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An Encompassing Forward-Looking Approach to Increase Resilience in the Banking Sector: A second life for EU Stress Tests

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An Encompassing Forward-Looking Approach to Increase Resilience in the Banking Sector:

A second life for EU Stress Tests

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EXECUTIVE SUMMARY

The EU-wide stress tests have constituted a very useful supervisory tool for increasing the resilience of the banking sector. This paper is a contribution to the ongoing discussion on the future changes of the EU-wide stress test. The paper outlines an encompassing forward-looking approach (e-FLAIR) to increase the resilience of the banking sector, where the stress test procedure is put in context with many other supervisory tools, including AQRs, revisions of internal models, capital planning reviews, SREP, ICAAP, sensitivity analyses and recovery plans. The paper claims that the current EU-wide stress test will benefit from the implementation of some changes: moving to a dynamic balance sheet, implementing a predominantly top-down approach, reinforcing the approach to assess capital-adequacy through a swift implementation of the Basel III finalization, overcoming the limitations of a single adverse scenario by considering more than one, by developing sensitivity analyses and by incorporating bank-specific stress tests. Finally, this paper proposes a move to a more balanced capital adequacy-profitability focus in the design of the stress test exercise.

"*Reports that say that something hasn't happened are always interesting to me, because as we know, there are **known knowns**; there are things we know we know. We also know there are **known unknowns**; that is to say we know there are some things we do not know. But there are also **unknown unknowns** – the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones*". (US Secretary of Defense Donald Rumsfeld, 12 February 2002).

1. Introduction

The EU-wide stress tests have constituted a very useful supervisory tool for increasing the resilience of the banking sector. This paper is a contribution to the ongoing discussion on the future changes of the EU-wide stress test. The paper outlines an encompassing forward-looking approach to increase the resilience of the banking sector, where the stress test procedure is put in context with many other supervisory tools, including Asset Quality Reviews (AQRs), reviews of internal models, capital planning reviews, Supervisory Review and Evaluation Process (SREP), Internal Capital Adequacy Assessment Process (ICAAP), sensitivity analyses and recovery plans.

The structure of the paper is as follows. Section 2 introduces the relevant taxonomy for the forward-looking assessment and the stress testing process[2]. Section 3 discusses the *pros* and *cons* of alternative ways to represent the prospective evolution of a financial institution, both in terms of capital adequacy and business model assessment. Section 4 identifies some possible ways of improving the EU-wide stress tests. Section 5 introduces e-FLAIR, the proposed supervisory forward-looking approach to increase the resilience of the banking sector, highlighting the need for a predominant Supervisory Leg which rules over the Bank Leg. The proposed approach shares some similarities, as well as some distinctive differences, with the approach outlined by the EBA in the Consultation Paper. Section 6 deals with the issue of disclosure and section 7 proposes the calendar of the exercise. Finally, section 8 concludes.

2. Forward-looking assessment of the banking sector: key definitions

This section provides a very brief overview on the key relevant concepts used for the forward looking assessment of the banking sector[3]. It very closely follows BCBS (2017b) which provides a very complete and rigorous taxonomy, in particular with regard to stress testing.

(a) Macro-financial Data and Projections: Historical Data, Baseline, Stress scenario

Let us start by the macroeconomic and financial variables. **Historical Data** corresponds to the set of observed macro-financial variables which are considered relevant to characterize the economic environment. Like all statistical information, some of those variables are subject to revisions, but they have already been released by the competent statistical authorities. **Baseline** is the set of macro-financial variables that is consistent with the best estimate of future economic and financial conditions, i.e. corresponds to the most likely future evolution of those variables[4]. **Stress Scenario** is the set of economic and financial conditions designed to stress the financial performance of a

[2] For a description of the most recent stress tests conducted for microprudential purposes see Board of Governors of the Federal Reserve System (2019, 2020a, 2020b), Bank of England (2019a, 2020) and EBA (2018).

[3] For the methodological descriptions of the exercises see Board of Governors of the Federal Reserve System (2020a), Bank of England (2019b), and EBA (2020). For a comparative analysis of stress testing with a special focus in the euro area, Japan, Switzerland and the United States see Baudino *et al.* (2018). Finally, Goldstein (2017) is the most complete book on stress-testing.

[4] This basically corresponds to a set of macroeconomic projections and a consistent set of financial assumptions. The ECB, the Bank of England, and the FED release regularly this type of projections.

financial system and in particular the performance of individual financial institutions. This adverse scenario should reflect (extremely) severe but plausible conditions. Thus, whereas the baseline is the most likely combination of economic and financial variables over the relevant horizon, the stressed scenario corresponds to a combination of economic and financial conditions defined to simulate a severe combination of shocks – covering a broad range of risk factors – to assess the resilience of a financial system and in particular the resilience of individual financial institutions.

(b) Bank's Data and Projections: Bank's Historical Data, Bank's Starting Point, Bank's Baseline Projection, Bank's Stressed Projection

Let us move now to the definition of equivalent concepts at the institution level. **Historical Data** corresponds to the set of relevant past information concerning the balance sheet, solvency, liquidity and the P&L statements of an individual institution. The **Starting Point** of a specific forward-looking exercise is the last complete set of information, concerning the last quarter for which the financial institution has released public data to the market, subject to audit validation and supervisory scrutiny. The **Bank's Baseline Projection** corresponds to projections, typically produced by financial institutions, built on the baseline macro-financial scenario, covering the balance sheet, solvency, liquidity and the P&L[5]. The **Bank's Stressed Projection** correspond to the equivalent set of projected variables, this time built on the adverse macro-financial scenario.

The concept of the **Bank's Baseline Projection** requires further description. This projection is built over harmonized macro scenarios and general guidelines set by the supervisor. **Bank's Baseline Projections** are extremely informative and constitute an essential micro-prudential supervisory tool for many reasons[6]: they provide information on the strategies of the institutions; they provide a solid basis for challenging the management teams on the evolution of solvency, liquidity and profitability; they are very informative identifying possible weaknesses to future liquidity, solvency or profitability; they allow the supervisor to assess the sustainability of business models, through the scrutiny of the projections; finally, by comparison with peers, they may reveal deviant patterns from the sector averages which, without detailed justification, should be challenged by the supervisor.

(c) Static vs Dynamic Balance Sheet

The **Static Balance Sheet** assumption corresponds to a situation in which the balance sheet of the institution is assumed to remain constant over the horizon of the exercise in terms of size, maturity and product mix; this assumption implies the freezing of the bank's balance sheet and therefore does not account for possible managerial actions either under the baseline scenario or under stress (i.e. under stress we are assuming that the management would not attempt to

[5] The Banco de Portugal refers to this concept as Funding and Capital Plans. See, for instance, the Financial Stability Report of the Banco de Portugal November 2011, Box 1.2, for the use of funding and capital plans and Instruction No 18/2015 for the regulatory requirements on the submission of those plans.

[6] Bank's Baseline projections are also an extraordinary useful macro-prudential supervisory tool: aggregating across banks it is possible to compare the projected evolution of the key aggregates (credit, deposits, etc.) and confront them with the projected evolution of the macro scenario; or, alternatively, assess if future common patterns – like excessive credit growth in certain segments or concentration on specific portfolios – can create risks for financial stability. But that is not the focus of this paper.

mitigate the effects of the adverse situation). The assumption of a static balance sheet brings simplicity and strengthened comparability across institutions, as well as an easier quality assurance process for the supervisor. The static balance sheet assumption, however, does not provide a realistic picture of the bank's balance sheet over the time horizon of the exercise. The static balance sheet assumption plays a central role in the EU-wide stress testing exercises.

The **Dynamic Balance Sheet** assumption corresponds to a situation in which the size, maturity and product mix are allowed to vary over the time horizon of the exercise, in such a way that it has to be consistent with the (common) macro scenario and allowing, subject to specific rules, for the incorporation of management decisions and in particular the bank's corporate plan. There are guidance principles defined by the supervisor to ensure full credibility to the exercise (like detailed justification of cost reductions and market share gains, for instance[7]). When the dynamic balance sheet is obtained under a common set of macroeconomic and financial variables it constitutes a very useful supervisory tool, as it provides a very insightful forward-looking view by the management on foreseeable developments at bank level allowing for comparability with peers. However, this greater realism comes with the cost of a more difficult supervisory scrutiny.

(d) Bottom-up vs Top-down Stress Test

A **Bottom-up Stress Test** is performed by the bank, taking as given the common adverse scenario. It can be performed either under the assumption of a static balance sheet subject to technical constraints (like caps/floors) defined by the supervisor, or under the assumption of a dynamic balance sheet. The exercise performed by the bank is typically subject to a quality assurance process and is therefore subject to possible adjustments by the supervisor. Those exercises have highly granular data – as bank's stressed projections have the same detail as bank's baseline projections – and are based on customized models developed by the bank.

Conversely, the **Top-down Stress Test** is performed by the supervisor relying on its own models – and on the historical data and starting point provided by the bank – under a common scenario and a common set of assumptions for all the participating institutions. Top-down stress tests can have a micro-prudential and/or a macro-prudential focus but this paper focus on top-down stress tests that have the purpose of assessing the resilience of individual institutions[8]. Top-down models can be leveraged by the inclusion of system-wide effects (spillover or feedback effects) – like amplification effects, interactions between the banking sector and the non-banking sector, and second round effects between the banking sector and the real economy – but, even incorporating these refinements, the focus of this paper will be maintained on individual resilience.

Therefore, bottom-up and top-down stress tests have been developed to assess the individual resilience of banks to adverse economic and financial developments and, in particular, (i) to challenge the bank´s capital position, requesting capital measures if necessary, and (ii) to support the supervisory process, namely concerning the determination of the Pillar 2 guidance (P2G). In

[7] See again Bank of England (2019b).

[8] Macroprudential stress tests have also a top-down configuration, as they are a tool designed to assess the system-wide resilience to shocks to support the design and calibration of macroprudential policy with the objective to identify and reduce systemic risk. See for instance Constancio (2017): "One important lesson of the Global Crisis was that the need to go beyond the micro-supervision goal of ensuring the robustness of individual financial institutions, particularly banks, was recognised. We learnt that the system can collapse even if, individually, institution by institution both solvency and liquidity positions seem quite safe."

both cases – bottom-up and top-down – the disclosure of the results takes place, usually, at bank level, being the granularity of information smaller in top-down stress tests.

(e) Sensitivity Scenario and Bank's Sensitivity-based projection

Sensitivity Scenario corresponds to the case in which only an extremely limited (or even a single one) set of risk factors is considered, if authorities are interested in a narrower (i.e. much more focused) range of factors to be assessed. The sensitivity analysis is conducted on a different path of macro-financial variables, where a limited set of variables has a different trajectory than the one considered in the baseline. Therefore, the **Bank's Sensitivity-based Projection** is built on this sensitivity scenario, under general guidelines set by the supervisor and using a dynamic balance sheet assumption.

It is important to distinguish between the different purposes of sensitivity analysis and stress testing. The key distinction is associated with the difference between 'risk' and 'uncertainty'[9]: stress tests are used in situations where the probabilities attached to future events are known, i.e. we have the conditions to quantify the occurrence of a given set of adverse economic circumstances ('risk'), typically located in the tail of the distribution; when there is no knowledge of such probabilities, because that type of events has not occurred in the past, it is more common to talk about 'uncertainty' and sensitivity scenarios. The most notable use of the sensitivity analysis, on a regular basis, has been the biennial exploratory scenario conducted by the Bank of England, which assesses the resilience of the banking system to what are judged to be the key emerging threats to financial stability[10].

(f) ICAAP Baseline Projection and ICAAP Stressed Projection

The ICAAP plays a key role in the risk management of credit institutions[11]. The ICAAP, which is a crucial input factor in the SREP, aims to, amongst other things, increase the resilience of individual credit institutions in periods of stress through an improvement in their prospective internal capital adequacy assessments, including comprehensive stress testing and capital planning. There is also a very close link between the ICAAP and the recovery plans: in both exercises institutions should assess different stress scenarios they might be exposed to (the link is especially direct if institutions user reverse stress testing in their ICAAPs) and allow for the set of management measures that would be available to restore the financial position of the institution following a significant deterioration.

Under the **ICAAP Baseline Projection** the institution is supposed to meet all the capital requirements, including the Pillar 2 guidance (P2G). For that purpose, and under a macro-financial scenario that is developed by the bank itself, the institution has to justify all the capital measures and management actions that are required to maintain the appropriate management buffers. The institution is also supposed to develop an **ICAAP Stressed Projection**, through the identification of own specific adverse scenarios reflecting its material vulnerabilities, concerning amongst other aspects the external conditions faced by the bank, the business model and the risk profile of the

[9] An economic distinction between uncertainty and risk was proposed by Frank H. Knight in 1921. According to Knight, 'risk is present when future events occur with measurable probability. Uncertainty is present when the likelihood of future events is indefinite or incalculable.'
[10] See Bank of England (2017).
[11] See ECB (2018).

institution. The nature of this stress test should reflect the idiosyncratic vulnerabilities of the institution – identified by thorough in-depth reviews and reverse stress testing exercises – and should be very precise in the definition of possible management actions under the adverse scenario, ensuring rigorous consistency with measures identified in the recovery plan.

3. Forward-looking assessment of the banking sector: the roles of the alternative unstressed and stressed projections

This section distinguishes the possible role of the alternative unstressed and stressed bank projections for the purpose of assessing the prospective resilience of a financial institution. We start by stating that possible capital shortages in the future can be due to various alternative reasons:

(i) because the current level of capital (**Bank's Starting Point**) is not properly measured, reflecting, for instance, incorrect asset valuation practices or incorrect prudential reporting;
(ii) because the likely future evolution of the bank over the next few years will tend to contribute to a deterioration of its capital position, possibly due to an inadequate business model (**Bank's Baseline Projection**) or because the bank is not taking action under challenging new market developments (**Bank's Sensitivity-Based Projection)**;
(iii) because possible future adverse developments (**Bank's Stressed Projection**) may affect the capital position in a sizeable manner.

To elaborate a little more on this, we draw the reader's attention to figure 1.

(FIGURE 1 ABOUT HERE)

The current position of a bank may be affected by a wide range of situations that, for many reasons, may not adequately be reflected in the starting solvency position of the bank. Some conceptually conceivable situations could be the following: asset valuation issues, concerning for instance credit quality[12], financial instruments[13] or IFRS9 implementation; breach of not yet apparent conduct issues[14] (like AML breaches or misselling of financial services that may lead to

[12] ECB (2019) shows that higher levels of corporate leverage have been facilitated by the significant reduction in funding costs. In addition, the share of high-yield and lower-rated investment-grade issuances have risen considerably in recent years, being the case that highly leveraged firms are more likely to be downgraded during economic downturns. This constitutes a risk for banking loans to highly leveraged corporates and strengthens the amplification channels between banks and the non-banking sector.
[13] See IMF (2018a, 2018b). IMF (2018a), for instance, indicates that some euro area G-SIBs hold material portfolios in Level 2 and Level 3 assets, carried at fair value on unobservable inputs; through a reverse stress test, the IMF assessed the size of valuation shock on Level 2 and Level 3 assets that would deplete capital buffers over SREP CET1 regulatory minimums.
[14] ECB (2019) devotes a full box to this issue, showing evidence that (i) euro area banks' net income would have been one third higher since 2015 without those fines, and that (ii) misconduct costs may also affect bank stock returns and market valuations, via reputational effects and higher provisioning needs.

future fines or responsibilities); underestimation of credit risk, by inappropriate RWA measurement[15]. Each of these examples corresponds to a possible 'problem' that may already exist (**Bank's Starting Point**) before conducting the stress test and that the stress test *per se* may not detect. For instance, if one wants to cover the risk of an inadequate measurement of impairments the best way to proceed is to conduct an AQR, to conduct on-site inspections and/or deep dives or similar supervisory tools, not a stress test.

In the same vein, if a firm does not have a sustainable business model the best way to detect this is through analyzing and challenging the corresponding **Bank's Baseline Projection** (or the **ICAAP Baseline Projection**) which, if correctly done, will lead to the conclusion that if appropriate action is not taken the current business model will endanger future capacity to generate capital by internal means[16]. The best way to assess if a bank has the conditions to restore profitability levels in the future is through the analysis of the **Bank's Baseline Projection** (or the **ICAAP Baseline Projection**) under a dynamic balance sheet incorporating the relevant management decisions; the best way to assess the future viability of an institution in a context of severe digital competition pressures (FINTECH/GAFAS challenges) is also better assessed and analyzed through the inspection of the Bank's Baseline projection or the **Bank's Sensitivity-Based Projection** under a scenario designed for that specific purpose. In the same vein, the best way to assess whether a given bank is or is not vulnerable to a low-for-long interest rate scenario is once again through the analysis of the Bank's Baseline projection or using a Bank's Sensitivity-Based projection, over a sufficiently long time horizon. In the same way, the best way to assess how the capital levels of an institution will adjust to tightening solvency requirements, like the Basel III implementation[17], is through the assessment and challenge of the Bank's Baseline Projection. Issues like adaptation to climate change[18] are also better analyzed through the design of a sensitivity scenario and assessment of the corresponding Bank's Sensitivity-Based Projection.

The stress test is the best way to assess the impact of a severe, but plausible, combination of economic and financial conditions defined to simulate a severe combination of shocks – i.e. a set of risk factors, covering for instance credit risk, market risk, operational risk, non-interest income risk, sovereign risk, or any other types of risks – to assess the resilience of a specific institution and the adequacy of capital levels. In particular, the ICAAP Stressed Projection is a very informative tool to identify the bank's main vulnerabilities and the management actions that would have to be taken in such an adverse situation.

The point that should be clear by now is that stress tests are no more than a supervisory tool – a very important one and a key element of the supervisory toolkit – which should be used in combination with other (equally powerful) tools like AQRs, on-site inspections, revisions of internal models, capital planning reviews, SREP, ICAAP, recovery plans and many others.

[15] In December 2017, the Basel Committee on Banking Supervision (BCBS) finalized the so-called Basel III framework with the specific purpose of addressing the excessive variability of risk-weighted assets. See BCBS (2017a).

[16] The issue of euro area bank profitability has been regularly addressed by the ECB's Financial Stability Reviews (2019, 2020). The underlying reasons for a persistently low profitability are many: stocks of legacy assets, the effects of the low-for long interest rate environment, poor cost-efficiency, insufficient income diversification, overcapacity and, after COVID-19, the expected increase in credit risk. ECB (2020) states that the aggregate ROE of euro area significant institutions declined, in 2019, to less than 5.5% and more than 80% of those institutions had an ROE below 8%, in spite of the long duration of the economic cycle for many countries in Europe.

[17] EBA (2019b) estimates that the full implementation of Basel III will increase, in average, the current minimum capital requirements by 23.6% and reduce the CET1 by 2.8 p.p., with higher than average effects on global systemically important institutions.

[18] ECB (2019) presents a box claiming that inconsistent disclosures by banks may be making difficult for markets to price bank´s climate-related risks.

Let us now return to the quote by Donald Rumsfeld. ***Known knowns*** are aspects that we are fully aware and that we should plan in advance: this basically corresponds to the **Starting Poin**t and, in general, the **Bank's Baseline Projection**. Typically, in terms of asset valuation, risk-weighted assets, or projected solvency ratios – as computed by banks - the risks tend to be balanced on the side of less conservatism than that aimed for supervisors; therefore, in order to address those risks, the supervisors should conduct a very rigorous scrutiny. ***Known unknowns*** are risks that we know exist, but we do not have the conditions to accurately anticipate their quantitative effect. Thus, in order to address these risks – which are associated to future crises and/or future trends that will challenge the banking sector – the supervisors should conduct **Stress Testing** and **Sensitivity Analyses**. Finally, ***Unknown unknowns*** are situations we are not aware of as they correspond to unidentified (or even unimaginable) risks. A major fraud in a bank is possibly the best example. Whereas, for *Known knowns* and *Known unknowns* we should identify and plan for risks which are already understood, when it comes to *Unknown unknowns* adaptability is the key, as we need to develop strategies to be able to address those unexpected situations. Resolution, Liquidation and Recovery Plans are the most adequate tools for such extreme events.

We shall now discuss how the different types of bank's projections (**Bank's Baseline Projection**, **Bank's Sensitivity-Based Projection** or **Bank´s Stressed Projection**) interact with two key aspects (**Static** versus **Dynamic Balance Sheets** and **Bottom-up** versus **Top-Down Stress Tests**) for the purpose of assessing the resilience of the banking sector under a predominantly forward-looking perspective. To qualitatively assess the relative merits and disadvantages of each type of bank's projection the following questions are used as reference:

(a) **Realism**: Does the projection bring realism to the exercise or, by the contrary, is it heavily limited by (too) hard assumptions and/or methodological constraints? In particular is it relevant for strategic and risk measurement purposes?
(b) **Forward-looking relevance**: Does the projection provide a useful forward-looking perspective on how the financial institution will address its current structural weaknesses/deficiencies, or not?
(c) **Accountability**: Does the projection provide an accountable view (i.e. very well defined ownership) on the projected profitability/solvency measures or, alternatively, is it subject to possible 'gaming' strategies?
(d) **Comparability**: Does the projection facilitate a level playing field across banks, while still taking into account banks' specificities, business models and risk profiles?
(e) **Relevance for the Supervisory Process**: Can the projection be used in a direct and informative way in the supervisory process, or does its relevance/lack of realism/'gaming' nature reduce its supervisory interest?
(f) **Potential for improvement**: Does the exercise behind the projection have any potential for improvement/reinforcement in terms of realism and relevance (for instance by allowing for the inclusion of interactions with the real economy or with the non-banking sector)?
(g) **Cost efficiency**: Are the objectives of the exercise achieved in an efficient way? (In terms of resources dedicated to the exercise, duration, number of iterations, set-up costs).

Figure 2 proposes a qualitative assessment of the relevance and usefulness of different bank projections - **Bank's Baseline Projection** (under dynamic and static balance sheets), **ICAAP Baseline Projection** and **Bank's Sensitivity-Based Projection** - according to the defined criteria. The **Bank's Baseline Projection** under a dynamic balance sheet performs very well under all the criteria: realism, forward-looking usefulness, clear ownership, relevance for prudential supervision (both to access capital adequacy and business model viability), potential for continuous improvement and also cost efficiency. It is a very useful tool for the management and, from the point of view of the supervisor, it provides the correct incentives for the bank: as this projection can be compared with the observed outcomes, sizeable deviations not explained (ex-post) by the bank indicate poor forward-looking capacities of the institution.

(FIGURE 2 ABOUT HERE)

The Bank's Sensitivity-Based Projection basically shares the same positive features. As there is no possibility of confronting the projections with outcomes, banks have some leeway as it is more difficult for supervisors to detect 'moderate' optimism. All in all, this type of projections is very useful for supervisory purposes, both for capital adequacy assessment and business model challenge. The **ICAAP Baseline Projection** essentially shares the same key futures and is, therefore, extremely useful for a full understanding of the bank's perspective on future capital developments by the supervisor. The **Bank's Baseline Projection** under a static balance sheet does not share those *pros*: it lacks realism, it has a very limited use from a forward-looking perspective, it has a hybrid ownership and therefore represents neither the bank nor the supervisor perspectives, it is not useful for challenging the business model and it is not cost-efficient considering all the iterations between the bank and the supervisor. It does provide, however, a high degree of comparability across banks, at the cost of lack of realism of the exercise

In conclusion, the forward-looking approach to assessing bank resilience should attribute a more prominent role to the **Bank's Baseline Projection** under a dynamic balance sheet, to the **Bank's Sensitivity-Based Projection**, and to the **ICAAP's Baseline Projection**, somewhat relegating the **Bank's Baseline Projection** under a static balance sheet to a secondary role in the forward-looking assessment.

Figure 3 assesses, under the stressed scenario, the relevance and usefulness of different banks' projections – **Bottom-Up (dynamic balance sheet)**, **Bottom-Up ICAAP**, **Bottom-Up (static balance sheet)**, **Top-down** – through a qualitative assessment of the same seven criteria. Top-down Projections rank fairly well in basically all the criteria, and in particular they have the clear advantage of corresponding to supervisory judgment. Top-down stress tests also allow for dynamic features of the balance sheet, bringing realism to the exercise. However, they lack perfect realism, as the supervisor has an imperfect knowledge of the bank, and some fixed costs are necessary to the development of the supervisory models. In particular, realism of Top-down stress tests requires a detailed modelling by the supervisor of key elements of the exercise – which require a very detailed knowledge of the institution – like PDs, LGDs, specific sensitivities to market variables, collateral assessments, as well as some assessment and decision as to which corporate decisions are credible, or not, under stress.

The Bank's Stressed Projection (under dynamic balance sheet) and the ICAAP Stressed Projection benefit from the dynamic balance sheet assumption, but there is always a possible

'gaming'/'beauty context' issue. Both have a marked forward-looking approach which makes them very useful for risk management and they also display some potential for improvement. Bank's Stressed projections (under a static balance sheet) perform poorly, because they provide the wrong incentives to banks: no use for risk management, temptation for 'beauty context', very limited use from a forward-looking perspective, high costs for banks and supervisors in terms of efforts to achieve a final projection.

(FIGURE 3 ABOUT HERE)

To conclude, the forward-looking approach to assessing bank resilience should attribute a higher role to the **Top-Down Stressed Projection** and, to a somewhat reduced degree, the **Bank's Stressed Projection and the Bank's Stressed ICAAP Projection** (both under a dynamic balance sheet), and somewhat relegate the **Bank's Stressed Projection** (under a static balance sheet) to a secondary role in the forward looking assessment. It also emerges from Figure 3 that stress testing is better suited to assessing capital adequacy levels than to assessing business model viability. We will explore the possibility to expand stress testing to a broader profitability- capital adequacy perspective later in the paper.

4. Possible improvements of the current EU-wide stress tests

EU-wide stress tests have proved to be a very useful supervisory tool for testing the capital adequacy of banks – which was actually considerably reinforced as a follow-up of stress testing exercises – and for providing a starting point when setting the Pillar 2 guidance (P2G)[19]. In spite of its very relevant contribution for a more resilient EU banking sector, the current EU Stress tests have a set of perceived weaknesses[20]. This section identifies five possible ways to improve the current stress testing framework and motivates the choices embedded in the encompassing forward-looking approach presented later in the paper.

(i) Static vs Dynamic Balance Sheet

In spite of ensuring simplicity and comparability, the static balance sheet assumption does not provide a realistic picture of the bank's balance sheet over the time horizon of the exercise. The Bank's Baseline Projection, under a static balance sheet, does not provide any relevant indication of the bank's expected strategies and actions for the years ahead and in particular on how the management is expected to act on future solvency, future liquidity and future profitability; i.e.

[19] For a description of the use of stress tests for policy purposes and possible developments see, for instance, Bank of England (2015), Dent *et al.* (2016), Feldberg, G. and A. Metrick (2019), IMF(2018a), Kapino *et al.* (2015), Quagliariello, M. (2019). There are also speeches that outline possible developments of the current stress test exercises: Campa (2019), Enria (2019a, 2019b), Guindos (2019), Tarullo (2016). The book by M. Goldstein (2017) also provides a very insightful perspective of the use of stress tests for policy purposes. Finally, the reader can also consult K. Dowd (2019) for a fierce attack on the commonly used stress testing procedures.

[20] Some papers propose possible adjustments and/or identify some weaknesses in the current EU stress tests. See for instance Bisio and Fiori (2019), Breuer, T. (2014), IMF (2018a) and the EBA Public Consultation document, EBA (2020).

such projection is basically uninformative on how the institution is supposed to perform over the exercise horizon.

In the same vein, this assumption limits the realism of the exercise as it does not account for possible managerial responses under the baseline and/or stress scenarios – like credit evolution[21], reduction in the labour force or branch dimension, business model adjustments – i.e. it assumes passive bank behavior throughout the entire horizon of the exercise[22].

Suggested way forward: Move to dynamic balance sheets.

(ii) Degree of reliance on banks' own models

In the EU-wide stress test banks apply the common methodology developed by the EBA using their own models. Internal models tend to be very complex and to display a persistent unwarranted variability in RWAs across banks, therefore possibly damaging transparency and even the level playing field of the exercise[23]. The bottom-up nature of the exercise provides all the incentives for the institutions to minimize the impact on prudential requirements rather than reinforcing their risk management capacities.

The EU-wide stress test has traditionally been focused on risk-weighted measures of solvency and, in particular, on the CET1 ratio. The methodological static balance sheet assumption somewhat constrains the usefulness of the leverage ratio under stress, as, by assumption, the denominator of the ratio (i.e. the leverage exposure) remains constant; therefore, the changes in this metric only reflect the decrease in Tier 1 capital.

A more robust approach to assess capital adequacy should rely on a broader range of capital metrics – unstressed vs stressed, risk-weighted vs non risk-weighted capital measures – and attaching a strengthened role to the full implementation of the December 2017 Basel agreement[24]. Borio *et al.* (2020) shows that three different capital metrics – risk-weighted capital requirements, leverage ratio and output floor – are complementary and mutually reinforcing in assessing capital adequacy as each one of these different standards constitutes a binding restriction for different banks. They illustrate the complementarity between output floors (which retain a high degree of risk sensitivity but are subject to model risk) and the leverage ratio (largely free of modelling assumptions) as one key element for a more robust capital framework.

[21] Budnik *et al.* (2019) show that a stress test based on the dynamic balance sheet assumption leads to higher capital depletion in the adverse scenario than if it were conducted under the static balance sheet; however CET1 ratios are higher, due to deleveraging that is not modelled using static balance sheets.

[22] US banks are required to submit a detailed description of all capital actions assumed over the planning horizon, in parallel with the submission of the stress tests. The UK stress test also allows for the consideration of capital mitigating actions under stress.

[23] Guindos (2019) said that "the [bottom-up] approach also provides banks with substantial leeway to materially underestimate their vulnerability to adverse circumstances, to "game" the exercise, in other words". Enria (2019a) went further by saying that "We also see banks conspiring to game stress tests, often with the help of external advisors. (…). We see this, we don't like it, and we will not tolerate it". For a critic view on the excessive reliance on internal models see for instance Acharya, V. *et al.* (2013), Breuer, T. (2014), and Schuermann, T. (2016).

[24] BCBS (2017a) states that a range of studies found an unacceptably wide and unwarranted variation in RWAs that makes it difficult to compare capital ratios across banks and undermines confidence in [risk-weighted] capital ratios. As a result the Basel finalization package introduces constraints on the estimates using internal models for regulatory capital purposes and, in some cases, removed the possibility of using internal models. It also introduced a capital floor that limits the amount of capital benefit a bank can obtain from using internal models relative to using the standardized approaches (limit of 27.5%).

Suggested way forward: Move to a reinforced holistic approach to measure capital adequacy (CET1 ratio, output floor, leverage ratio) in line with the Basel III finalization[25].

(iii) Ownership of the stress tests

The ownership of the current EU Stress Test is hybrid[26]. Banks provide their estimated impacts relying, as said above, on their internal models and static balance sheets. Supervisors carry out very thorough quality assurance in a situation of significant information asymmetries[27], but ultimately, they do not take the results as their own assessment. This is probably the most distinctive difference between the US and UK exercises, where the supervisor owns the final results, and the EU one, where basically there is no well-defined ownership of the final results.

Suggested way forward: Move to top-down stress tests and full ownership of the exercise by the supervisor.

(iv) Nature and variety of adverse scenarios

The current nature of the exercise restricts attention to a single adverse scenario. It is easily understandable that a bank may perform very well under a specific adverse scenario and, on the contrary, be severely affected in alternative and as relevant stress scenarios[28]. Therefore, focusing on a single fixed stress scenario does not necessarily provide robust information about an individual bank, just because a single scenario is not equally stressful for all banks. Worse than that, repeating the key features of the exercise creates a perverse incentive for mimicking the supervisor model (i.e. the risk of model monoculture[29]) rather than developing own risk management procedures.

Possible solutions for this limitation are the following: using complementary stress test scenarios; exploring the benefits associated with sensitivity analysis; allowing the banks to present their own stress tests in parallel with the stress test exercise, therefore contributing to a more integrated supervisory process.

Suggested way forward: Consider more than one adverse scenario; Develop sensitivity scenarios; Incorporate ICAAP in the stress testing procedure[30].

(v) The informative value of the stress tests

Sometimes the point is made that EU-wide stress tests do not succeed in transmitting the belief that the banking sector is resilient, i.e. do not fully convince the markets on the strength of the EU banking sector. In general, three aspects of the current stress testing procedure may lead to this perception: static balance sheet, large reliance on bank's own models, and the hybrid ownership

[25] See "Basel III: finalizing post-crisis reforms", BCBS (2017). As this report states "The revisions to the regulatory framework will help restore credibility in the calculation of RWA by: enhancing the robustness and risk sensitivity of the standardised approaches for credit risk and operational risk, which will facilitate the comparability of banks' capital ratios; constraining the use of internally modelled approaches; complementing the risk-weighted capital ratio with a finalised leverage ratio and a revised and robust capital floor".

[26] This point is explicit made in the EBA Public Consultation document, EBA (2020).

[27] This is a principal-agent problem, with the ECB playing the role of the principal. See for instance Casellina *et al.* (2020).

[28] Breuer, T. (2014) makes the point that the restriction to one adverse scenario may provide a wrong illusion of safety.

[29] See Hirtle (2018) or Tarullo (2019).

[30] On the usefulness of ICAAP in the context of the supervisory process see Bisio and Fiori (2019), and Quagliariello (2019).

of the exercise. The predominant focus on top-down stress tests conducted by the supervisor will address all three points. On top of that, this paper defends the reintroduction of minimum capital hurdles – both under the baseline and under stress – defined both in terms of the risk-weighted CET1 and the leverage ratio. This makes it clear that stress tests can have immediate consequences, in particular if capital levels are significantly reduced under stress.

Suggested way forward: Move to top-down stress tests; Reintroduce binding hurdles.

5. An encompassing forward-looking approach to increasing resilience in the banking sector (e-FLAIR)

This section presents a coherent set of proposals for developing an encompassing forward-looking approach to increasing resilience in the banking sector, which will be designated as e-FLAIR. This proposal relies on what has been discussed in the first half of the paper and has a clear micro-prudential nature as the main intended objectives are (i) the definition of adequate bank's capital levels, and (ii) the challenge of the business model of the bank, considering its sustainability over the medium term[31].

The e-FLAIR approach reinforces the forward-looking perspective which is (should be) a prominent feature of the supervisory process. Stress Tests are a crucial part of the supervisory toolkit, but their merits only became fully exploited when used in combination with other supervisory tools like AQRs, RWAs reviews, ICAAP, SREP, on-site inspections, capital planning exercises, sensitivity analyses, and recovery plans. This section further highlights the benefits of the integration of the stress testing exercise in the supervisory process.

The e-FLAIR proposal shares many characteristics with the Discussion Paper on the future challenges to the EU-wide stress test released by the EBA for public consultation. In particular, this paper draws on the following key aspects of the EBA discussion paper:

(a) A common set of **historical data** provided by banks, at the most complete level of granular disclosure used;
(b) A common set of banks' **starting points** for the forward-looking exercise, based on audited annual accounts and prudential scrutiny;
(c) A common prospective **macro-financial baseline** defined by the most likely future developments of the economy;
(d) A common central **stress test**, defined by a set of economic and financial conditions designed to stress the financial performance of the institutions participating in the exercise;
(e) A common **(high granular**) **template** to be supplied by banks as the result of the bank leg, covering historical data, the starting point, baseline and stressed projections;
(f) A **(less granular) template** to be supplied by supervisors with the results and the supervisory judgment of the top-down stress test;

[31] This framework is also extremely suited to deal with liquidity planning and liquidity stress testing. The SSM, for instance, conducted a stress test in 2019 to assess banks' resilience against liquidity shocks. However, this extension of e-FLAIR is not discussed here as the current main challenges of the EU banking sector typically lie on solvency and, even more so, on profitability.

The e-FLAIR approach includes also the following aspects, which differ from the previous EU-wide stress tests and also from those contained in the EBA Consultation Paper. In terms of bank level the following results would be submitted:

(g) **Bank's Baseline Projections** under a dynamic balance sheet, corresponding to their more likely projections under the common macro-financial baseline scenario, incorporating the relevant management decisions and corporate plans;
(h) **Bank's ICAAP Baseline Projections** under a dynamic balance sheet, corresponding to their more likely projections under a bank-specific macro-financial baseline scenario, incorporating the relevant management decisions and corporate plans;
(i) **Bank's Stressed Projections** under a dynamic balance sheet, corresponding to a common central stress test, also incorporating management decisions to face the adverse conditions (consistent with the recovery plans);
(j) **Bank's Stressed Projections under ICAAP**, obtained through idiosyncratic stress tests run by the bank under the EBA guidelines[32];
(k) **Bank's Sensitivity-Based Projections** under a common sensitivity exercise considering a selected risk factor.

In terms of the supervisory leg, which constitutes the prominent element of the stress test, the following exercises would be conducted:

(l) Supervisors will produce their supervisory assessments based on **Top-down** models on the common stress test;
(m) The supervisor will also implement **complementary stress tests** scenarios using top-down models.

The exercise should be conducted under a more robust assessment of capital adequacy, characterized by:

(n) Prudential information based on the **Basel III finalization package**[33] , to address the issue of excessive risk-weighted variability[34];
(o) A more holistic approach to **capital measurement**, in which the assessment of capital adequac4y should rely on a broader range of capital metrics (unstressed vs stressed, risk-weighted vs non risk-weighted solvency[35] measures), already incorporating **output floors**[36];

[32] See the EBA *Guidelines on stress testing*. See Bisio, P. and R. Fiori (2019) for the advantages in the integration of ICAAP in the EU-wide stress testing process.
[33] The Group of Central Bank Governors and Heads of Supervision announced, on 27 March 2020, a delay of one year in the implementation timeline of the outstanding Basel III standards, to increase operational capacity of banks and supervisors to respond to COVID-19. The revised calendar for the Basell III finalization agenda will be concluded on 1 January 2023, with the exception of the final implementation date for the output floor, with the phasing down of all transitional arrangements to take place by 1 January 2028.
[34] BCBS (2020) estimates that the full phasing-in of Basel III will make the Tier 1 minimum capital requirements to increase by 17.3-18.2% for European banks, which compares with a small decline (-0.5% in the US) and a moderate decrease in the rest of the world (-5.4%). The same report shows that leveraged ratios, at end-June 2019, are lower in Europe (5.1%) than in the Americas (6.2 per cent) and the rest of the world (6.6 per cent).
[35] It is also worth mentioning that BCBS (2017a) defined that global systemically important banks (G-SIBs) are subject to higher leverage ratio requirements. More precisely, the leverage ratio buffer for each G-SIB will be set at 50% of its risk-based buffer. For instance, a bank with a 2% risk-based buffer will have a 1% leverage ratio buffer and so will be expected to maintain a leverage ratio of at least 4%. See Tarullo (2016) for the need to look simultaneously to the leverage ratio and risk-weighted capital measures.
[36] The deferred Basel III finalization process implies that the output floor will increase from 50 per cent, on 1 January 2023, to the final figure of 72.5 per cent, on 1 January 2028.

(p) Consideration of explicit **pass-or-fail hurdles** under the baseline and under the adverse scenario.

The advantages of using a more robust assessment of capital adequacy – relying on risk-weighted capital measures, output floors and the leverage ratio – results directly from the complementarity of those metrics. Annex 1 discusses why those capital measures are complementary through the identification of the respective *pros* and *cons*.

It should also be clear that the stress test should have, under specific circumstances, immediate consequences. From that point of view e-FLAIR defends the reintroduction of minimum capital hurdles – both under the baseline and under stress – defined in terms of the risk-weighted capital measures, the CET1 ratio in particular, and the leverage ratio[37]. The definition of pass-or-fail hurdles is a key piece of the stress tests conducted by the Bank of England and the FED and should be reconsidered in the context of the revision of the EU-wide stress test[38]. The existence of such a set of hurdles provides an element of credibility to the exercise, even if, as in other geographies, this restriction is frequently not binding in a stress test[39]. The reason for this is very clear, as current capital levels are much higher than they were at the time of the GFC and therefore they are, in general, in conditions to absorb the losses under an adverse scenario[40].

The Discussion Paper released for public consultation by the EBA (2020) introduced a set of proposals intended to be applied in the 2022 EU-wide stress test. Bearing in mind the decision to postpone the 2020 stress test, it is natural to assume that the intended changes are likely to be considered now for a 2023 EU-wide stress test. By then, the Basel III finalization agenda will be fully implemented with the only exception of the transition period for the output floor. Considering that the stress test would tend to cover a 3 to 5 years period, most if not all of the increase in the output floor (from 50 to 72.5 per cent) will have to be incorporated in the 2023 EU-wide stress test.

Let us now turn to the description of the most salient features of the proposed approach, distinguishing the starting point, the bank leg and the supervisory leg. Under e-FLAIR, and somewhat differently than what has been presented in the EBA Discussion Paper, the supervisory leg has a markedly prominent role in the exercise.

A. The Starting Point

An indisputable and reliable initial set of balance sheets and, in particular, a very prudent assessment of the accounting and solvency starting point is a strictly necessary condition for a

[37] This paper does not address the issue of the definition of specific quantitative hurdles.

[38] As an example, the Bank of England (2019) defined bank-specific hurdle rates for its 2019 annual cyclical scenario stress test (ACS) in the ranges of 6.9-8.1 in terms of the CET1 ratio (on a transitional IFRS 9 basis) and 3.47-3.86 for Tier 1 leverage ratios (the aggregate averages were 7.5 and 3.69 respectively). Those hurdle rates incorporate buffers to capture domestic systemic importance as well as global systemic importance. IMF (2018) conducted a top-down stress test for the euro area with a CET1 hurdle ration in the range of 7.0-7.5 per cent.

[39] The European Court of Auditors (2019) stated that information on capital requirements for each bank and on how many banks would have breached them under stress was missing in the EBA's reports.

[40] Schuermann (2016) provides a very interesting distinction between stress testing in wartime and in peacetime, summarized in the following statement: "If wartime stress testing is about getting capital into the banking system, peacetime is about deciding whether to let it out". Enria (2019a) stated that "Rather than measuring the actual size of capital holes against a supervisory yardstick, stress tests now help us to spot vulnerabilities in banks". The EBA moved away from the pass/fail framework when, after the improvement of capital ratios, it was no longer considered necessary to focus on immediate capitalization and the exercise shifted to a contribution to the SREP process and the determination of the P2G. But this is not a reason to eliminate the binding hurdles.

robust forward-looking assessment of the banking sector[41]. For that reason, it is advisable to assess the need for a point-in-time assessment of the valuations of bank assets - from both accounting and prudential perspectives - prior to the beginning of the stress test, complementing the regular exercises conducted by the supervisor[42]. This type of exercise, run under the guidance of the supervisor, relies, amongst other aspects, on independent assessments on the valuations of the selected assets[43], including illiquid assets[44], and on the highly scrutinized measurement of risk-weighted assets[45].

The first comprehensive asset quality review at euro area level was conducted by the ECB, with reference to 31 December 2013[46]. The relevance of a similar exercise, prior to the EU-2023 stress test, is a matter subject to assessment by the supervisors; therefore, this paper considers this possibility as optional, i.e. subject to decision by the supervisors.

B. The Bank Leg

The bank leg would be based on a dynamic balance sheet and the required granularity requested by the supervisor, to make comparability across banks possible. The banks would provide the **Bank's Baseline Projection**, the **Bank's ICAAP Baseline Projections**, the **Bank's Stressed Projection**, the **Bank's ICAAP Stressed Projection**, and the **Bank's Sensitivity-Based Projection**.

The proposed design of the bank leg would have several advantages for banks. The comprehensive forward-looking approach just outlined would address the criticism that the current stress test exercises do not help risk management and strategic planning. The bank leg, as described above, opens new possibilities for using and improving bank capacities in those two areas, as the design of the exercise becomes extremely relevant for business management.

In particular, the bank leg would provide a very complete set of possible managerial decisions under crisis for each bank: restrictions on dividends paid, no share repurchases, limits on bonuses and remunerations to personnel, conversion of other capital instruments (AT1), asset disposals, leverage limitations, limits on risk exposures, growth limitations, etc. The identification of this list of managerial remedy actions would be extremely important for the execution and follow-up of the stress test. Figure 4 presents a possible definition of the management decisions that could be allowed for the baseline and stressed projections.

[41] Flannery (2019) makes this point very clear in the context of the US stress tests.

[42] The Banco de Portugal conducted a series of supervisory asset quality reviews over the period 2011-2013. For more complete information see the Financial Stability Report May 2012, Box 4.3, and some public communications (17 October 2011, 16 December 2011, 1 March 2012, 3 December 2012 and 28 March 2014). The document attached to the press release of 28 march 2014 constitutes a summary of the four supervisory asset reviews conducted by the Bank.

[43] One possibility could be the forward-looking assessment of loans to large corporates, with a special focus on firms that rely heavily on market leveraged loans.

[44] See IMF (2018b) and Coelho et al. (2020) illustrate that even modest valuation shocks on Level 2 and Level 3 assets could impact considerably in CET1 capital levels of some G-SIBs.

[45] The SSM runs a targeted review on internal models (TRIM) aiming to reduce inconsistencies and unwarranted variability when banks use internal models to calculate their risk-weighted assets. The EBA also runs similar exercises.

[46] In preparation to the start of the Single Supervision Mechanism (SSM), the ECB has conducted a comprehensive assessment which included a point-in-time assessment of the accuracy of the carrying value of bank's assets as of 31 December 2013 and provided the starting point for the stress tests. The AQR was undertaken by the ECB and NCAs and was, naturally, based on a uniform methodology and harmonized definitions.

(FIGURE 4 ABOUT HERE)

From that point of view, the information that exists in the recovery plans is particularly relevant – bearing in mind the highly bank-specific nature of the possible measures and their obvious use in a dynamic balance-sheet context – as incorporating some of the recovery options in stress testing would foster bank risk management. Integrating recovery plans in the stress testing exercise reinforces the 'encompassing' nature of e-FLAIR.

The suggested design of the bank leg brings considerable gains in terms of overall consistency and efficiency of the supervisory process. Let us see, from a supervisory point of view, what are the potential gains associated with the **Bank's Baseline Projection**, the **Bank's Stressed Projection**, the **Bank's ICAAP-Stressed Projection** and the **Bank's Sensitivity-Based Projection**.

The Bank's Projections – and in particular the **Bank's Baseline Projection** - would constitute, in a perfectly comparable way across the participating institutions, the basis for the supervisor's assessment of the liquidity, capital and sustainability of the business model. Given their unconstrained nature, other than their reliance on the common baseline scenario, the baseline projections (based on a dynamic balance sheet) would provide three distinctive advantages: (a) the possibility to assess the viability and sustainability of the business model; (b) the possibility to assess the consistency of the bank's strategy, as ex-post evolutions would be confronted with the submitted projections, providing a quantitative basis for supervisors to identify institutions with more deficient (or less reliable) planning procedures; and, finally, (c) the possibility of being used, after supervisory judgment, as a reference point for the supervisory leg.

The Bank Leg, as described above, opens up very good possibilities for improvements in the key supervisory processes run by the supervisor, in particular in terms of the SREP. The presentation of Baseline Projections in a fully consistent way, as they are conditional on the same set of macroeconomic projections, constitutes a very powerful insight into the prospective evolution of profitability. In a situation in which EU banks' profitability remains under threat from a wide range of factors – low-for-long interest rates, an extremely unfavorable macroeconomic environment following COVID-19, remaining legacy issues, reduced levels of overall cost efficiency, overcapacity, digitalization challenges and, in general, competition from non-banks – the assessment, by the supervisor, of those Baseline Projections is a privileged basis for the SREP Business Model assessment[47], with regard to viability (within one year), sustainability (within three years) and sustainability over the cycle (more than three years).

It is also very important to highlight the fact that the realism brought about by the Baseline Projections, which incorporates the respective corporate plans over the near future, also provides a straightforward credibility (and consistency) test. Backtesting is particularly suited to reviewing unconstrained Bank's Baseline Projections as, by definition, it is much easier and informative to assess the justification of deviations between the predictions under the baseline and the observed outcome (which banks should be able to explain thoroughly) than to challenge, ex-post, stressed funding and capital plans, in particularly under the constant balance sheet assumption, as stressed situations typically do not materialize and balance sheets move over time. It is straightforward to assess *ex-post* if the discrepancies between submitted plans and observed outcomes – as well as discrepancies between a specific plan and the following one – are explained by inadequate

[47] The current assumptions (i.e. static balance sheet, no incorporation of corporate measures, binding caps and floors) limit seriously the incorporation in the SREP. See for instance Bisio and Fiori (2019).

planning or by unforeseen developments, not controlled by the institutions (like differences in the technical assumptions of the macro-financial baseline). The deviations could be the basis for an application of 'penalties' in the SREP assessment, as unexplained deviations would probably be due to the deficient quality of the exercise (either because of a lack of good governance, or good analytical tools or, even, the intention of misrepresenting risk[48]).

Finally, the **Bank's Baseline Projection** and the **Bank's Stressed Projection** could be used as a reference point (or as a benchmark) for the top-down stress test, i.e. the supervisory leg, subject, however, to supervisory scrutiny.

The identification of truly idiosyncratic vulnerabilities of individual firms – not perfectly captured with common scenarios and common sensitivity analyses – should be done under ICAAP, i.e. the **Bank's ICAAP Stressed Projection**. ICAAP processes, if adequately challenged by supervisors, are particularly suited to bringing the point of view of the bank in a structured way. The ICAAP gives banks the possibility of identifying alternative shocks of relevance, with some variations in relation to the common stress test, and the identification of the corresponding management actions[49].

The sensitivity analysis in the bank leg – i.e. the **Bank's Sensitivity-Based Projection** - also provides a convenient way to assess, in a comparable way, how banks have the conditions to address very specific risks that are likely to affect the banking sector over the next few years. Supervisors will therefore gain very relevant information on bank-specific vulnerabilities and on how banks are positioned to deal with more adverse paths than the central one, whilst simultaneously assessing how the banking sector is prepared for those challenges. Thus, sensitivity scenarios would be an additional tool in the regular challenging of business models, consistently applied across banks, being extremely informative and useful for SREP.

Bank's Sensitivity-Based Projections would be obtained under one sensitivity exercise – capturing specific risks – to assess how the bank is prepared to face future challenges likely to affect the banking sector and thus the institution, in particular in terms of the business model and prospective profitability. These scenarios should perhaps cover a period of 5 years, as they correspond to gradual, rather than sudden, pressures on the banking sector that accumulate over time. Three possible suggestions for the sensitivity exercise are the following:

SENSITIVITY SCENARIO 1: a higher penetration of new digital players and/or GAFAs in the financial services market, with the corresponding negative volume effects and also possibly negative price effects due to reinforced competition[50];

SENSITIVITY SCENARIO 2: a more marked and prolonged scenario characterized by low-for-long interest rates, a low-for-long inflation environment, low-for-long productivity growth, which threatens banks' profitability through both a price effect and a volume effect; this

[48] Casellina *et al.* (2020), focusing on bottom-up stress tests, suggest creating a system of monetary penalties proportional to the difference between the expected and the realized losses of a portfolio, applying the penalty criterion proposed by the Italian mathematician de Finetti. Their approach would be applied in a much more straightforward manner to deviations and funding and capital plans, replacing monetary penalties by higher requests of P2G (as a result of a more negative SREP assessment).

[49] BCBS (2017) explicitly acknowledges that "Indeed, successful stress testing requires banks to generate individual stress scenarios that test the key risks germane to their business models and take into account the concentrations which are knowingly accepted by the strategic orientation of the bank's business activities".

[50] See, for instance, BCBS (2018) on alternative scenarios on the speed and on the scale of how the banking sector would be impacted by GAFS/FINTECH.

sensitivity scenario could also assess how banks would implement the Basel III finalization agenda, in terms of capital requirements, in a context of reduced profitability;

SENSITIVITY SCENARIO 3: an earlier (than expected) adoption of climate change transition measures[51].

C. Supervisory Leg

The supervisory leg – the prominent piece in the full exercise - will be based on a full top-down approach, relying on supervisory macro-micro models that combine bank reaction functions with a detailed modelling of their balance sheets[52]. The supervisor has full ownership of the exercise and correspondingly is totally accountable for the results. It benefits, however, from the fact that Bank's Baseline Projection and the Bank's Stressed Projection are provided by the banks and can be, subject to supervisory scrutiny, used as reference for the supervisory exercise.

Needless to say, the realism of Top-Down stress tests requires detailed modelling by the supervisor of key elements of the exercise – involving a very detailed knowledge of the institution – like PDs, LGDs, specific sensitivities to market variables, collateral assessments, as well as some guidance and ruling on which corporate decisions are credible, or not, under stress.

There are three necessary elements to increase the robustness of top-down stress tests for micro-prudential purposes: use of a broad range of complementary models; consideration of a variety of amplification and interaction effects; and finally, the definition of a range of alternative adverse scenarios. Let us see those aspects, one by one.

The current EU stress tests are characterized by a heavy reliance on banks' own models. The Top-Down approach would be reinforced through the systematic use of a wider range of models than currently, complementing the top-down model with a broad range of analytical tools and procedures intended to increase the robustness of the exercise: detailed bank-specific elements; strong involvement of on-site and off-site supervisors; a set of rules (like 'rules of thumb') and benchmarks[53] to scrutinize the plausibility of the results; assessment of the coherency of the aggregated (across banks) levels of credit with the macro-financial scenarios; and the bottom-up estimates made by the banks themselves.

Top-down stress tests are particularly well-suited to including a series of spillover or feedback effects that considerably increase the realism of the exercise[54]. The following examples illustrate some possible extensions: second round effects between the banking sector and the real economy; interconnectedness between the banking sector and the non-banking sector;

[51] NGFS (2020) recommend supervisors to develop methodologies such as scenario analysis and stress testing to estimate the magnitude of exposures to climate-related and environmental risks, presenting a very good survey on the many initiatives that were already concluded. The report present climate-risks as drivers of the following prudential risk categories: credit risk, operational risk, market risk, underwriting risk and liquidity risk. See also the Bank of England's 2021 Biennial Exploratory Scenario, where firms will submit management actions indicating how they will react to a given scenario and then a second round of the exercise will explore system-wide effects. In the opinion of the author scenario analysis is a much more appropriate way to assess climate-change related risks than stress testing.

[52] The ECB has developed a quite broad range of models with these characteristics. See for instance Budnik *et al.* (2019) for a stress testing exercise relying on dynamic balance-sheets. IMF (2018a) is another excellent example of a top-down model which can be used for micro-prudential purposes.

[53] There is a very wide use of benchmark parameters, considering the conditional evolution of PDs and LGDs under the stress scenario as well as benchmark quantitative rules concerning, for instance, the evolution of net interest income or market risk. See EBA (2019).

[54] Budnik *et al.* (2019) conducts a top-down stress test explicitly considering an augmented adverse scenario involving a "credit crunch" preceded by an excessive bank deleveraging as a result of the adverse shock.

amplification channels under stress, like fire sales[55] or sudden increase in risk premia for selected financial instruments[56]; possible solvency-liquidity adverse loops[57]. The inclusion of these effects is extremely difficult under a bottom-up approach. What is also clear is that the inclusion of those interaction channels would not deviate the exercise at all from its micro-prudential focus. One aspect that is also relevant is the following: the explicit consideration of those spillover effects constitutes a reason for differences between the results reported by the supervisor and by the banks in the same stress exercise[58].

The final point to be addressed concerns the definition of the multiple common scenarios that could provide a more robust assessment of the capital strength of each particular bank. This paper suggest some tentative possibilities: using an adverse scenario similar to the one that has been used in past EU stress tests, but complemented by a range of adverse scenarios that display different degrees of relative intensity of shocks (to the real economy, financial markets, and asset prices); or, alternatively, use a capital adequacy-profitability stress test exercise to complement the current capital adequacy exercise. Banks would only run one stress tests, i.e. the common central stress test (either the capital adequacy or the capital adequacy-profitability one) [59].

ADVERSE SCENARIO 1: CAPITAL ADEQUACY FOCUS

This adverse scenario would continue to be characterized by a severe real recession accompanied by an abrupt repricing of risk premia in global financial markets and an asset prices shock, repeating the narrative of the past stress tests[60]. Under this approach, the common central stress test could be complemented by the following alternative scenarios:

(a) A stress test incorporating interactions and amplifications originating outside the banking sector, like in the leveraged loans market or in the asset management sector[61], reinforcing the original shock;
(b) The impact of previous 'real' stress tests, like the way COVID-19 affected the banks[62] [63], which is particularly relevant, because if affects the banks via a very strong loan quality effect but

[55] ECB (2020) presents evidence that, under COVID-19, bank and non-bank interconnections amplified financial contagion, through forced asset sales and impact on short-term funding (stemming from the sizeable direct exposures, ownership links and common exposures.
[56] Constâncio (2016) suggest the development of top-down exercises including (i) interactions between banks and the real economy, (ii) contagion effects stemming from interconnectedness with non-banks in the shadow banking sector, (iii) interaction with other non-financial sectors.
[57] See IMF (2018a) for an illustration.
[58] Budnik *et al.* (2019) illustrates this point.
[59] A third different nature of the stress test could be obtained from what is usually referred to as a market-based scenario, which would use primarily market-based data (share prices, price-to-book ratios, volatilities and spreads) to assess an institution's solvency and/or viability. Market-based stress tests were first suggested in Acharya *et al.* (2012). Vickers (2019) contend that, for major banks with price-to-book ratios less than one, stress tests based on market values should also be run and published. Dermine (2019) also claims for the need of an increased role in price-to-book ratios when assessing banking resilience. For counter-arguments and skepticism on the market-based approach see Constâncio (2016), who highlights that capital requirements resulting from such an exercise could vary substantially in a matter of months, possibly exacerbating the fragilities of banks in periods of heightened market uncertainty.
[60] Of course, this option has the risk of producing unintended structural effects in the industry by repeating the key features of the stress test, as banks take managerial decisions having in mind what they consider to be the most likely stress test.

[61] In a recent Bank of England working paper, Farmer *et al.* (2020), develop a system-wide financial stress test to incorporate interacting contagion and amplification effects. More precisely they apply their model on top of the EBA 2018 stress test, capturing solvency and liquidity channels through four interacting amplification channels: default contagion, price-mediated contagion via asset sales, funding contagion, and liquidity stress via margin calls. The authors claim for the need to calibrate capital buffers (both Pillar 2 and the counter-cyclical capital buffer) explicitly taking into account system-wide dynamics.
[62] Bank of England (2020) conducted a desktop stress test to assess if the existing usable buffers of capital were sufficient to absorb the losses under an updated macro scenario, incorporating the estimated effect of COVID-19. This desktop stress test is characterized by a very sharp and sudden real contraction as well as by market paths for bank rates and long-term interest rates that remain low as a result of monetary policy (in contrast with previous stress test scenarios in which a very material increase in interest rates took place).
[63] The ECB has also conducted a COVID-19 Vulnerability Analysis.

has a mitigated risk premium effect due to the very strong monetary policy reaction, thus constituting a different type of shock and affecting banks in a different way from the most commonly used test[64];

(c) An integrated liquidity and solvency stress test, exploring interactions between them as liquidity and solvency interactions can be material[65];

(d) The previous constrained bottom-up approach to serve as a benchmark for the impacts.

Figure 5 presents the relative importance of the real, financial and asset prices shocks across the five designs of the stress test in a schematic way.

(FIGURE 5 ABOUT HERE)

The design (or narrative) of the stress scenarios mentioned above follow the usual approach to stress testing: using previous crises to calibrate the adverse scenario of the stress test and, correspondingly, see how the banking sector is affected. One conceptually different alternative would be to create a narrative – not primarily based on previous crisis episodes – specially designed to stress the banking sector. In a context of low profitability, overcapacity, high level of costs to income ratios, high levels of indebtedness of the private sector (households and non-financial firms) that narrative could be based on unfavorable prospects for credit growth (reduced perspectives for volume effect) and on a low-for-long interest rate environment (meaning a very limited room for a positive price effect). One possibility for the adverse scenario, with a simultaneous capital adequacy – profitability nature, could therefore be the following:

ADVERSE SCENARIO 2: CAPITAL ADEQUACY-PROFITABILITY FOCUS

- A depressed (but not extreme) scenario in terms of GDP growth, in terms of productivity growth and in terms of price growth, which is equivalent to assuming that debt levels would be a drag on growth and not eroded by nominal growth;
- In the spirit of the low-for-long, this scenario should have a 5-year horizon, rather than the usual 3 years;
- This depressed (but not extreme) scenario could be defined, for instance, as the Growth-at-Risk[66] 25th (or 20th) percentile GDP growth, in terms of real growth[67];

[64] Randal Quarles, the Vice Chairman for Supervision on the Federal Reserve Board was quoted on this: "[T]he right thing to do is for us to continue our stress tests but as part of them to analyze how banks' portfolios are responding to real, current events, not just to the hypothetical event that we announced earlier this year."

[65] The report by BCBS (2017) states: "In addition to the more traditional well-known transmission channels between liquidity and solvency (ie the bank lending channel, the bank capital channel and the risk-taking channel), the prevalence of high leverage, maturity mismatches in bank's balance sheets, mark-to-market accounting and asset fire sales can exacerbate adverse dynamics and feedback effects". The report by the European Court of Auditors (2019) explicitly acknowledges that liquidity risks for banks have not been in the scope of the EU-wide exercise, presenting the counter-example of the use by the IMF of a more complete approach involving both liquidity and solvency testing to assess the resilience of the euro area banking system. Also, Kapinos *et al.* (2015) have already recommended that liquidity and capital adequacy stress tests should be merged, given the very strong links between them.

[66] See Adrian *et al.* (2020).

[67] As the Growth-at Risk approach links current macro-financial conditions to the distribution of future growth and helps in the detection of the key vulnerabilities stress tests need to focus on, a special effort should be devoted to assess how current vulnerabilities (like corporate and household balance sheet weaknesses and low banking profitability) would affect the distribution of conditional forecasts of GDP.

- In addition, some additional pressures on profitability could be included, like greater penetration of FINTECH/GAFAs in the market and fiercer price competition;
- This type of scenario would simultaneously pressure capital levels and limit the possibility of increasing capital through generating results;
- Rather than focusing only on solvency levels, this stress test could also be focused on the relationship between banks' return on equity (ROE) and the corresponding cost of equity (COE); would banks manage, in such adverse conditions, to close the ROE/COE gap through credible cost reduction measures, efficiency gains and business model adjustments?

6. Disclosure

As already explained, the supervisory leg plays a predominant role in this supervisory process. The top-down stress test (i.e. the supervisory leg) is intended to assess if each institution is able to absorb losses under a common adverse scenario; if that is not the case, the bank should take measures to reinforce its solvency levels. The results should be disclosed using a common template but, as proposed in the EBA discussion paper, should refer to a more limited set of information – like the US and the UK stress tests – bearing in mind the top-down nature of the exercise and the necessarily less granular level of detail. On top of the results concerning the common stress test, the supervisor would release qualitative information – regarding capital adequacy – on the complementary stress tests, presenting the results, for instance, by buckets of impact on capital metrics.

As an immediate result, the supervisory leg could have the announcement of capital building measures by some of the participating banks, if this emerges as an immediate implication of the stress test. From that point of view, the proposed approach fully benefits from the development of the bank leg, as it allows for a complete description of possible actions under an adverse scenario (identified under ICAAP, under the common stress test, and under the sensitivity analysis). But it could also be the case – by far the most likely one – that no immediate capital reinforcement measures should be needed, as the current capital levels already incorporate the results of past stress tests (through the P2G).

It has been argued throughout this paper that this encompassing approach maximizes benefits for the supervisory process, especially with regard to its very convenient inclusion in the SREP process[68]. As at present, the EU-wide stress test would continue to be particularly important in the supervisory decision-making process in terms of determining the Pillar 2 guidance.

This paper does not advocate the disclosure of the P2G for a varied list of reasons: the P2G is not a binding requirement in the recently agreed CRD5/CRR2 package; the P2G does not determine automatic restrictions in the distribution of dividends; P2G has been introduced precisely to ensure that capital add-ons stemming from the stress tests are not included in the P2R as binding[69]; there is the risk that, by disclosing it, the market perceives the P2G as binding; no disclosure of the P2G provides an extremely valuable flexibility to the supervisor in times of crisis;

[68] The EBA Public Consultation document, EBA (2020), explicitly makes the point that the EU-wide stress test is less integrated in the regular supervisory process when compared to the UK and US cases.

[69] In normal times the management capital buffer is in excess of the P2G, but in times of crisis the management buffer (and the P2G) may be depleted and an adequate time to rebuild the capital cushion is determined by the supervisors.

and finally, and as regularly stated by supervisors, the P2G does not depend only on Stress Test outcomes. The argument of the benefits of increased transparency on the markets in general and investors in particular does not seem to be compelling enough to compensate all the referred *cons*. Furthermore, keeping in mind that, as the P2R is currently publically released, market participants know the *management capital buffer* for each bank exactly (i.e. CET1 minus P1, the P2R and the regulatory buffers)[70].

Finally, in terms of the sensitivity test, the EBA would release aggregate results, sample distribution metrics and the corresponding analysis, indicating how the banking sector is able to react to emerging challenges for financial stability (such as low-for-long interest rates, competitive pressures from FINTECH/GAFAs, and financial risks resulting from climate change). This approach would be extremely useful for identifying, assessing and communicating the implications of the relevant key trends that may impact the banking sector. Individual information provided by the banks would, naturally, be incorporated into the SREP procedure and all the necessary supervisory follow-up measures would be transmitted to the individual institutions for swift implementation.

The supervisory leg plays a prominent role under e-FLAIR as it provides an assessment of the EU supervisors to the banks and to the public. Therefore, the results of the bank leg at individual level should not be released on the site of the EBA, for the very reason that it does not own the corresponding results and they are not subject to any type of supervisory approval[71]. Yet it is worth mentioning that the full benefits of disclosing information on the EU banking system at a very wide degree of granularity would be fully preserved by the continuation of the EBA's EU-wide transparency exercise, which constitutes the most relevant disclosure exercise of banking information at global level.

7. Exercise calendar

The stress test exercise calendar can be considerably shortened – from the scheduled duration of 6 months for the 2020 stress test to a shortened 4 months period – as the option for a two-leg approach, with well-defined ownerships, allows for a substantial reduction in the interactions between the supervisor and the banks. It is clear for all the stakeholders that the supervisory leg is the one that prevails at the end of the exercise. In any case, and to avoid information gaps, there are two moments of interaction: banks submit the 'bank leg' to the supervisor for challenge and (moderate) supervisory scrutiny, which makes a revision of the initial submission possible if the bank so wishes; in the second instance, the supervisor presents the results of the top-down exercise to the bank, two weeks prior to the public disclosure of the results, allowing the bank to react and/or to provide additional information, which makes some final adjustments possible, if judged necessary, by the supervisor.

This is one of the most important advantages of e-FLAIR and increases substantially the efficiency of the exercise. A possible tentative calendar for the 2023 stress test exercise is presented below

[70] At the EU level the P2G is only released in some Nordic countries. In the UK, banks are required to disclose P2A (binding) but not P2B (non-binding) which is equivalent to the current SSM practices. What is common in all the EU countries is the fact that no SREP results are disclosed.

[71] As banks have the total ownership of the bank leg they could, conceptually, release all the relevant information respecting the usual procedures for market information. However, it is not obvious at all that banks would continue to use the current degree of granularity, as the inclusion of corporate planned actions could indirectly reveal some confidential business information. Moreover, the risk of confusion for market participants does not recommend this possibility.

distinguishing three phases: the preparatory phase, the forward-looking phase (or the stress testing phase, i.e. that which lasts for 4 months), and the follow-up phase.

PREPARATORY PHASE

- Publication of the final methodology of the EBA forward-looking exercise by October-November 2022, including the templates and any relevant guidance for the exercise;
- Release, by 15 December 2022, of a preliminary macro-financial projection (based on the ECB December projections) with the very specific purpose of permitting banks, if they so wish, to do preparatory work on the definition of their baseline projections[72];
- Optional: Scrutiny of the Banks' Starting Point, first quarter of 2023 (but not later than 15 March).

FORWARD-LOOKING PHASE

- The stress test's duration is 4 months, from 15 March 2023 to 15 July 2023, therefore corresponding to a 17-18 week period;
- Week 1 – Day 1: The EBA releases the macro-financial baseline, drawing on the most recent ECB projections[73];
- Week 3 – Day 5: Banks submit the following package to the EBA: Historical Data, the Starting Point, the Baseline Projection, the ICAAP Baseline, the ICAAP Stress Test, and the corresponding narratives;
- Week 4 – Day 1: The EBA releases the common (macro-financial) adverse scenario, the complementary stress testing adverse scenarios, and the sensitivity scenario;
- Week 7 – Day 5: Banks submit the (common) Stressed Projection, the Sensitivity-Based Projection and the corresponding narratives to the EBA;
- Weeks 8 – 9: Meetings between supervisors and banks, where banks present their submissions and face supervisors' challenging;
- Week 9 – Day 5: Last day for banks to submit the full set of results, concluding the bank leg phase (ownership belongs to the banks, so they have a final say on projections);
- Week 14 – Day 5: Supervisors conclude the Top-Down Baseline Projection, the Top-Down (common) Stressed Projection, and the complementary Top-Down Stressed Projections; the results are sent to banks;
- Weeks 15 – 16: Meetings between supervisors and banks and definition of possible (immediate) capital measures;
- Week 16 – Day 5: The supervisory leg is closed;
- Week 17: The results of the stress test (i.e. the predominant supervisory leg) are released by the EBA and immediate capital measures, if necessary, are announced; the aggregate results and the sample distribution metrics of the sensitivity analysis are also released by the EBA.

[72] Unless unexpected events take place, two consecutive macroeconomic projections tend not to differ substantially.

[73] This date would make it possible to incorporate the set of macroeconomic forecasts of the ECB covering the 2023-2025 period, as they are usually released by mid-March.

FOLLOW-UP PHASE

- 31 March – 15 April 2024: Banks submit a report explaining the deviations between the baseline projection for 2023 (presented one year ago) and the final outcome.

8. Conclusions

Micro-prudential supervision has been extraordinarily reinforced since the Great Financial Crisis. With the key objective of increasing the resilience of individual institutions and of the financial system as a whole, the main focus of supervisors has been progressively adapting to successive challenges: initial focus on liquidity, at the very beginning of the financial crisis; prolonged focus on capital reinforcement, which in a first step was aimed at 'more and better' capital (numerator) and then started to progressively address the issue of excessive risk weights variability (denominator). The implementation of the Basel III finalization – and therefore the issue of capital adequacy – still remains at the top of the current micro-prudential priorities.

Probably as important as the considerations on capital adequacy, it is also the case that key challenges exist in the area of profitability: the return on equity of banks remained weak at the end of 2019, in spite of the long economic expansion; a number of euro area banks do not earn the cost of their capital facing sustainability pressures over the medium to the long term; long-lasting low interest rates tend to have negative consequences on EU banks profitability; the rapid pace of technological advances, along with a change in the competitive landscape represent a key strategic challenge for banks; overcapacity and legacy assets are an additional burden for banks. It is therefore natural to conclude that the current forward-looking focus of micro-prudential supervision lies somewhere between the capital adequacy and the capital adequacy – profitability perspective. Thus, this paper suggests a move to a more balanced capital adequacy – profitability focus in the design of the stress test exercise.

Stress tests have contributed decisively to a much more resilient banking sector since the Global Financial Crisis and the double-dip recession in the euro area. This paper outlines an approach that fully integrates the stress test in the regular supervisory procedure and maximizes the benefits of interactions with other supervisory tools, like AQRs, revisions of internal models, capital planning reviews, SREP, ICAAP, sensitivity analyses and recovery plans.

As explained in the paper the current EU-wide stress test will benefit from the implementation of some changes: a move to a dynamic balance sheet, implementation of a predominant top-down supervisory leg, a reinforced approach to assess capital-adequacy through a swift implementation of the Basel III finalization, to overcome the limitations of a single adverse scenario by considering more than one, by developing sensitivity analysis and by incorporating bank-specific stress tests.

The proposed approach also addresses the main points raised by the European Court of Auditors (2019) concerning necessary improvements in the EU-wide stress test: the need for a top-down approach, to ensure greater consistency and more control of the process; the need for alternative stress scenarios and/or complement the exercise with sensitivity tests; the mention of capital gaps that emerged under normal economic and financial conditions and not reflected in the starting point data provided by banks; the need for an increase in the informative value of publications.

Figure 1: The Starting Point, the Baseline, the Stress Test

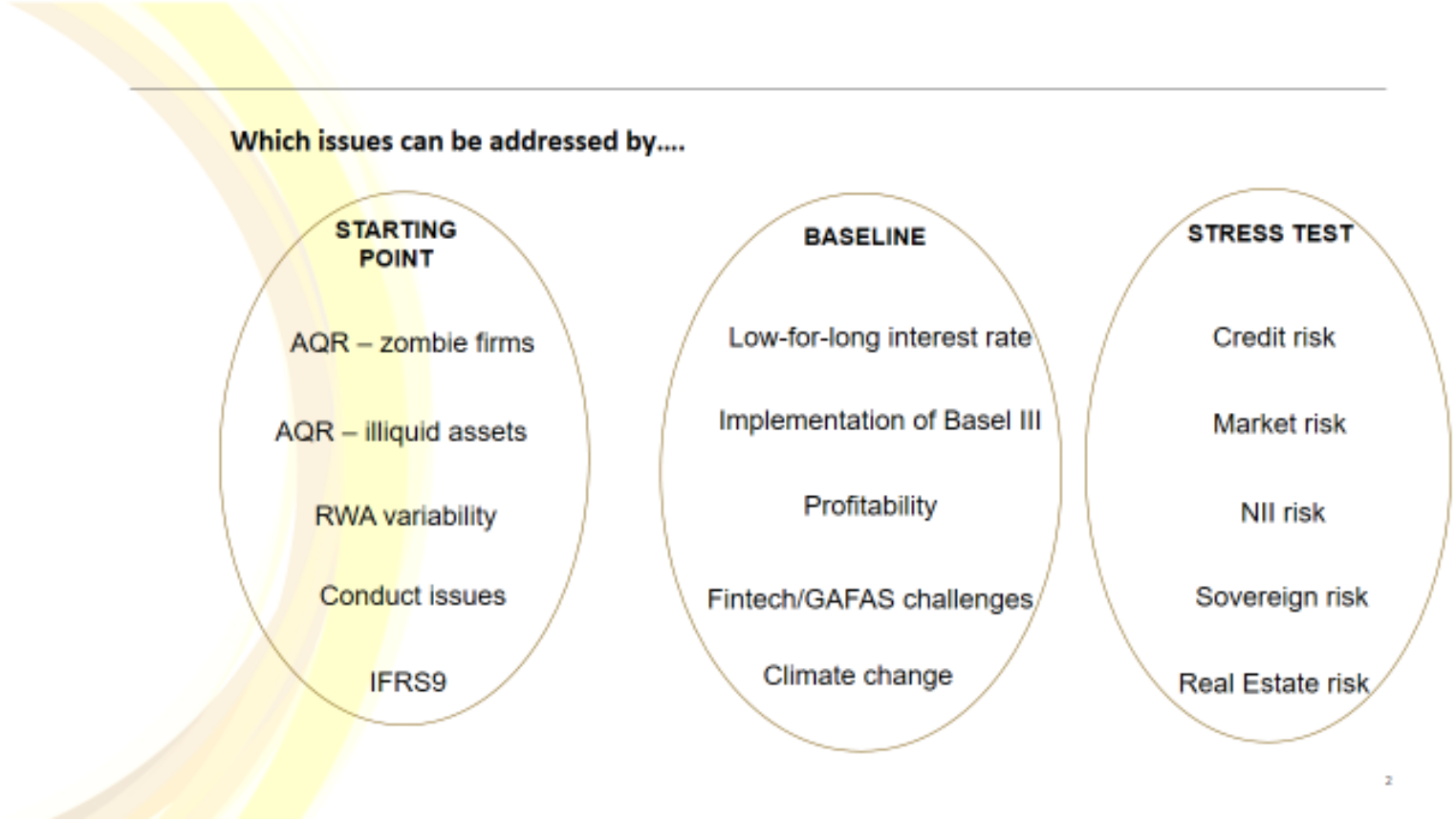

FIGURE 2 - BANK'S PROJECTIONS (baseline or sensitivity scenario)

	Dynamic BS	**Static BS**	**ICAAP**	**Dynamic BS Sensitivity-based**
KEY FEATURES				
Economic scenario	Baseline	Baseline	Bank	Sensitivity scenario
Ownership	Bank	Hybrid	Bank	Bank
Corporate decisions	Yes	No	Yes	Yes
Granularity	High	High	High	High
ASSESSMENT CRITERIA				
Realism	High	Low	High	Medium-High
Forward-looking	High	Low	High	High
Accountability	High	Low	High	Medium-High
Comparability	Medium	High	Low	Medium
Supervisory use				
Capital Adequacy	High	Medium	High	High
Assess Business Model	High	Low	High	High
Potential for improvement	Medium	Low	Medium	Medium
Cost-efficiency				
For banks	High	Low	High	High
For the supervisor	High	Medium	High	High

FIGURE 3 – STRESSED PROJECTIONS

	Bottom-up Dynamic BS	**Bottom-up ICAAP**	**Bottom-up Static BS**	**Top-down Dynamic BS**
KEY FEATURES				
Economic scenario	Stress	Banks' own	Stress	Stress
Ownership	Bank	Bank	Hybrid	Supervisor
Corporate decisions	Yes	Yes	No	Yes
Granularity	High	High	High	Medium
ASSESSMENT CRITERIA				
Realism	Medium	Medium	Low	Medium
Forward-looking	High	High	Low	High
Accountability	Medium	Medium	Low	High
Comparability	Medium	Low	High	High
Supervisory use				
Capital Adequacy	Medium	Medium	Medium	High
Assess Business Model	Low-Medium	Medium	Low	Medium
Potential for improvement	Medium	Medium	Low	High
Cost-efficiency				
For banks	High	High	Low	High
For the supervisor	High	High	Low	Medium-High

FIGURE 4: POSSIBILITY OF MANAGEMENT DECISIONS

	BASELINE			STRESSED PROJECTION			
	Static BS	Dynamic BS	ICAAP	Static BS	Dynamic BS	ICAAP	Top-Down
Cost measures	?	✓	✓	?	✓	✓	?
Business measures	×	✓	✓	×	✓	✓	?
Credit variation	×	✓	✓	×	✓	✓	✓
Risk profile	×	✓	✓	×	✓	✓	?
Funding Structure	×	✓	✓	×	✓	✓	✓
Securities Disposal	×	✓	✓	×	✓	✓	?
Level 2/Level 3 Disposal	×	✓	✓	×	×	✓	×
Earnings retention	✓	✓	✓	✓	✓	✓	✓
Dividends/Bonus retention	✓	✓	✓	✓	✓	✓	✓
M&A, Divestments	×	✓	✓	×	×	✓	×
Asset sales	×	✓	✓	×	×	✓	?
AT1 conversion	×	✓	✓	×	✓	✓	✓
Raise of capital	×	✓	✓	×	×	✓	×

Note: (?) means subject to supervisory discretion (i.e. they are not automatic, they are subject to supervisory assessment).

FIGURE 5 – POSSIBLE TOP-DOWN STRESS TESTS VARIANTS (capital adequacy focus)

	Bottom-Up EU-wide 2018	Top-Down	COVID-19	Non-Banking interactions	Solvency--Liquidity ST
Severe Global Recession	✓✓	✓✓✓	✓✓✓✓	✓✓	✓✓
of which:					
2nd round real effects		(✓)			
Financial Markets Stress	✓✓	✓✓	✓	✓✓✓✓	✓✓✓
of which:					
interconnectedness (banking/non-banking)				(✓)	
amplification effects (on spread yields/fire sales)				(✓)	
solvency-liquidity adverse loops					(✓)
Asset Prices Shock	✓✓	✓✓	✓	✓✓✓	✓✓
of which:					
interconnectedness (banking/non-banking)				(✓)	

Legend: The number of ✓ provides an ordinal (not cardinal) ranking of the size of the three types of shock (severe global recession, financial markets stress, asset prices shock). The magnitude of these shocks is affected by the inclusion of the following spillover or feedback effects: 2nd round effects, interactions between the banking and the non-banking sectors, amplification effects, solvency-liquidity adverse loops.

ANNEX 1 – A multiple-metrics approach to capital measurement[74]

This annex briefly explains the complementary role that risk-weighted solvency measures, the output floor and the leverage ratio have for an adequate assessment of capital adequacy. The leverage ratio benefits from its simplicity: it is hard to game and it is easy to compare across institutions. However, as its requirements in terms of capital are identical regardless of the inherent assets' degree of risk – as it requires the same amount of capital to fund high-risk and low-risk assets – banks seeking to maximize returns on capital have the incentive to have more risky assets.

This leads us to the main *pros* of the CET1 ratio: the granularity allows to consider riskiness at the degree of each individual asset; this promotes risk management practices; finally, and contrarily to the leverage ratio, tends to mitigate incentives for excessive risk taking on high-yield assets. A CET1 ratio subject to an output floor tends to share the same *pros*; as the leverage ratio does not have these characteristics, they are clearly the *cons* of the leverage ratio.

The leverage ratio has some obvious *pros*: simplicity of computation is one. It is also true that the leverage ratio overcomes the problem of zero weights for some assets (like holdings of sovereigns); the leverage ratio provides better protection against risks and/or uncertainties that are difficult to model (model risk). Finally, some empirical evidence shows that the leverage ratio is less pro-cyclical than the CET1 ratio[75]. In all those cases the CET1 ratio subject to an output floor tends to share the corresponding *cons* of the CET1 ratio.

The CET1 ratio has also associated other *cons*: risk of a boost in financial leverage, at the institution level, by increasing exposures to low risk-weighted assets; risk of gaming and, as result, lack of market confidence on risk-weighted capital measures. The CET1 ratio subject to an output floor somewhat addresses these issues, but does not resolve them totally. These aspects are clear *pros* for the leverage ratio, which makes comparability simpler, overcoming the complexity and lack of transparency under the risk-weighted framework.

It is however the case that some of the *cons* of the risk-weighted CET1 are addressed more adequately by an output floor than by the leverage ratio. Excessive variation of RWAs for the same exposures, extremely low levels of model-based RWAs for some exposures and horizontal inequality between standardized and internal model weights are aspects that are all addressed by the CET1 ratio subject to an output floor and not addressed, or at least satisfactorily addressed, by the leverage ratio.

[74] This annex is based on Bank of England (2014), Borio *et al.* (2020), and BCBS (2014). The important aspect on how those metrics react under stress (under static and dynamic balance sheets) is not dealt with in this paper.
[75] Goldstein (2017) surveys some empirical findings that favor the use of the leverage ratio *vis-a-vis* the use of the CET1.

FIGURE 6 – CAPITAL METRICS (Pros and Cons)

	Risk-weighted CET1	Output Floor	Leverage ratio
Considers risk of individual assets	✓✓	✓✓	××
Mitigates risk for excessive risk-taking (low incentives to riskier, higher-yield assets)	✓✓	✓✓	××
Promotes risk management practices	✓✓	✓✓	××
RWAs dispersion and inconsistency	××	✓✓	×
Low levels of model based RWAs	××	✓✓	×
Horizontal inequality in RWAs requirements	××	✓✓	×
Risk of building-up of excessive leverage	××	×	✓✓
Risks of gaming (non comparability)	××	×	✓✓
Lack of market confidence in RWAs	××	×	✓✓
Pro-cyclicality	××	××	✓✓
Model risk	××	×	✓✓
Treatment of zero RWAs	××	××	✓✓
Simplicity (versus complexity)	××	××	✓✓

Legend: ✓✓ means *pros*; ×× means *cons*; × means mitigated *cons*.

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