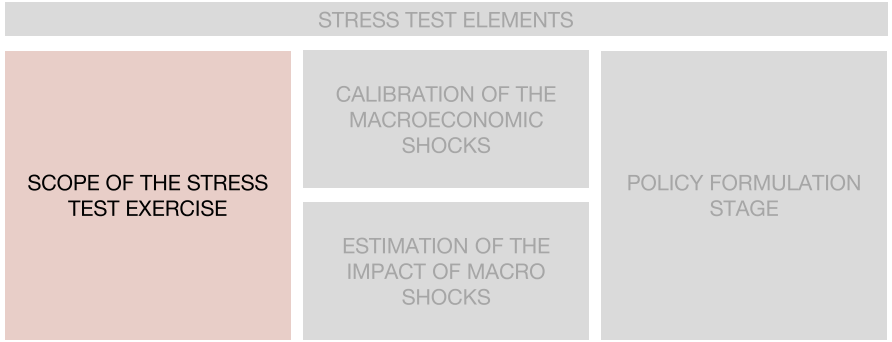
- The following figure presents the **key elements** of Stress Test Exercises:



METHODOLOGIES AND SCENARIOS

Scope of the exercise

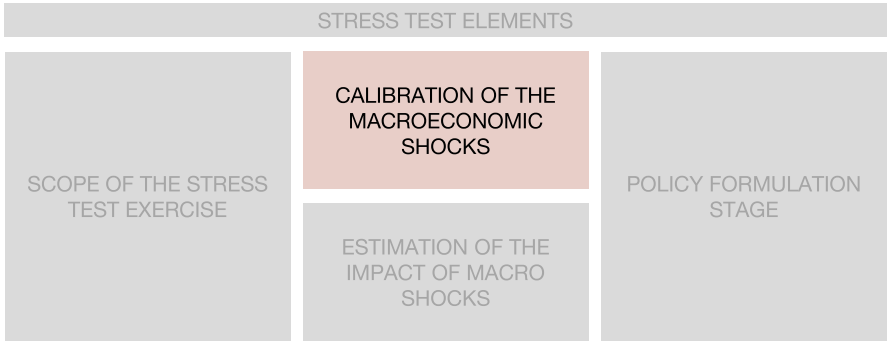
- The scope of the exercise is key in order to determine its nature:



- In the first stage the following key parameters must be decided:
  - ✓ Level of the analysis in terms of participants and areas of study
  - ✓ Time horizon for the exercise
  - ✓ Approach:

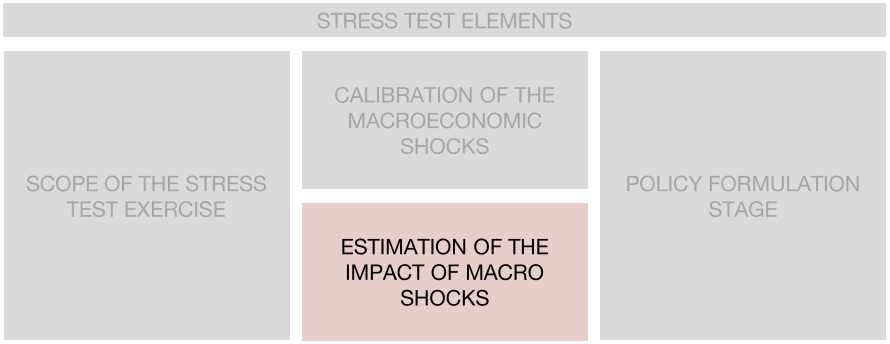
TOP – DOWN	VS.	**BOTTOM - UP**
Whole System / Significant Portion Homogeneous Data Homogeneous Framework of Analysis		Bank level Bank specific Model Bank specific Data

- The definition and calibration of the macroeconomic shocks are part of the second stage:



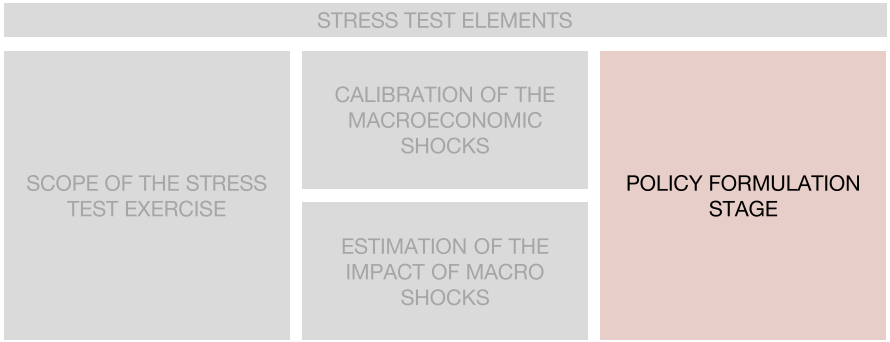
- The second stage of a stress test consists of establishing those improbable, but plausible adverse shocks that may negatively affect the stability of the system being tested and with respect to which the system's soundness and resilience is to be checked.
- The process of characterising the shocks to be considered consists in turn of various sub-stages:
  - ✓ Identification and definition: the type of shock to be considered must be determined .
  - ✓ Calibration: the size of the shock to be considered is specified.
  - ✓ Implementation: introduction into the system and quantification of its impact.

- Effects on macroeconomic variables are transferred to the main elements of the banking system.



- This stage is based on the relationships established (usually via an econometric model) between macro-variables and the main elements, under the form of economic and financial variables, of the banking system.
- It consists of choosing certain key variables that directly affect the financial condition of the system analysed (for example, a certain portfolio or some of its components) and estimating how they change in response to the defined shock.
- For this stage, Bank of Spain has developed its tool named Forward Looking Exercise on Spanish Banks (FLESB), which will be shown in more detail in the next section.

- In the last phase, the application of what has been learned is sought:



- As a corollary to the previous stages, policy responses must be considered once the impact on financial stability and the estimated resilience of the system have been determined from the results of the stress exercise.
- There is a need to consider what measures will help the smooth working, efficiency and continued stability of the system under examination.

WEAKNESS OR VULNERABILITY → **EXISTING PRUDENCIAL ELEMENTS**
- ✓ Revise
- ✓ Adjust
- ✓ Strengthen

For further information "TOP-DOWN STRESS TESTS AS A MACRO-PRUDENTIAL TOOL: METHODOLOGY AND PRACTICAL APPLICATION". Carlos Pérez Montes and Carlos Trucharte.

https://www.bde.es/f/webbde/GAP/Secciones/Publicaciones/InformesBoletinesRevistas/RevistaEstabilidadFinanciera/13/Mayo/Fic/ref2013245.pdf

CONTENT

- FLESB has typically used a baseline scenario and up to two adverse scenarios (baseline, medium adverse and severely adverse):

  - The **baseline scenario** is usually aligned with macroeconomic forecasts and it is thus useful to evaluate the solvency of the bank sector under the expected macroeconomic path.
  - The **adverse scenarios**:
    - *These scenarios are commonly hypothetical and they do not represent a good conditional forecast (proper communication of this fact is essential).*
    - *The adverse scenarios capture the potential materialization of relevant macro-financial risks.*
    - *The introduction of a countercyclical element in scenario design (greater distance between adverse and baseline scenarios when macroeconomic performance is good) can facilitate the use of the stress test for Macroprudential purposes.*

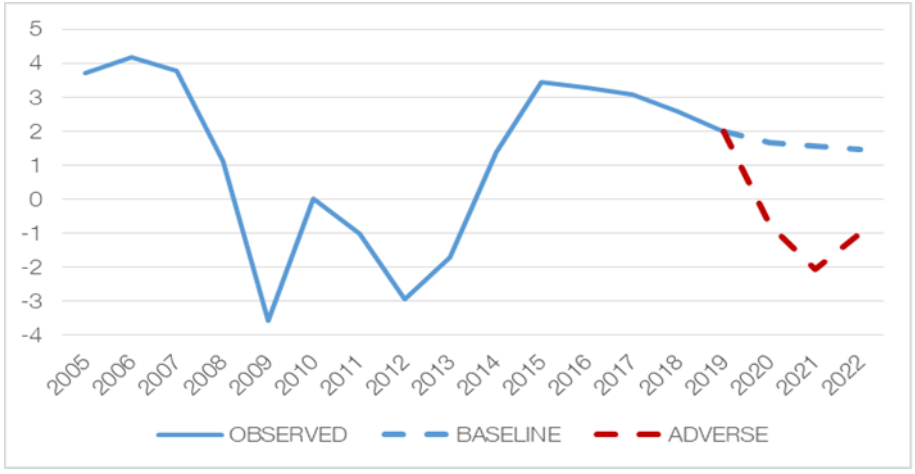
- **Ease of communication motivates the focus on few scenarios**, which are generally the most relevant setups for a majority of stakeholders.
- If the **EBA EU-Wide Stress Test scenarios** are available (every two years), the FLESB uses those scenarios, which cover macroeconomic evolution both in Spain and abroad.
- Capability to **adapt to a higher number of scenarios.**

➢ The macroeconomic scenario covers key variables with an effect on the **Spanish Economy**:

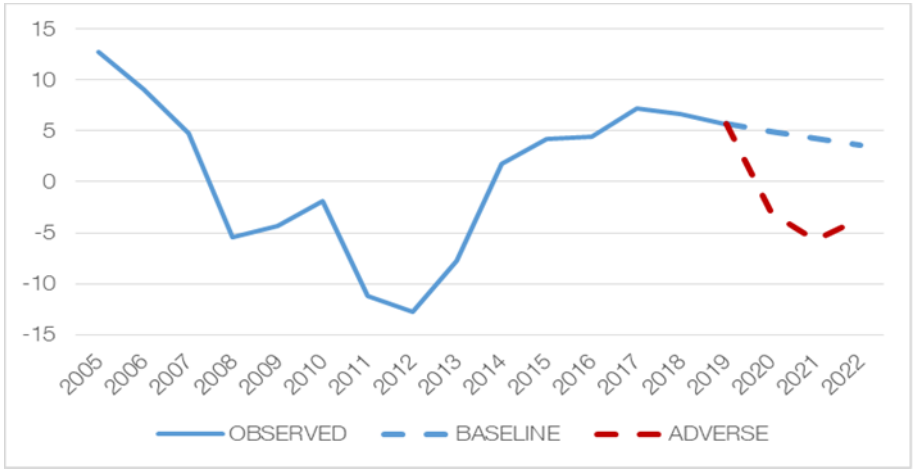
- ✓ Real GDP
- ✓ GDP deflator
- ✓ Nominal GDP
- ✓ HICP
- ✓ Unemployment rate (%)
- ✓ Euribor, 3 months
- ✓ Euribor, 12 months
- ✓ Long term interest rate (10-year bond)
- ✓ Madrid stock exchange index (growth rate)
- ✓ House prices (growth rate)
- ✓ Land prices (growth rate)
- ✓ Exchange rate ($/eur)
- ❑ Credit to households for consumption (growth rate)
- ❑ Credit to households for housing (growth rate)
- ❑ Credit to firms (growth rate)

EBA ST 2020: A "LOWER FOR LONGER" ADVERSE SCENARIO – PATH OF KEY VARIABLES

GDP GROWTH



HOUSE PRICE GROWTH



ARCHITECTURE OF THE BANK OF SPAIN STRESS TEST

Data

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CENTRAL CREDIT REGISTER

- Loan by loan data (Aprox. 50M every month)
- Information on each loan status, sector of activity, collateral type…
- Monthly data

From 2016 the CCR includes new information that will allow to reduce the data requested by BoS to the entities.

→

- Probability of Default
- Cure rates
- Credit conversion factors (CCFs)

BANKS' INVENTORY DATASETS FOR SUPERVISORY PURPOSES

- Information gathered yearly ad-hoc
- Granular loan and collateral data
- Cross-sectional data

→

- Loss Given Loss (LGL)
- Foreclosed assets

REGULATORY REPORTS ON CREDIT EXPOSURES

- Supervisory reporting reconciling banks' accounting and credit portfolio figures
- Classifies banks' credit exposures using different dimensions

→

- Exposure at Default (EAD)

ADDITIONAL SOURCES OF INFORMATION

- Banks business plans and P&L projections
- Other official reporting templates (i.e. balance sheets, P&L…)

→

- Pre-Provisioning Profit (PPP)
- Consistency checks

ARCHITECTURE OF THE BANK OF SPAIN STRESS TEST

Portfolios

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- **Credit risk** in domestic exposures is a key part of the FLESB Solvency Tool. Seven different portfolios are analysed separately:

RETAIL	MORTGAGES	44%	% of total system exposure
	CONSUMPTION LOANS	10%	
	SELF-EMPLOYED ENTREPRENEURS	4%	
CORPORATE	CORPORATES	19%	
	SMALL AND MEDIUM ENTERPRISES	15%	
	REAL ESTATE DEVELOPERS	6%	
	PUBLIC WORKS	2%	

- The **SIs** and the **LSIs** are treated separately in order to identify different business characteristics.

SIGNIFICANT INSTITUTIONS	12	WITH SIGNIFICANT INTERNATIONAL ACTIVITY
		REST
LESS SIGNIFICANT INSTITUTIONS	45	BANKS
		COOPERATIVES
OTHER LESS SIGNIFICANT INSTITUTIONS	15	BANKS: PRIVATE BANKING, TRADE, INVESTMENT SERVICES, etc.

- The calculation of **Expected Loss (EL)** is a central element of the exercise and a key determinant of the evaluation of the solvency of individual banks.
- For each bank and for each of the seven portfolios, we estimate EL as a function of more fundamental credit risk parameters: PD, Loss Given Loss, Cure Rate and Credit Conversion Factors.

EL = PD x LGD [Loss Given Loss x (1-Cure Rate)] x EAD (adjusted by CCFs)

- The expected loss is calculated **under the IFRS9 framework.**

STAGE 1	STAGE 2	STAGE 3
Performing	Assets with significant increase in credit risk	Non - Performing
PROBABILITY OF DEFAULT		
PD 12m	PD lifetime	PD = 1
CURE RATE		
Cure New Defaults	Cure New Defaults	Cure All Defaults

EL = PD x LGD [Loss Given Loss x (1-Cure Rate)] x EAD (adjusted by CCFs)

PROBABILITY OF DEFAULT

- This parameter is built from CCR data. The default status of individual loan exposures is tracked over time.
- It is possible to calculate the rate of normal loan exposures of a certain bank and portfolio that enter default in a given period (Flow into default). One econometric model for each of the seven portfolios and for each group of banks (SI, LSI).

$$PD_{bank,\ time,\ sector} = F[\sum \alpha_{j,sector} \cdot \text{Macro Variable}(j)_{time} + \sum \beta_{k,sector} \cdot \text{Bank Variable}(k)_{bank,\ time}]$$

- Additionally, the transitions between the different stages are calculated and moved based on the regression obtained for S1 to S3, because it is a more robust series.

YEAR 1

		T + 1		
		S1	S2	S3
T	S1	-	X	X
	S2	X	-	X
	S3			

YEAR 2

		T + 1		
		S1	S2	S3
T	S1	-	X	X
	S2	X	-	X
	S3			

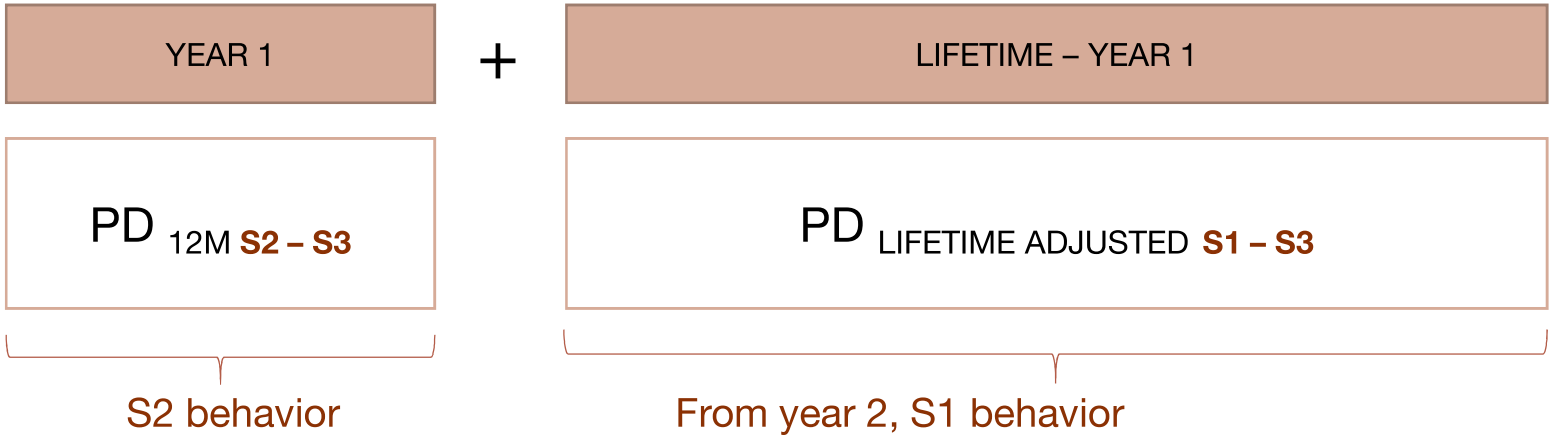
YEAR 3

		T + 1		
		S1	S2	S3
T	S1	-	X	X
	S2	X	-	X
	S3			

EL = PD x LGD [Loss Given Loss x (1-Cure Rate)] x EAD (adjusted by CCFs)

PROBABILITY OF DEFAULT

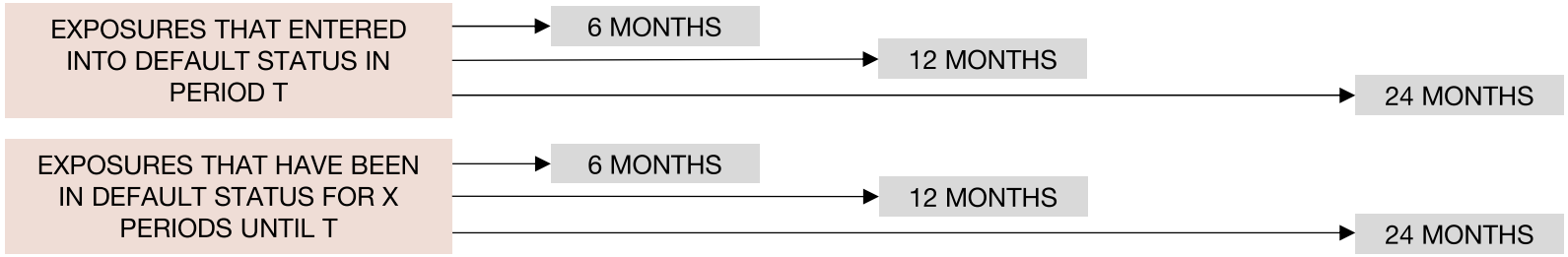
- PD lifetime is calculated and it will be applied to the S2 exposures.
- The lifetime probability is estimated observing a longer period (four years, 6 for mortgages).
- As shown in the following diagram, the PD for exposures in S2 is formed from two different components:



EL = PD x LGD [Loss Given Loss x (1-Cure Rate)] x EAD (adjusted by CCFs)

CURE RATE DATA

- Possibility that defaulted exposures may recover (or “cure”) prior to foreclosure/liquidation
- The default status of individual exposures is tracked over time.
- It is possible to calculate the rate of defaulted exposures of a certain bank and portfolio that exit out of default in a given horizon (flow out default).
- As other risk parameters, cure rates evolve over the economic cycle and they are amenable to statistical modelling.



EL = PD x LGD [Loss Given Loss x (1-Cure Rate)] x EAD (adjusted by CCFs)

LOSS GIVEN LOSS

- For exposures that default and do not cure, the associated losses must be calculated

$$LGL = 1 - \frac{Adjusted\ Collateral\ Value}{Loan}$$

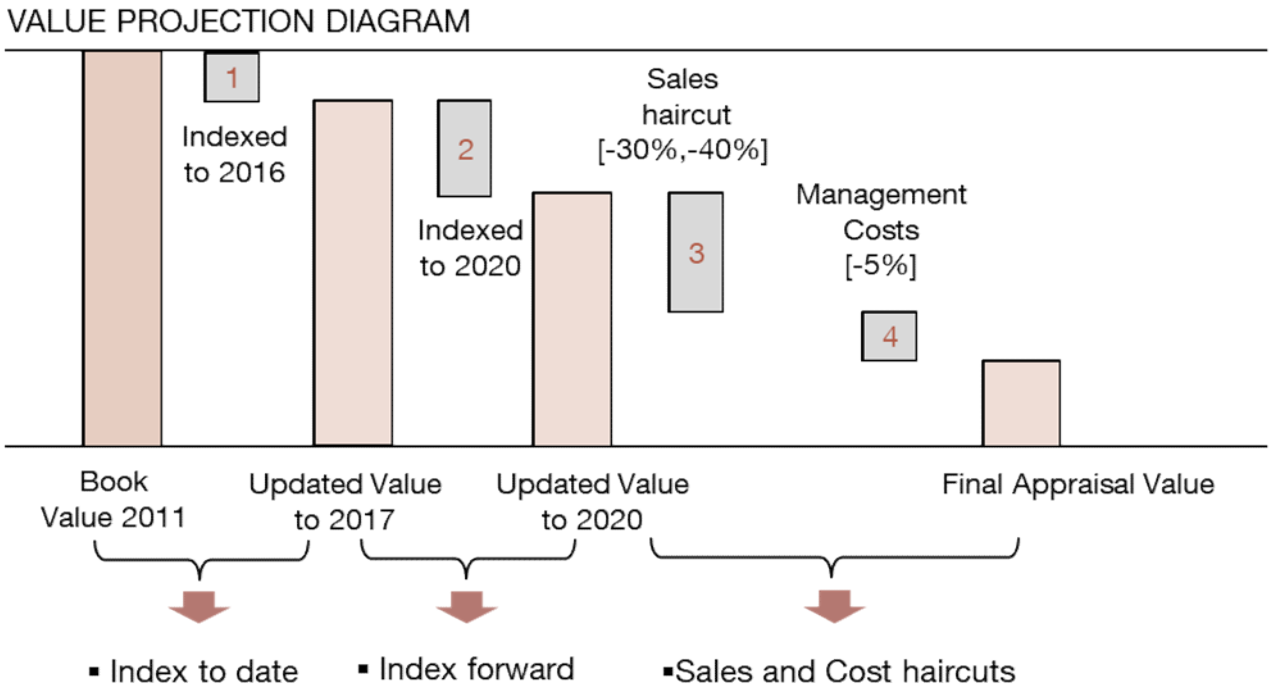
- To compute the ***Adjusted Collateral Value***, we index forward **appraisal values** considering different **macroeconomic scenarios** and different **valuation haircuts.**
- The calculation of the LGL combines **information of different datasets**: loan tape and file of foreclosed asset sales.
- We compute a **different LGL for each bank-portfolio-default status** combination. This means we have a different LGL for loans on performing (S1, S2) or default (S3) situations.

- An analogous procedure is applied to calculate the loss rate over gross accounting value of the stock of foreclosed assets

EL = PD x LGD [Loss Given Loss x (1-Cure Rate)] x EAD (adjusted by CCFs)

LOSS GIVEN LOSS

- Adjustment factor to collateral values is calculated as follows:



- For the projections the macroeconomic scenarios are used in models by province.

EL = PD x LGD [Loss Given Loss x (1-Cure Rate)] x EAD (adjusted by CCFs)

EXPOSURE AT DEFAULT

- Credit register is used to calculate **credit conversion factors (CCFs)**, that is, the additional amount of credit a company obtains by making extended use of its credit facility precisely prior to default.

$$EAD_t\_Adjusted = EAD_t + CCF * Undrawn\ part_{t-1}$$

Credit Performing in period t-1 → Normal in period t : Ø

Credit Performing in period t-1 → Defaulted in period t : CCF

$$CCF = \frac{Drawn_t - Drawn_{t-1}}{UnDrawn_{t-1}}$$

ARCHITECTURE OF THE BANK OF SPAIN STRESS TEST

Pre Provisioning Profit

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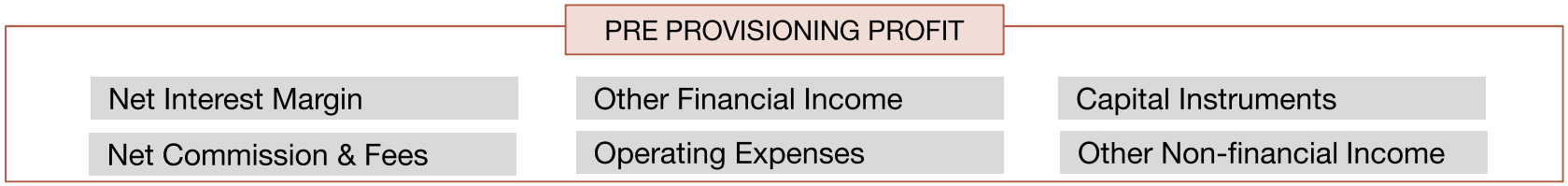
- PPP is not modelled directly. Instead, each component is projected independently:



- PPP projections for each component are estimated using:
  - The **business plans** templates reported by the banks (three-year horizon)
  - The data in **regulatory reports** of banks to Bank of Spain
  - Time series and projections (scenarios) of **macroeconomic variables.**
- There are different possible methodologies:
  - The business plans are the starting points for the exercise after analyzing the outliers.
  - The utilization of econometric models in order to relate the PPP components to the macroeconomic variables.

ARCHITECTURE OF THE BANK OF SPAIN STRESS TEST

Internacional

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- The current crisis has an **impact on the global economy.** Therefore, it is especially relevant to estimate the generation of new capital resources in the foreign subsidiaries.
- The SI with significant international activity have a **63% of credit exposure out of Spain.**

MACRO SCENARIO

- Real GDP Growth
- Inflation
- Interest Rates
- Unemployment
- Exchange Rate

CREDIT GROWTH

- In Local currency: Function of Real GDP, Inflation and the Credit to GDP Ratio
- In Euros: Additional Impact of Exchange Rate

EXPECTED LOSS MODELS

- For each, country of interest 4 portolios are modelled:
  - Large Corporates + OFIs
  - SMEs
  - Households – House Acquisition
  - Households – Others
- For each country-portfolio-stage losses are computed from granular parameters (EBA templates and Corep)
  - Transition Rates (TR13, TR23, etc.)
  - LGDs and Loss Rates (LTLR2X, LTLR3, etc.)

PPP Impact

- For each country, PPP is broken down into (based on public financial statements):

- Net Interest Income
- Other PPP: ROF, Net Fees, Op. Expenses, etc

- Under the assumption of stable margins, PPP is driven by:

  - Credit Growth
  - NPL

- RWA are calculated in accordance with the **evolution of credit** (Spain, Abroad) in each **scenario.**
  - Reconciliation between **banks' credit growth projections in Spain** and **BDE scenario for average credit growth in Spain.**
  - Prudent **credit growth** assumption for key subsidiaries based on balance sheet data.
- Additional correction based on **an increase of NPLs (Spain, Abroad)** derived from the EL model and the different macroeconomic scenarios.
- Maintain constant the elements not in the focus of the analysis (operational risks, market risk, etc).
- **Macroeconomic scenarios** impact RWAs through credit growth and the determination of the level of non-performing exposures.

CONTENT

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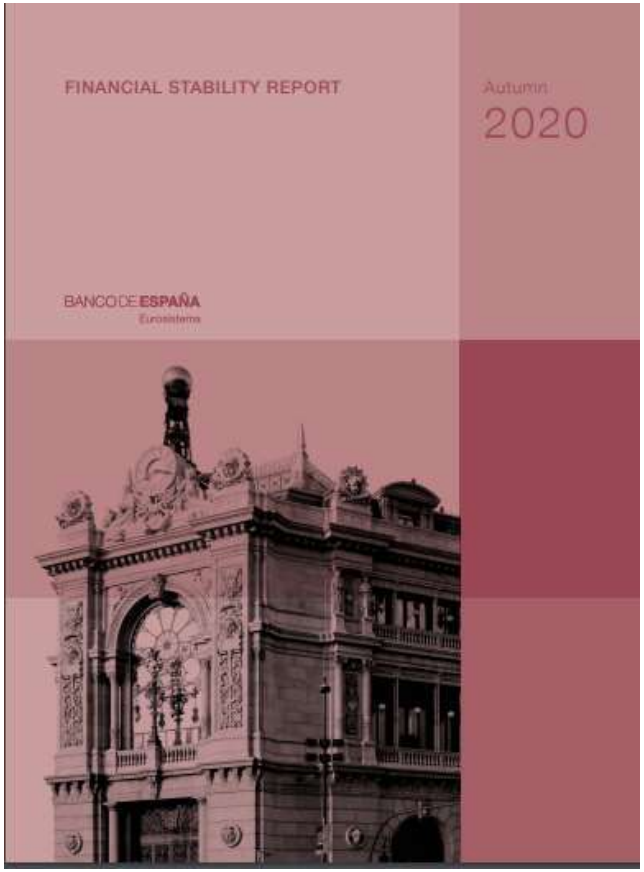
4. Spanish Experience during the COVID-19 Crisis
5. Climate change and stress test

- Last October, Bank of Spain published its **Financial Stability Report.**
- The **main risks** faced by the Spanish economy during the CoVid19 crisis are presented.
- Also the **FLESB results** shown in this presentation are included.



https://www.bde.es/f/webbde/Secciones/Publicaciones/InformesBoletinesRevistas/InformesEstabilidadFinancera/20/ficheros/FSR_Autumn2020.pdf

- As a result of the grave economic crisis caused by the COVID-19 pandemic, the **scenarios are markedly contractionary**
  - …defined by a **severe shock the first year** and a gradual recovery afterwards
  - The **baseline** scenario for Spain reflects a cumulative **fall in GDP of 1.6%,** with the decline much exacerbated under the **adverse scenario (- 5.7%)**

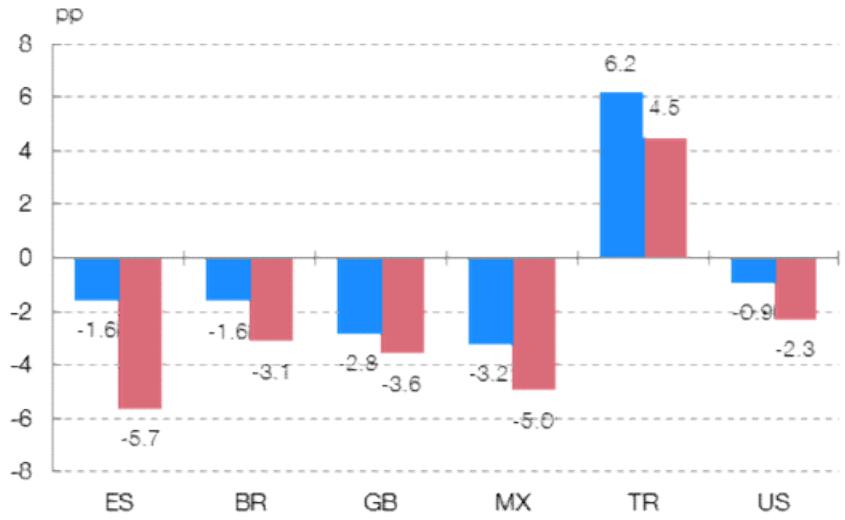
MACROECONOMIC SCENARIOS

	Baseline scenario 2020-2022	Adverse scenario 2020-2022
GDP (cumulative growth)	-1.6	-5.7
Unemployment rate (% of labour force) (average)	18.6	23.5
Price of housing (cumulative growth)	-3.8	-11.6
Lending to households for house purchase (cumulative growth)	-5.4	-11.1
Lending to households for other purposes (cumulative growth)	-12.0	-17.6
Lending to businesses (cumulative growth)	-2.2	-5.9
12-month interbank interest rate (average)	-0.3	-0.2
10-year sovereign bond interest rate (average)	1.0	1.3

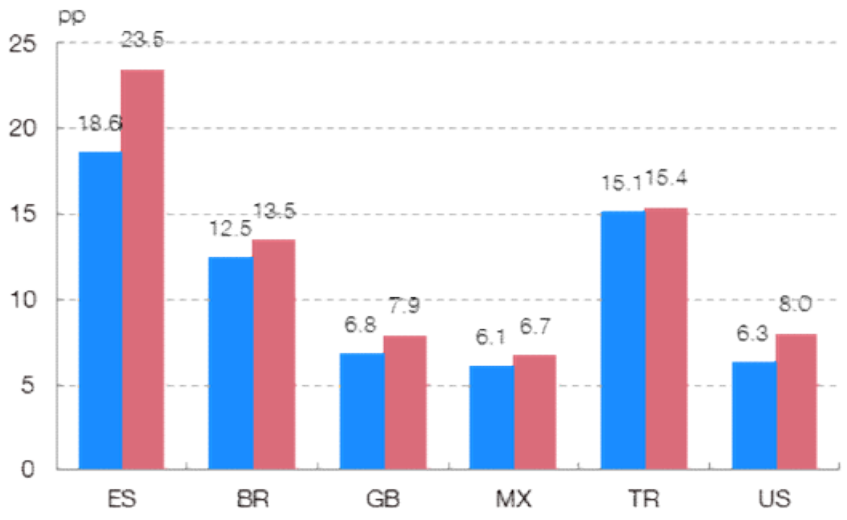
SOURCE: Banco de España.

- At the **international level** the scenarios reflect a **similar pattern to that of Spain in terms of GDP growth**
  - **Only Turkey posts positive average growth** thanks to a vigorous recovery (albeit one accompanied by imbalances)

1 YEAR-ON-YEAR RATE OF CHANGE OF GDP UNDER THE BASELINE AND ADVERSE SCENARIOS (a)



2 UNEMPLOYMENT RATE UNDER THE BASELINE AND ADVERSE SCENARIOS (b)

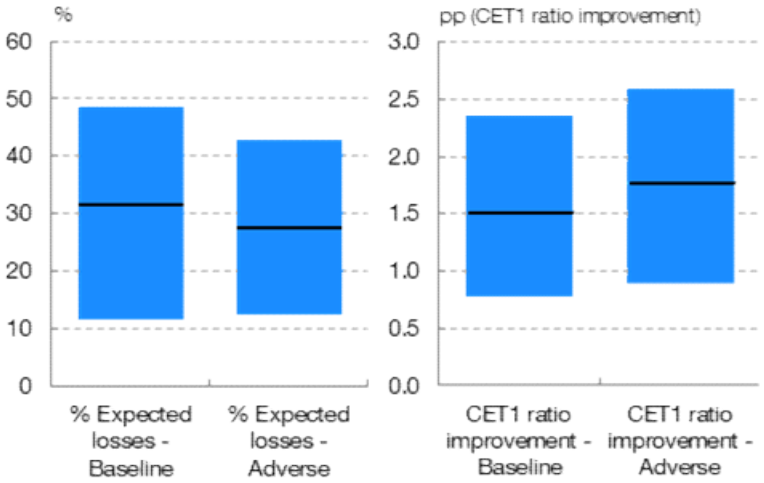


SOURCE: Banco de España.

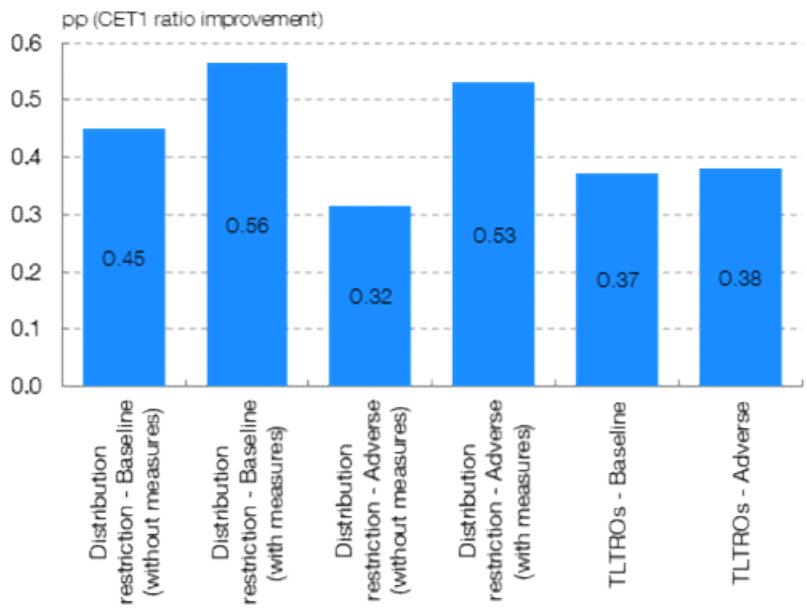
a Cumulative GDP growth over the exercise's three-year horizon (2020-2022).
b Average unemployment rate for the exercise's three-year horizon (2020-2022).

- The FLESB framework was used to assess the **impact of the measures adopted on the solvency of Spanish institutions**, under certain methodological assumptions
  - The **guarantees** have a significant favourable impact on the CET1 ratio under both scenarios, with a degree of variation in the final impact according to the default risk of the portfolio guaranteed
  - The **restrictions on dividend distribution** and the new **TLTRO programme** also have a positive impact, but one smaller than that of the guarantees
- The effect of the restrictions on dividend payouts is reinforced by the other measures

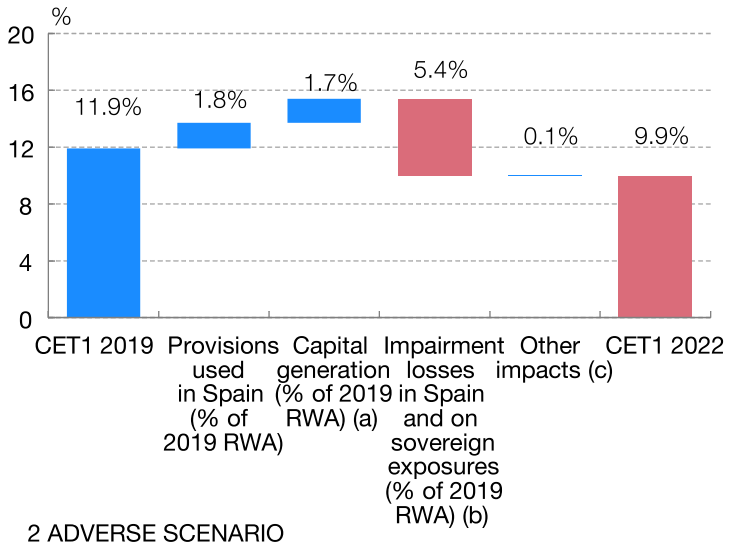
1 EFFECT OF THE ICO GUARANTEE FACILITY (b)



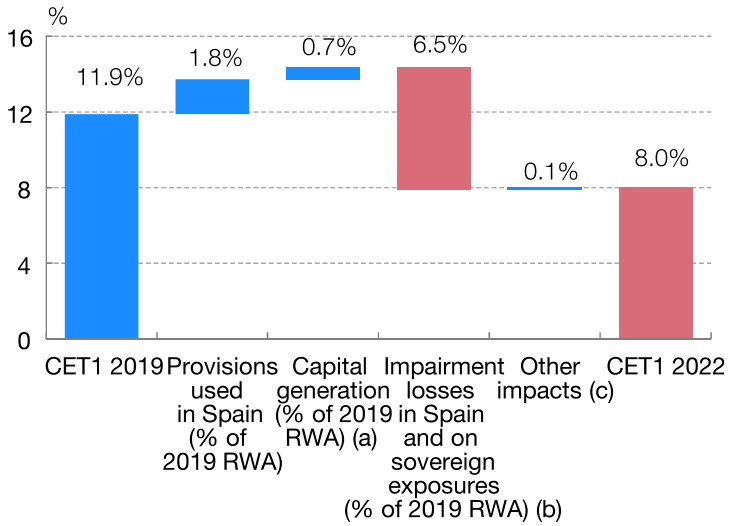
2 EFFECT OF THE DIVIDEND DISTRIBUTION RESTRCTION AND THE TLTRO SERIES (c)



1 BASELINE SCENARIO



2 ADVERSE SCENARIO

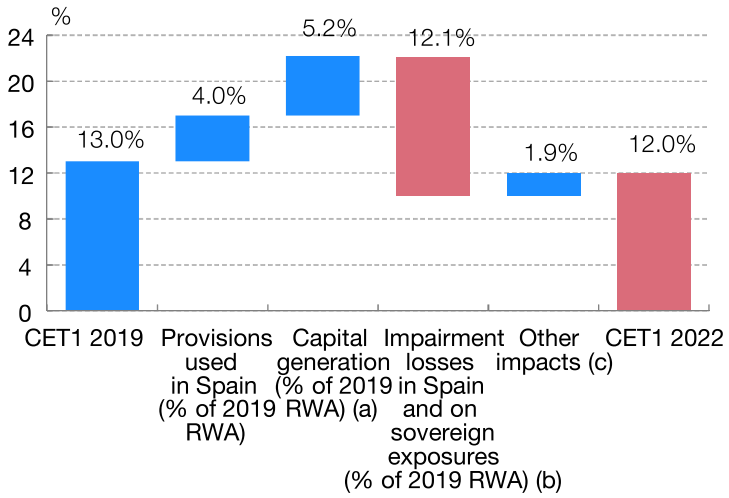


- The institutions with significant international activity record a **decline of** 2 pp in their CET1 ratio under the baseline scenario and of **3.9 pp under the adverse scenario**
- Institutions with significant international exposure appear to display **notable resilience** to the grave economic impact of the global crisis associated with the pandemic, which severely limits the capacity to generate new capital through net operating income in Spain and increases impairment losses.
- The **global economic contraction** would limit the generation of new capital resources in the foreign subsidiaries used to reduce the impact of the deterioration in Spain.

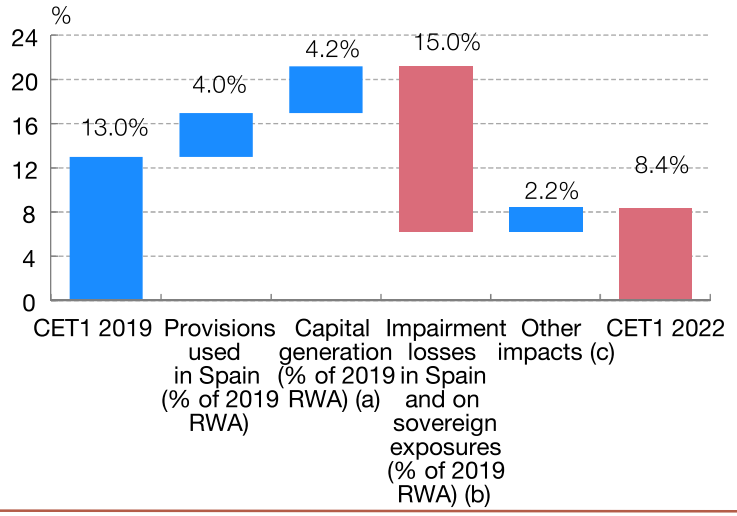
Chart notes:

a The generation of loss-absorbing capital in the case of institutions with significant international activity includes net operating income in Spain and net profits obtained in foreign operations.
b Impairment losses on loans and foreclosed assets in business in Spain, and the impact on capital of the potential impairment of sovereign exposures at the consolidated level.
c Other consolidated gains and losses, taxes, translation differences, dividend distribution and changes in RWA.

1 BASELINE SCENARIO



2 ADVERSE SCENARIO

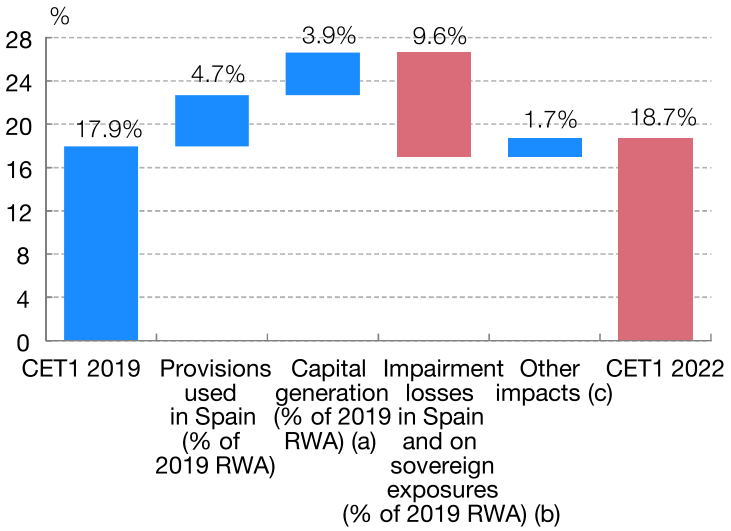


- The other institutions supervised by the SSM record a **decline** of 1 pp in their CET1 ratio under the baseline scenario and **of 4.6 pp under the adverse scenario**
- The other SSM institutions endure a **high volume of impairment losses** in business in Spain in both scenarios, **partially offset by** the **provisions used** and the **net operating income** generated, and also by some **deleveraging**, included in the other impacts.
- The additional impairment losses under the adverse scenario result in the **difference between the starting and 2022 CET1 ratios (4.6 pp) being higher than the difference for the other two groups.**

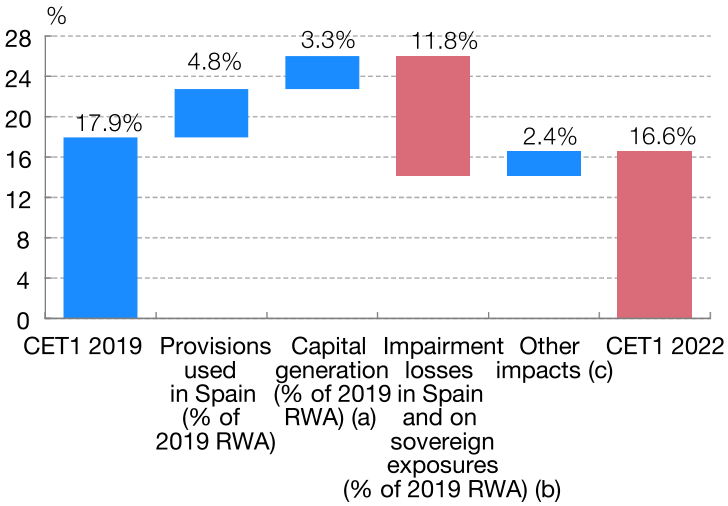
Chart notes:

a The generation of loss-absorbing capital in the case of the other SSM institutions includes mainly net operating income in Spain, with a very limited contribution by net profit from foreign operations.
b Impairment losses on loans and foreclosed assets in business in Spain, and the impact on capital of the potential impairment of sovereign exposures at the consolidated level.
c Other consolidated gains and losses, taxes, translation differences, dividend distribution and changes in RWA.

1 BASELINE SCENARIO



2 ADVERSE SCENARIO



- Lastly, the institutions supervised directly by the Bank of Spain see their CET1 ratio increase by 0.8 pp under the baseline scenario, but **fall by 1.3 pp under the adverse scenario**
- The group of institutions under direct national supervision maintains a **notable level of solvency** under both scenarios, **despite also enduring very significant impairment losses.**
- In addition to having a substantially **higher starting CET1 ratio**, this group of institutions, whose business model is conservative, incurs **lower impairment losses** than the significant institutions concentrated in Spain.

Chart notes:

a The generation of loss-absorbing capital is determined by net operating income in Spain.
b Impairment losses on loans and foreclosed assets in business in Spain, and the impact on capital of the potential impairment of the group's sovereign exposures.
c Other consolidated gains and losses, taxes, translation differences, dividend distribution and changes in RWA.

- Additionally, a **sectoral analysis** was carried out to assess the situation of the companies that a priori are considered more sensitive to the CoVid19 crisis.

- **Main aspects** were studied: exposures and total assets distribution, non performing exposures, main financial ratios, weight of the net profit vs GDP and first impact on the stock market.

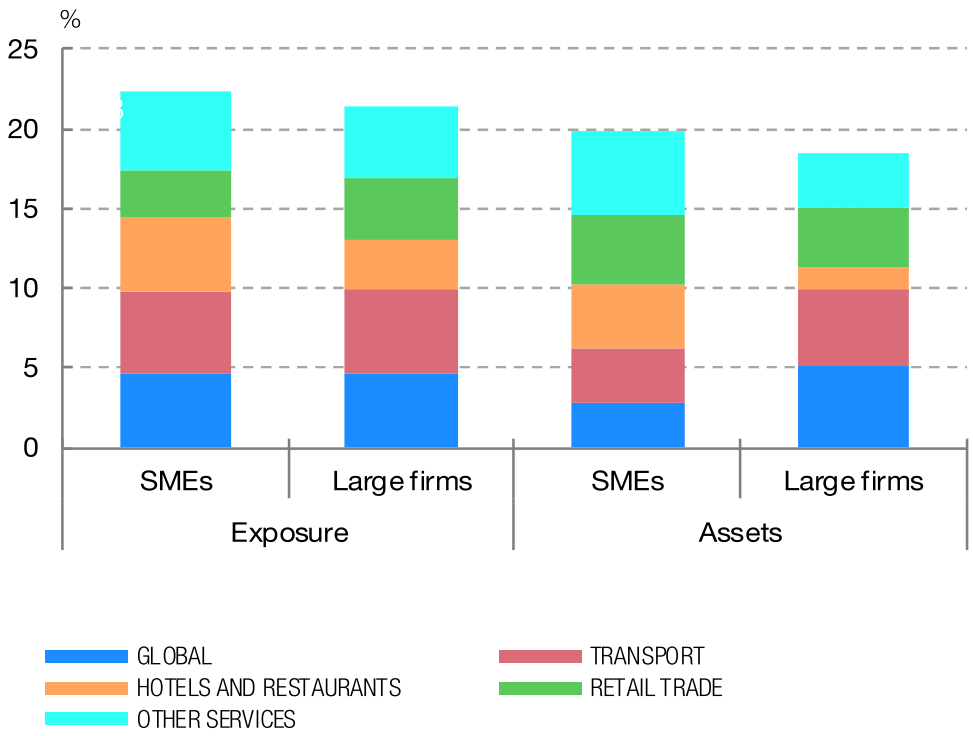
- Not only the aggregated values were analysed but also the distribution of the **different exposures in each bank.**

- This analysis were published partially and in an aggregate way in the **IEF of Spring 2020**. The following slides show some of the graphics included in relation to this study (https://www.bde.es/f/webbde/Secciones/Publicaciones/InformesBoletinesRevistas/InformesEstabilidadFinancera/20/ficheros/FSR_Spring2020.pdf)

- Currently, Bank of Spain is working in order to incorporate a **greater sectoral breakdown into the FLESB models.**

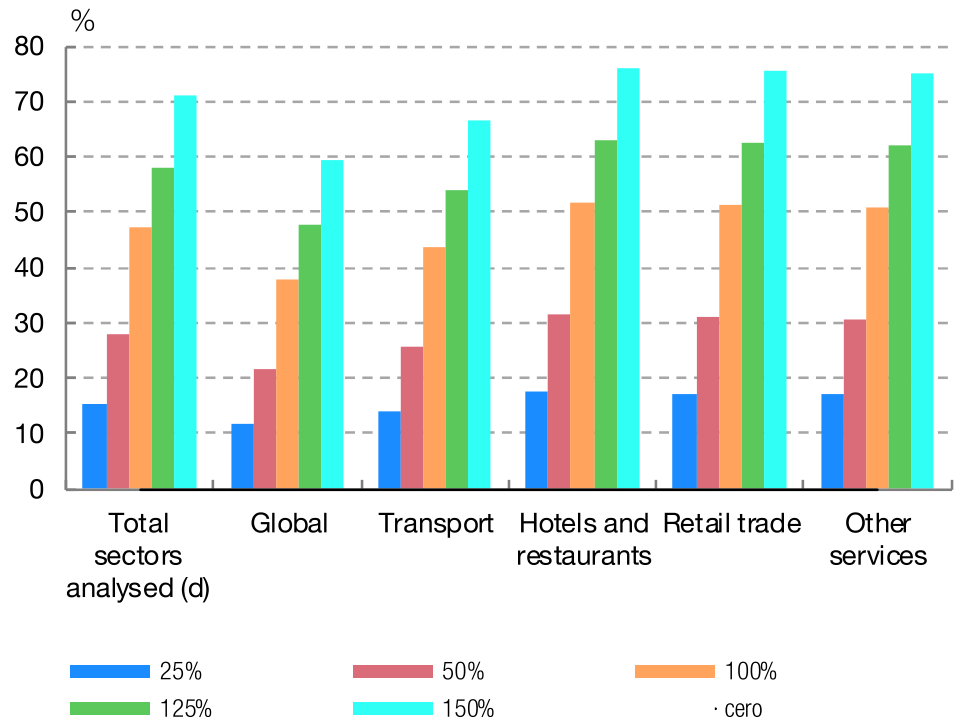
- For both large firms and SMEs, in December 2019 the exposures of the **sectors that are a priori most sensitive to the initial impact of the coronavirus crisis stood at 20%** (of bank lending and of total assets)…
- …with the **services sector** accounting for most of the exposures (weight of 15%).

1 CREDIT EXPOSURE AND TOTAL ASSETS



- The adverse **impact** of the coronavirus crisis on the non-performance of loans to firms will **vary among sectors and among firms**, and will hinge on their initial financial position
- Applying statistical models to the experience of the previous global financial crisis (2007 to 2012) is possible to simulate the **future evolution of the default rate** by sector.

2 NON-PERFORMING EXPOSURE AS A PERCENTAGE OF TOTAL EXPOSURE

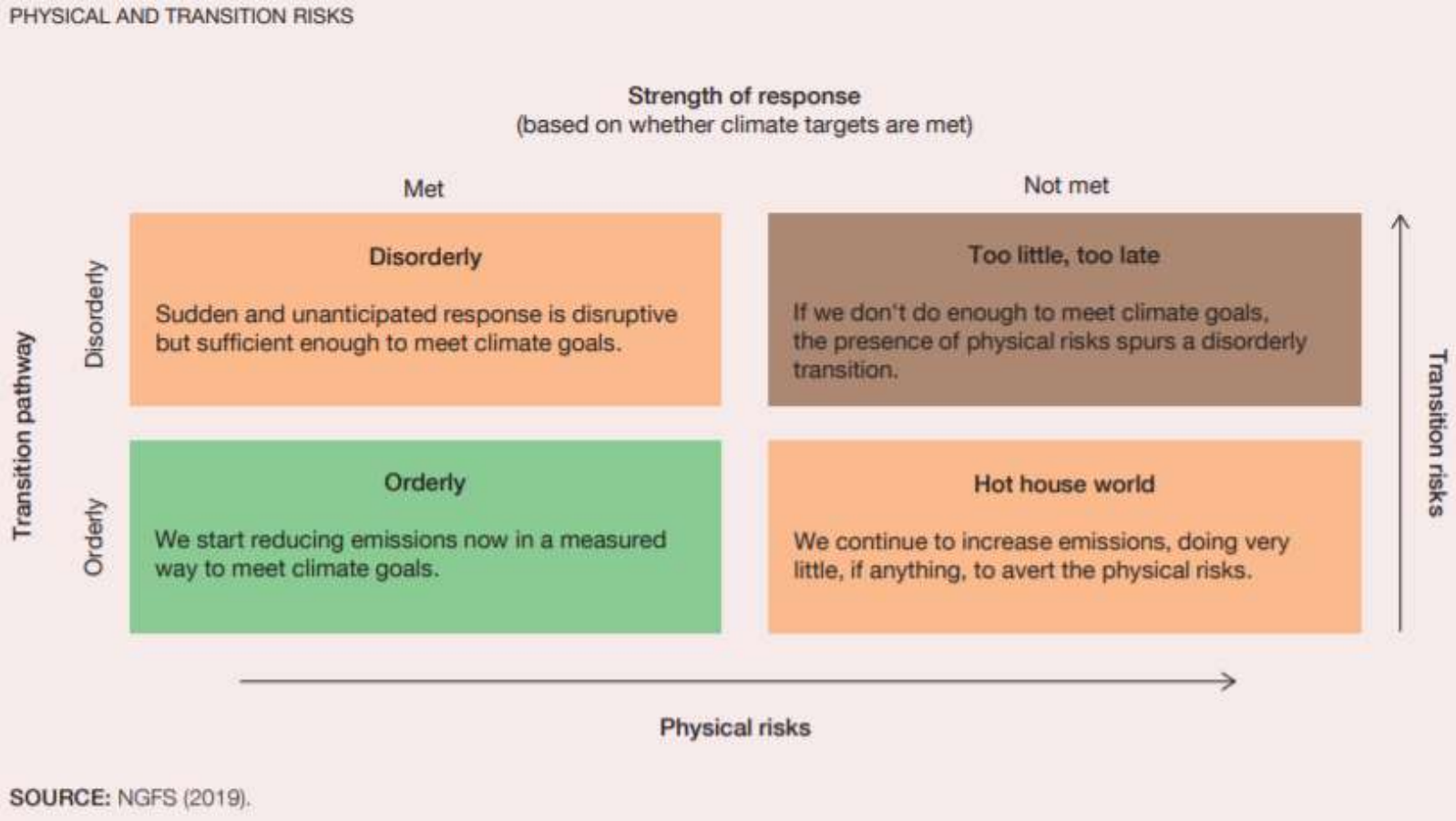


CONTENT

- Given the **growing relevance of the risks associated with climate change**, there is an increased need to assess the impact of their materialization on the resilience of financial institutions.
- To this end, the analysis focuses on the **impact on the main macroeconomic variables** and, more specifically, on the **portfolio** and **activity of each institution** though credit, market and operational risks.
- In the first place, the **narrative of the physical and/or transition risks determines how these risks will enter** in the simulation. A combination of risks or a more focused approach can be taken into account, depending on the purpose of the stress test.
- Furthermore, **the interconnectedness of physical and transition risks**, particularly over long time horizons, should be taken on board.

PHYSICAL RISKS		TRANSITION RISKS
• Long lasting droughts • Earthquakes • Changes to the biological diversity in certain areas • Deforestation • Etc	+ / o	• Establishment of a high tax on CO_2 emissions • Prohibitions on the use of certain materials • Development of a new relevant business innovation • Etc

- The following box shows the different scenarios resulting from the possible **combinations** of physical and transition risks:



Box 3.1 “The financial system and climate change”, Financial Stability Report, Autumn 2019, pp. 115-117

- Once the narrative is established, the impact has to be translated into the main macroeconomic variables generally included in stress testing exercises (GDP, house prices, inflation, unemployment rate, etc.)
- **Shocks and effects** over the financial sector and real economy **have to be quantified.**

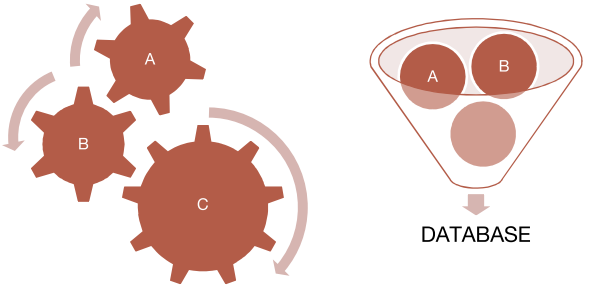
  - In the case of the **physical risks**, these shocks should be defined with some level of **geographical and sectoral breakdown.** For example, if the risk narrative for the scenario includes torrential rain, the shocks will be more likely in certain areas and have a greater impact on the specific sectors located in them.
  - In the case of **transition risks, the scenario's sectoral dimension is pivotal.**

- The document published by the NGFS in July 2019 provides with details about the **transmission channels** on the physical and transition risks, and the description of **different methodological approaches.**

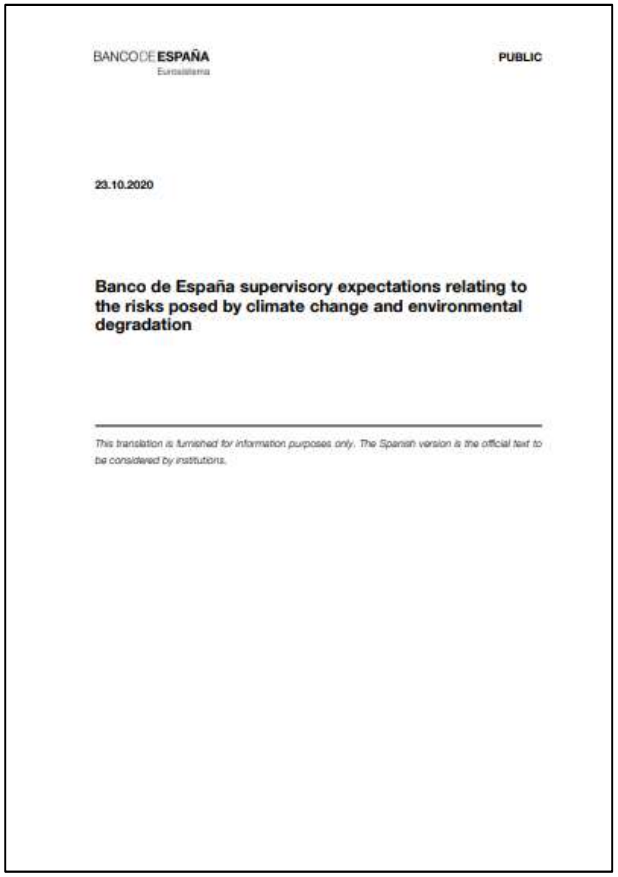
https://www.ngfs.net/sites/default/files/medias/documents/ngfs-report-technical-supplement_final_v2.pdf

- The next step implies the translation of the macroeconomic scenarios built on climate change shocks to **impacts over the financial situation of deposit institutions**. The usual channels of stress can be considered:
  - **Credit risk**: the possible loss of value of collateral and the higher default rates of certain customers, caused by the scenario translating into loss of business, fines, taxes, etc., will be quantified. It is also possible to incorporate the potential effect had on the risk profile of customers engaged in new alternative technologies, who could see their activity grow.
  - **Market risk**: the sectoral structure of the portfolio must be considered, as concentration in declining sectors -with obsolete activities and technologies- or in sectors that have to adapt to agents' new preferences or to new regulations may reduce the value of such instruments.
  - **Operational risk**: extreme events may occur associated with the materialization of climate change risks and/or a potential transition. for example, physical risks may affect an institution's very activity owing to the location of office buildings or operational centers in an area that is more exposed to disasters or due to changes in sector-specific legislation or to possible litigation on account of exposures to polluting sectors.

- One of the main challenges when running and analyzing this kind of stress test is the availability of data.
- Currently, the **sectorization level** available to institutions is not so detailed and it would be useful to better know the business of their clients, and also the purpose of the loans requested.
- Furthermore, it is desirable to have information regarding individual **CO_2 emissions** of companies and the **environmental assessment** of real assets, such as the energy efficiency, the distance from the coast or the classification of the land.
- This is undoubtedly a novel area of work and there is still room for further progress, but it is necessary to **become aware as son as possible to start collecting the necessary data** and achieve coherent and robust results in the shortest time period possible.



- In October 2020, the **Banco de España** published a document on its expectations as a supervisory institution regarding the risks posed by climate change and environmental degradation.
- **The report covers different areas** and, without claiming to be exhaustive, establishes the main lines of action about:
  - Business model and strategy
  - Corporate governance
  - Risk management (including stress test)
  - Information disclosure
- The **principle of proportionality** should be understood according to the nature, size and complexity of the institutions and of the risks inherent in their business model and activities.
- It is not expected that institutions implement all the lines of action immediately, but the Bank of Spain expects to start analyzing the progress **18 months after the publication.**


BANCO DE ESPAÑA
Eurosistema

PUBLIC

23.10.2020

Banco de España supervisory expectations relating to the risks posed by climate change and environmental degradation

This translation is furnished for information purposes only. The Spanish version is the official text to be considered by institutions.

https://www.bde.es/f/webbde/INF/MenuVertical/Supervision/Normativa_y_criterios/Recomendaciones_BdE/Banco_de_Espana_supervisory_expectations_relating_to_the_risks_posed_by_climate_change_and_environmental_degradation.pdf

- **Some central Banks are developing this kind of stress tests already**
- In 2018, the central bank of the Netherlands (De Nederlandsche Bank (DNB)) was one of the first central banks to run a stress test of this kind based on transition risks:
  - five-year time horizon,
  - four scenarios tanking into account the potential sudden implementation of policy measures aiming at mitigating the adverse impact of the climate change. Also the impact of technological advances that reduce CO_2 emissions are considered in the analysis.
- Other central Banks are also developing climate change stress tests, such as Bank of England, Banque de France, Danmarks National Bank or Banco de España.
- The **European Banking Authority (EBA)** aims to develop a stress test on climate change, but in the short term, a sensitivity analysis is being implemented as part of its regular risk assessment of EU credit institutions with a sample of voluntary banks, focusing on transition risks and considering a longer time horizon.

See Vermeulen, R., E. Schets, M. Lohuis, B. Kolbl, D. J. Jansen y W. Heeringa (2018). "An energy transition risk stress test for the financial system of the Netherlands". DNB Occasional Studies, Vol. 16-7. De Netherlandsche Bank.
Bank of England (2019). "Discussion Paper. The 2021 biennial exploratory scenario on the financial risks from climate change". December 2019.
See Reuters news "France to stress test banks, insurers' climate risks next year" 29 November 2019.
Danmarks Nationalbank (2019). "Climate change can have a spillover effect on financial stability". Analysis No.26. December 2019.

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THANKS FOR YOUR ATTENTION

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