IN-DEPTH ANALYSIS

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How demanding and consistent is the 2018 stress test design in comparison to previous exercises?

Banking Union Scrutiny

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Abstract

We provide an assessment of the design and calibration of the 2018 EU-wide stress test. The adverse scenario for the 2018 stress test is more severe than for previous stress tests in terms of the assumed GDP decline in the EU area. However, the test is less severe in terms of the losses that banks are expected to incur under the scenario. The adverse scenario has a highly asymmetric impact on different European countries, such that countries with a high degree of trade openness are affected considerably more. It seems unlikely that the assumed scenario constitutes the most plausible threat scenario for the EU economy.

Since banks use heterogeneous models to forecast the stress scenario impact on loan losses and since the EBA does not publish its own respective benchmark parameters, the public cannot fully assess the true severity of the test in terms of its impact on banks' capital. We argue that both the lack of transparency and the heterogeneity of banks' practices to forecast stress scenario induced losses considerably weaken the credibility of the stress test and limit its usefulness in supporting market discipline among European banks.

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LIST OF ABBREVIATIONS

A-IRB	Advanced Internal ratings-based approach
BCBS	Basel Committee on Banking Supervision
bp	Basis points
CCF	Credit conversion factors
EAD	Exposure at default
EBA	European Banking Authority
ECB	European Central Bank
ESRB	European Systemic Risk Board
EU	European Union
F-IRB	Foundation Internal ratings-based approach
GL	Guidelines
IIF	Institute of International Finance
IRB	Internal ratings-based approach
LGD	Loss given default
PD	Probability of default
RWA	Risk-weighted assets
SA	Standard approach
RTS	Regulatory technical standards
SME	Small and medium-sized enterprise(s)
SREP	Supervisory Review and Evaluation Process
SRM	Single Resolution Mechanism
SSM	Single Supervisory Mechanism

EXECUTIVE SUMMARY

In January 2018, the European Banking Authority (EBA) launched details regarding the 2018 EU-wide stress test. In this paper, we discuss details of the macro-financial scenario published by the ESRB and in the EBA/ECB methodology, as well as the translation of this adverse scenario to the market risk scenario. Our analysis reaches the following conclusions:

- **Main characteristics of the ESRB scenario:** The adverse scenario constitutes the most severe scenario compared to previous EU stress tests (the deviation of the baseline EU growth rate is more than 8 pp in 2020). The adverse shock most likely originates in the US and transmits to Europe via an increase in risk premia. The country-specific calibration implies a highly asymmetric impact of the scenario: countries with a high degree of trade opened seem to be more affected compared to countries with lower openness.

- **Plausibility of the ESRB scenario:** While it is difficult to foresee what kind of future macroeconomic crisis will emerge, we can question whether a foreign shock originating in the US really constitutes the most relevant risk to the European banking sector. Further, we identify some seemingly implausible country-specific adjustments of macro variables following the adverse shock

- **Forecast of banks' loan losses under the 2018 stress scenario:** Applying a methodology from Niepmann and Stebunovs (2018), we forecast the impact of the 2018 adverse scenario on banks' credit losses. Based on the assumption that banks' internal forecast models have not been changed since 2016, we conclude that the 2018 stress test will presumably lead to lower losses compared to the 2016 stress test.

  The EBA does not publish its benchmark risk parameters regarding the translation of the scenario to credit risk. These risk parameters are only provided to banks. This lack of transparency makes it impossible for the public to assess the severity of the stress scenario and weakens the credibility of the EU-wide stress test exercise. A redesign of the stress test that focusses on the information requirements of market participants could improve the effectiveness of the stress test in in supporting market discipline among European banks.

- **Translation of the ESRB scenario to the market risk scenario**: We identify several inconsistencies when comparing the calibration of the ESRB adverse scenario with the EBA/ECB market risk scenario. These inconsistencies are possibly the result of political bargaining between regulators from different countries to soften the calibration of the stress test.

- The 2018 stress test introduces some methodological changes, the most important of these being the introduction of IFRS 9. However, the EU transitional arrangements allow banks to completely neutralize all IFRS 9 impacts and even alleviate the severity of the stress test.

1. OVERVIEW

In this paper, we provide an assessment of the design and calibration of the 2018 EU-wide stress test. Our evaluation focuses on the following three questions:

1. Is the 2018 EU-wide stress test (and in particular the adverse macro-financial scenario) internally consistent?
2. Are the design and parameters more demanding than those of previous EU-wide stress test exercises? How severe is the stress test compared to the US stress test?
3. Would it be advisable to have more demanding scenarios, additional elements, or additional explanations, also in view of practices and developments outside of the Banking Union?

To answer these questions, we start with a characterisation of the 2018 ESRB adverse scenario (Chapter 2). This description is based on the information provided by the ESRB when announcing the 2018 exercise. In the next step, we evaluate the consistency (Chapter 3) and methodological changes (Chapter 4) of the 2018 stress test, with a focus on the adverse scenario. To do so, we focus on how the ESRB 2018 scenario impacts individual banks. We then examine how demanding the 2018 exercise is compared to previous European exercises, as well as stress tests conducted in the US (Chapter 5). We also provide a forecast of the credit losses resulting from the 2018 adverse scenario (Chapter 6) based on a methodology developed by Niepmann and Stebunovs (2018). Finally, we provide proposals for adjusting the design of European stress tests (Chapter 7) and propose questions for the public hearing in the ECON committee (Chapter 8).

2. THE ADVERSE MACRO-FINANCIAL SCENARIO FOR THE 2018 EU-WIDE BANKING STRESS TEST

Main characteristics of the ESRB adverse macro-financial scenario. On 31 January 2018, the European Banking Authority (EBA) formally launched the 2018 EU-wide stress test. The underlying hypothetical adverse scenario for the 2018 EU-wide stress test originates from a shock outside the European Union that spills over into Europe via financial and trade channels. The scenario can be characterized by four systemic risks (similar to the EBA 2016 EU-wide bank stress testing exercise):

1. repricing of risk premia triggered by policy expectation shock that results in tight financial conditions;
2. feedback loop between bank profitability and low nominal growth;
3. public and private debt sustainability concerns
4. liquidity risks in the non-banking sector

Of these four systemic risks, the first is considered most relevant. The mapping of these four systemic risks into macro-financial shocks as published by the European Systemic Risk Board (2018) is illustrated in Appendix Table 1. The shock is assumed to cover three years; Starting in Q1

2018 and ending in Q4 2020. Results of the stress test exercise are expected to be published by 2 November 2018.

Calibration of the ESRB adverse macro-financial scenario. The adverse scenario is triggered by a shock to bond yields and equity prices in global financial markets, resulting in changes in future market expectations. The shock of the adverse scenario is triggered outside the European Union, most likely in the United States, given that US stock prices are expected to decline most strongly (by more than 41 %). As a consequence, interest rates and risk premia in European countries increase. The model used for the scenario calibration is based on Henry (2015).

Table 1 provides an overview of EU averages for the 2018 ESRB scenario and the respective figures for the 2016 scenario. The adverse scenario results in an increase of long-term interest rates by more than 80 basis points. Stock prices slump by almost 30 % in the first year of the shock and banks' funding costs increase, as indicated by the increase of the money market rate by 55 basis points in the first year, 47 in the second year and 39 in the third year of the scenario. With regards to the real sector, there is decline in foreign demand for EU products (level deviations from the baseline: -6.6 % in 2018; -9.3 % in 2019; -7.6 % in 2020) and the GDP growth rate in the EU (growth rates in the adverse scenario: -1.2 % in 2018; -2.2 % in 2019; 0.7 % in 2020). The average EU inflation rate is still considered positive (inflation rate in the adverse scenario: 1.3 % in 2018, 0.4 % in 2019, 0.0 % in 2020) and unemployment rises over the upcoming three years (deviations from the baseline: 0.7 % in 2018, 2.3 % in 2019, 3.3 % in 2020).[1] Residential as well as commercial real estate prices experience a cumulative decline of roughly 20%.

The assumed scenario has strikingly different impacts across European countries. To illustrate these differences, we focus on Germany, France, Italy and Spain. The impact of the long-term rates in the year of the shock is the mildest in Germany (62 bp) followed by France (76 bp), Spain (115 bp) and Italy (121 bp). The stock price reaction in 2018 is relatively similar in these four countries (Germany -30.6 %, France -32.2 %, Spain -33.8 %, Italy 34.6 %). The macroeconomic consequences of the 2018 adverse scenario are quite different across countries. Regarding GDP decline, the cumulative GDP decline over the three years of the stress test period is – 3.3 % for Germany, - 1.5 % for France, – 0.8 % for Spain, and - 2.7 % for Italy. The differences are presumably due to the openness of the economy. A larger share of EU imports and exports will leave a country more affected by a shock emanating from outside the EU.

A similar pattern can be observed for the unemployment rate between Germany and France. While it is assumed that the German unemployment rate would deviate from the baseline rate by 0.9 % in 2018, 2.4 % in 2019 and 3.2 % in 2010, the increase of the unemployment rate in France is considerably lower (0.1 % in 2018, 0.6 % in 2019, 1.5 % in 2020).

[1] To provide another example beyond the four countries we have been focusing on here, we consider the unemployment rate in Denmark. In the year 2020, the unemployment rate deviation from the baseline scenario amounts to an increase of 6.3 pp (in Italy the increase is only 2.2 pp).

	ESRB **2018** EU-wide ST			ESRB **2016** EU-wide ST		
	2018	2019	2020	2016	2017	2018
Shock to long-term interest rates (basis points)	83	85	80	71	80	68
Stock price shocks (deviations from the baseline %)	-29.9%	-27.2%	-21.5%	-25.4%	-24.7%	-16.4%
Money market rates (three-month interbank offered rates, basis points)	55	47	39	33	23	6
Foreign demand for EU products (level deviations from baseline in %)	-6.6%	-9.3%	-7.6%	-6.3%	-7.9%	-6.5%
GDP growth in EU countries (adverse growth rates %)	-1.2%	-2.2%	0.7%	-1.2%	-1.3%	0.7%
HICP inflation in EU countries (adverse rate %)	1.3%	0.4%	0.0%	-0.9%	-0.2%	-0.2%
Unemployment rate in EU countries (adverse rate %)	7.9%	9.0%	9.7%	9.9%	10.8%	11.6%
(rate deviations pp)	0.7%	2.3%	3.3%	0.7%	1.9%	2.8%
Residential real estate prices (adverse growth %)	-9.6%	-9.8%	-0.8%	-7.7%	-2.9%	-0.6%
Commercial real estate prices (adverse growth %)	-11.1%	-7.5%	-2.7%	-5.6%	-6.7%	-3.5%

Table 1: Comparison of the ESRB scenario calibration of the 2018 and 2016 EU-wide banking stress tests

Sources: European Systemic Risk Board (2016), European Systemic Risk Board (2018);

Translation of the ESRB adverse macro-financial scenario into risk parameters of banks.

In order to calculate the hypothetical impact of the assumed ESRB stress scenario on the capital adequacy situation of each bank, numerous scenario implied risk parameters (loan losses, changes in risk weighted assets, changes in net interest income, etc.) need to be forecasted, under the condition that the assumed stress scenario becomes reality. This forecast inevitably provides an enormous amount of discretion when it comes to the details of each forecast. In order to curtail the range of discretion, supervisors issue methodological guidelines and additional risk parameters. The EBA and ECB jointly take the ESRB scenario as a starting point and derive a larger and more detailed set of risk parameters that banks should use when they calculate the implied capital adequacy situation under stressed conditions. Some of these risk parameters are made public (the so called "Stress Test Market Risk Scenario"). This set of parameters is mainly used in order to calculate the stress scenario impact on the bank's trading books. Economically much more important are scenario impacts in the banking book, including loan losses and changes in risk weighted assets due to a deterioration of the credit quality of performing loans. The EBA communicates these parameters to the banks that take part in the stress test, but does not make these parameters public and does not allow banks to share this information with other parties.

The adverse scenario mostly impacts banks' profits or losses and regulatory capital, mainly through the following three channels:

- *Credit risk:* Banks applying internal ratings-based approach (IRBA) models are supposed to incorporate the ESRB macro parameters into their own risk models in order to calculate capital requirements (this approach is often referred to as a "bottom-up" approach). There are, however, two limitations to this approach. First, not all banks (particularly not small ones) have IRBA models in place for all of their credit portfolios. Second, the impact resulting from this exercise is then compared to benchmark risk parameters that the ECB jointly determines with the EBA. These parameters are the result of transmitting the macroeconomic scenario into bank-specific risk parameters, i.e. "probabilities of default" (PDs) and "loss given default" (LGDs). From previous exercises we know that the EBA has always provided PD/LGD benchmark parameters for important portfolios (e.g. corporates, retail, sovereign, institutions, split-up by countries) to banks, in order to give them sufficient information about the EBA's expectations regarding the translation of the macroeconomic scenario into the underlying risk parameters of specific bank portfolios.

  If the impact of the adverse scenario on a portfolio's risk parameters determined by banks' internal models is more severe than the benchmark risk parameters provided by the ECB/EBA, the bank is supposed to implement the adverse scenario based on the internally determined risk parameters. If the opposite holds true, banks have to provide arguments for why their specific portfolio's risk parameters react less to the adverse scenario, compared to the benchmark case. Once the supervisor is convinced by the bank's arguments (and/or the deviation from the benchmarks is within a realistic/reasonable range), the bank may use its own risk parameters. Otherwise, the EBA/ECB benchmark risk parameters have to be applied. The same holds for the (rather small) banks having no IRBA models in place for all of their credit risk portfolios.

  For those portfolios whose capital charges are not determined by internal rating models, as well as all portfolios of banks that do not use internal models to determine their capital charges, the ECB/EBA benchmark risk parameters are applied to assess the impact of the

adverse scenario. Given that the benchmark EBA/ECB risk parameters are not publicly available, we cannot assess in detail the severity or the consistency of the 2018 stress test regarding its impact on the loan book and other related balance sheet items.

- *Market risk:* The impact of market risk on all banks' positions at partial or full fair value measurement is to be assessed via a full revaluation after applying a set of stressed market risk factor shocks based on the adverse macroeconomic scenario (European Banking Authority 2018a). Here the EBA/ECB publishes extensive documentation on the translation of the ESRB adverse shock into the so called "market risk scenario" (European Banking Authority 2018b). In the next section, we discuss whether this translation seems to be consistent.

- *Net Interest Income*: Banks need to project future interest income, subject to a cap on the applicable effective interest rate under the adverse scenario. Maturing assets and liabilities will by assumption be replaced with new assets and liabilities. The interest rate margin earned on these depends in part on the rise of sovereign bond interest rates, as banks are required to reflect a proportion of the changes in these rates in order to forecast future interest rates of their repriced liabilities (European Banking Authority 2018a). The methodology to be applied allows banks to forecast higher future earnings when the government bond interest rate is assumed to increase strongly. This effect is particularly relevant for Spain and Italy, as these countries are assumed to experience a very large interest rate shock. Overall, net interest income is capped in the sense that it must not exceed the current income levels under the adverse scenario.

Banks need to further determine the impact of the adverse scenario with regards to "Conduct risk and other operational risks" as well as "Non-interest income, expenses and capital". The impact of these issues are, however, expected to be considerably smaller as compared to the impact on credit, risk, market risk and net interest income. We therefore focus on these three elements in our analysis.

3. EVALUATING THE CONSISTENCY OF THE ADVERSE MACRO-FINANCIAL SCENARIO FOR THE 2018 EU-WIDE BANKING STRESS TEST

Issue #1: Design and interpretation of results of the ESRB macro-financial scenario: The ESRB adverse scenario constitutes an exogenous shock to risk premia that originates outside the European Union (i.e. a decline in stock prices by 41 percent in the United States). The impact of this macro-financial scenario on different European countries is highly asymmetric: the growth rate impact for Germany is -4.4 %, for France -1.8 % and Italy -2.0%. With regards to unemployment, the adverse scenario translates into an increase of 0.9 % in Germany and only 0.1 % in France and 0.3 % in Italy. Irrespective of the plausibility of the design of this adverse scenario (see Issue #2), implementing a scenario with such asymmetric effects in different countries means that banks will be differentially affected based on their location. Given the extremely heterogeneous macroeconomic scenario among EU-countries, the EU-wide stress test is, to a large extent, a "country-by-country" stress test (i.e. effects from the idiosyncratic risk profile of individual banks are likely to be dominated by country effects). The EBA nonetheless publishes "bank-by-bank" results of the exercise. But the stress test results for individual banks from

different countries are hardly comparable, because the country specific treatments under the stress test must be taken into account in any comparison.

Issue #2: Consistency of the ESRB macro-financial scenario: While it is extremely difficult to forecast which adverse scenario is most likely to affect the EU, it is worthwhile to briefly discuss the plausibility of the basic ESRB scenario of the 2018 exercise. In this scenario an external shock in confidence that seems to take place in the US leads to an abrupt increase of risk premia. There are two questions worth raising:

1.) Does the calibration of the current ESRB scenario seem plausible?
As outlined in the previous the section, the adverse scenario implies a quite asymmetric impact on the four countries analyzed (i.e. Belgium, Sweden and Germany are considerably more affected than France, Spain and Italy). Since the assumed shock is emanating outside Europe, it is plausible that the GDPs of countries with strong international trade relations are worse hit. Still, it is difficult to understand the precise pattern of GDP shocks. For example, Sweden, Portugal and Belgium are badly hit (GDP declines of 10.4 %, 4.3 % and 4.5 %) while Spain (-0.8 %), Poland (- 0.2 %) and Cyprus (- 0.2 %) are almost unaffected by the shock. Similar observations apply to the unemployment rate. Why should the Danish unemployment rate increase by 6.3 % under stress, while unemployment in Italy stays almost constant in the adverse scenario (+ 2.2 %)? While it cannot be ruled out that the countries are hit in the particular manner postulated in the EBA scenario, it would be interesting to understand what particular assumptions or modelling choices led to this rather surprising parameter choice.

2.) Is a shock to risk premia originating in the US the most relevant scenario for the EU?
We could question whether a recession shock originating in the US really currently constitutes the most relevant adverse macro-finance scenario for the EU. Given the remaining high debt to GDP levels of several European countries and the political discussion regarding a commitment to the European Monetary Union, alternative adverse macro-financial scenarios that emerge within the EU may seem more plausible.

Overall, it is important to stress that by definition the ESRB has to make certain assumptions when defining an adverse scenario and that any of these choices might be subject to criticism.

Issue #3: Impact of the ESRB macro-financial scenario on banks' credit risk: As described above, the ECB/EBA translates the ESRB adverse scenarios into bank-specific risk parameters, i.e. "probabilities of default" (PDs) and "losses given default" (LGDs). The EBA/ECB provides banks with these PD/LGD benchmark parameters for important portfolios (e.g. corporates, retail, sovereign, institutions, split-up by countries). Discussions with several bankers have revealed that these benchmark parameters play a significant role in determining the actual impact of the stress test on banks' credit risk. This is especially true for the sovereign debt portfolio of the banking book where the top-down provided mark-ups for PDs are clearly one of the most relevant details in assessing the impact of the adverse scenario.

Given the importance of these parameters, we have contacted the Director of Economic Analysis and Statistics and the Directorate General Micro-Prudential Supervision IV of the ECB, in order to understand the details of these parameters. Unfortunately, we learned that the benchmarks are only circulated to banks running the stress test as part of the stress test material. Not publishing these parameters makes it difficult to assess the 2018 EU-wide stress scenario. Note that it is not only the macroeconomic scenario, but also the translation of the scenario into banks' risk parameters (i.e. PD and LGD changes) that determines the "strength" of a credit risk stress test. We notice that the EBA is very transparent with some parts of the EU-wide stress test (i.e. methodological notes, the macroeconomic scenario, the market risk parameters, the stress test templates, and even FAQs are published on the EBA website), but highly relevant information on the translation of the macroeconomic scenario into credit risk benchmark parameters is not disclosed to the public (including the European Parliament and European Commission) and is only shared with banks.

Issue #4: Internal consistency of the EBA stress scenario (focusing on the adverse scenario): The EBA stress test scenario consists of two parts: the "Adverse macro-financial scenario" developed by the ESRB and the "Market risk scenario" as published on the EBA website. Both papers postulate stressed values for a large number of risk parameters. The authorities claim that these parameter values are plausible and to be expected, given the assumed stress event that is summarized as "an abrupt repricing of risk premia in global financial markets triggered outside the European Union which spills over to European countries".

Apparently, the scenarios' values have been derived with a portfolio of different modelling techniques, including computational macroeconomic models, statistical analysis of co-movements of various parameters and judgmental idiosyncratic adjustments. The question of internal consistency cannot be answered with a simple "true" or "false". However, expert judgement reveals some particular areas where consistency seems to be weak and questionable. Only a few observations will be presented here:

- The stock price scenarios provided by the ESRB do not seem to be consistent with the stock price scenarios provided by the EBA/ECB in the "market risk scenario". For Malta, the ESRB forecasts larger losses than the market risk scenario – for Norway, the opposite is true. Malta experiences a decline of 21.5 % (2018), 19.7 % (2019) and 15.6 % (2020) according to the ESRB, but the market risk scenario specifies a decline of only 9.6%. For Norway, the ESRB forecasts stock market declines of 27.7 % in 2018, 25.1 % in 2019, and 19.7 % in 2020 - but the market risk scenario postulates a larger loss of 28.5 %.

- The stress test scenario postulates both a severe global recession and a rather strong increase of long term government bond yields in Europe. Both are highly unlikely to happen at the same time. More consistent with empirical evidence and in contrast to the EBA stress test design, the US stress test by the Federal Reserve assumes a decline rather than an increase of interest rates. The EU stress test seems to be driven by the assumption that a global increase in risk premia also drives up government bond yields. But this contrasts with the empirical experience that an increase of risk aversion drives investors

to "safe havens" and thus decreases the interest rates of countries such as Switzerland, the USA and Germany. Inconsistent with this experience, the EBA stress test foresees government bond yield increases for all countries. Even stranger is the observation that government bond rates in countries such as China, Japan, Peru or Ukraine remain almost unchanged even in the adverse scenario – this appears highly unlikely in a scenario that is described as a global shock to risk premia.

- Under the assumption of a global shock to risk premia, the spread between swap rates and government bond rates should also increase. The EBA stress test scenario indeed implies this for most countries, but implies an implausible decline of the (10 year) swap spread in Switzerland, the UK and Turkey.

While we do not know the reason for these apparent inconsistencies, one possible explanation may be rooted in political negotiations between countries in the design phase of the stress test. If several regulators from different countries demand changes to the proposed scenario and the ultimately chosen scenario is the result of political bargaining among those regulators, the resulting adaptations are a likely to introduce inconsistencies.

4. METHODOLOGICAL CHANGES OF THE EBA 2018 VS. THE EBA 2016 STRESS TEST

The severity of the 2018 stress test also depends on the methodological guidelines that banks need to apply when they forecast the stress scenario consequences for their capital adequacy situation. At this point, we can only highlight a few methodological changes between the 2016 and 2018 stress tests which could make the 2018 stress test more or less severe.

Impact of IFRS 9. For banks that start to report under IFRS 9 in 2018, the 2018 EU-wide stress test takes the IFRS 9 impact into account in starting point data as well as in the projections of banks.[2] IFRS 9 is widely expected to severely affect the equity capital ratios in two ways: First, IFRS 9 causes a permanent increase in loan loss provisions, because the accounting provisions for loans with significantly deteriorated credit risk ("S2 exposures") will increase.[3] Second, in a severe recession, the amount of S2 exposures is likely to increase substantially above pre-crisis levels and will further increase provisions and reduce capital under stressed conditions.

The effect of IFRS 9 introduction depends on the definition that banks apply in order to identify S2 exposures. The new 2018 EBA guidelines limit the scope of discretion exercised by banks, by requiring that loans be treated as S2 if they experience a threefold increase of lifetime PD since the initial recognition.[4]

[2] European Banking Authority (2018a), EBA stress test methodological notes 2018, paragraph 25.

[3] Provisions for these loans change from 1-year expected loss to lifetime expected loss.

[4] European Banking Authority (2018a), EBA stress test methodological notes 2018, paragraph 51.

While we believe that IFRS 9 will have an important impact on the EBA stress test results in the long run and make the test more severe, we expect that the European transitional arrangements will allow banks to completely neutralize these effects in the derivation of the 2018 stress test results and even improve (!) their capital ratios instead. To see why, note that banks are asked to recognize IFRS 9 effects as of 1 January 2018, they are not required to anticipate other changes after this date.[5] But the EBA had stated earlier in an opinion on the EU transitional arrangements that these rules "would result in the full neutralization of any impact on CET1 arising from the application of IFRS 9 during the first year of the transitional arrangements."[6] Even worse, the EBA states that the rules are not sufficiently prudent, as they may allow some provisions to be added back to CET1 and therefore have a positive (!) impact due to IFRS 9.[7] Summing up, we expect that the introduction of IFRS 9 will not have the expected and intended effect of making the stress test more severe. In contrast, they may actually alleviate the severity of the stress test due to the details of the transitional arrangements.

Stricter modelling requirements: mortgage loan losses. In a number of areas, the EBA has sharpened the methodology by giving more detailed guidelines. For example, losses from mortgage loan defaults must be forecasted under the newly introduced assumption that the projected house price decline will already happen in the first year and that house prices will not increase thereafter.[8]

Stricter modelling requirements: new floor for the projected losses from material conduct risks. In recent years, some banks have reported very large losses from conduct risks. The projection of these losses in the stress scenario is thus an important stress test element. The stress test asks the banks to do their own forecasts for these losses. However, this forecast is subject to floors set by the authorities which are based on the individual banks' historical loss experience.

However, a floor was applied in 2016 only to small (non-material) losses and thus left a large degree of discretion to banks on how to forecast losses from large ("material") events. The 2018 methodological guidelines introduce a floor for both material and non-material conduct losses.[9] Nevertheless, banks may deviate and use more optimistic projections for material conduct loss if banks propose a justification that is judged "reasonable" by the authorities.

[5] European Banking Authority (2018a), EBA stress test methodological notes 2018, paragraph 26, 27.

[6] European Banking Authority (2017), Opinion of the European Banking Authority on transitional arrangements and credit risk adjustments due to the introduction of IFRS 9, 06 March 2017, p.8.

[7] European Banking Authority (2017), Opinion of the European Banking Authority on transitional arrangements and credit risk adjustments due to the introduction of IFRS 9, 06 March 2017, p.5 f.

[8] European Banking Authority (2018a), EBA stress test methodological notes 2018, paragraph 112.

[9] European Banking Authority (2018a), EBA stress test methodological notes 2018, paragraph 389 & Box 31.

Loosening of modelling requirements – dividend income. There are some examples where the stress test methodology is changed in a way that allows banks to exercise more discretion and thus reduces the severity of the stress test. One example is the projection of dividend income from subsidiaries of a bank. In the 2016 stress test, these dividends were prescribed by the authorities.[10] In 2018, banks are allowed to use their own, perhaps more optimistic projections.[11] The projections are subject to a floor but this floor is less conservative than the 2016 stress test rules.[12]

5. COMPARING THE 2018 EU-WIDE BANKING STRESS TEST TO PREVIOUS EU AND USA STRESS TESTS

Comparison with previous EU stress tests. The adverse scenario of the 2018 EU-wide stress test implies an 8.3% deviation of average EU GDP from its baseline level, in 2020. This constitutes the most severe scenario to date, as can be seen below in Figure 1 (European Systemic Risk Board (2018)). In Table 1 above, we contrast the macro impact of the 2018 and 2016 scenarios in more detail. This comparison illustrates that the adverse 2018 macro-financial scenario is indeed considerably stricter compared to the previous exercise. Only the adverse unemployment rate in EU countries seems higher under the 2016 scenario. This is, however, driven by an improvement in the baseline unemployment rate. Thus, the deviation of the unemployment rate from the baseline scenario is also tougher under the 2018 scenario.

While the ESRB 2018 scenario seems to be more demanding regarding the deviation of macro variables from the baseline compared to previous exercises, it is important to note that the overall macroeconomic situation in the EU has improved since the last exercise was conducted in 2016. Given this, it is not clear whether the actual impact on credit losses of the 2018 ESRB scenario is expected to be more severe compared to previous stress tests. In order to provide an assessment of this question, we provide evidence from a forecast on the impact of the 2018 ESRB scenario on banks' credit losses, in the following chapter.

[10] Under the adverse scenario, the minimum of current dividends and historical dividends had to be used. European Banking Authority (2018a), EBA stress test methodological notes 2016, paragraph 395.

[11] European Banking Authority (2018a), EBA stress test methodological notes 2018, paragraph 410 – 413.

[12] The 2018 floor for the adverse scenario is based on current dividends. In 2016, the minimum of current dividends and historical dividends had to be used, see footnote 8.

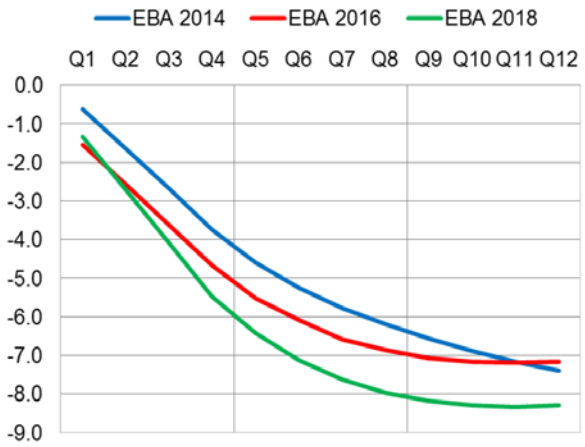

Figure 1: EU real GDP deviation from the baseline comparison between EBA exercises for 2014, 2016 and 2018 (percent). Source: European Systemic Risk Board (2018)

Comparison of US stress test and European stress test. The Federal Reserve Bank in the US conducts stress tests as required under the Dodd-Frank Act[13] that are similar to the EBA stress test. The two most important differences are:

1. The macroeconomic scenarios used
2. The process used to derive the impact of the scenario on individual banks

Table 2 compares important input parameters of the 2018 stress test in the US and Europe.

	Fed stress test adverse scenario	**EBA stress test adverse scenario[14]**	**Fed stress test severely adverse scenario**
GDP (Maximum adverse growth)	- 2.25 %	- 3.6 %	- 7.5 %
Unemployment rate (Max. adverse change)	+ 2.5 %	+ 3.3 %	+ 5.25 %
Stock prices: max. decline	- 30%	- 29.9 %	- 65 %
Residential house prices changes (cumulative)	- 12 %	- 19.6 %	- 25 %

Table 2: Comparison of input parameters of the 2018 stress test in the US and Europe

Source: 2018 Supervisory Scenarios for Annual Stress Tests Required under the Dodd-Frank Act Stress Testing Rules and the Capital Plan Rule, February 2018

[13] See Federal Reserve (2018).

[14] Figures for the EU area.

As is evident from the table, the EBA adverse scenario is more severe than the adverse scenario in the US, but less severe than the "severely adverse scenario". Hence it can be concluded that the EBA adverse scenario falls between the adverse and severely adverse scenarios.

The second big difference between the two stress tests concerns the application of these scenarios to individual banks in order to derive the aggregate stress scenario impact on the capital ratios of each bank. In the US, the Federal Reserve calculates the impact on each banks loan losses and risk weighted assets and applies proprietary models in order to estimate the impact for the various business segments of each bank. This so called "top down" approach guarantees a consistent modelling approach across different banks. The EBA stress test is a "bottom up" exercise which allows the banks to use their own data, experience and methodology to derive the impact of stress scenarios on the individual bank. Empirical research by economists of the Fed shows that this design element introduces a large degree of discretion in the derivation of results. This discretion could be used in order to underestimate the expected effect and ultimately make the stress test less severe.[15] Another paper shows that the forecasts by European banks regarding the impact of the stress test scenarios are relatively precise.[16] We conclude that the bottom-up design of the EBA stress test leads to the possibility that stress test results have a higher degree of heterogeneity as compared to the US stress test and may be less informative for a comparison of stress test results among different banks. It also may allow banks to exercise a high degree of discretion and thereby alleviate the severity of the stress test scenario when compared to the US stress tests conducted by the Fed. More research and transparency is needed in order to compare both tests and make a final judgement on the severity of these tests.

6. FORECAST OF CREDIT LOSSES FROM THE 2018 ESRB ADVERSE SCENARIO

In a recent paper, Camara et al. (2017) developed a methodology to reengineer the underlying credit loss models that banks use to forecast their credit losses from the adverse scenario for different portfolios. Given that the EBA has published extensive information on banks' estimated loss rates of retail and corporate portfolios from the 2014 and 2016 stress tests, the authors use this information to estimate the link between three country-specific macro factors (i.e. GDP growth, unemployment and the inflation rate) and banks' reported loan loss estimates. Importantly, the authors show that the models derived by this exercise have substantial predictive power to project actual loan losses of these banks during the subsequent years following the publication of the stress tests results. This increases our confidence in the accuracy of the methodology employed to forecast the 2018 stress test results. Based on the methodology of Camara et al. (2017), economists of the Board of Governors of the Federal Reserve System conducted a counterfactual analysis that determines what banks' credit losses would have been if exposures, models or scenarios had remained the same compared to the stress tests of the years 2014 and 2016 (see Niepmann and Stebunovs (2018) for details). Their analysis can be used to

[15] See Niepmann and Stebunovs (2018).

[16] See Camara et al. (2017).

simulate the expected credit losses of the 2018 stress test, if we assume that banks use the same internal forecast models in 2018 and in 2016.

Results of the simulation of aggregate bank losses of the 2018 ESRB scenario. In Table 2, we summarize the aggregate projected bank loan losses of the EU-wide stress test assuming the 2018 scenario. For this simulation, the 2018 as well as 2016 exposures of banks, and the same models used by banks in the 2016 exercise, are applied. The estimates were provided to us by the authors of Niepmann and Stebunovs (2018) applying exactly the same methodology as in their paper. Even though the 2018 ESRB EU-wide stress test scenario is the most severe scenario in terms of GDP decline, it can be expected to result in smaller credit losses compared to the 2016 scenario. This holds true irrespective of whether one simulates the 2018 scenario using banks' 2016 exposures (upper part of Table 3) or, alternatively, the most recent exposures that banks hold on their balance sheets (lower part of Table 3).

What could be the underlying reason for the surprising result that a more severe macro scenario leads to considerably lower credit losses? One explanation is that the actual macroeconomic situation in the EU has improved between 2016 and 2018. Most importantly the unemployment rate is lower by about 2 pp. Given that the 2018 scenario has a high loading on the unemployment rate, the impact of the 2018 scenario translates into fewer credit losses. A second explanation is that the 2018 scenario tends to have less effect on those banks that were especially drastically affected by the 2016 scenario.

	Scenario 2016	**Scenario 2018**
Applying 2016 exposures/models		
Adverse	159,945	136,456
Baseline	91,355	78,801
Applying 2018 exposures and 2016 models		
Adverse	158,918	136,039
Baseline	91,422	79,002

Table 3: Forecast of the 2018 aggregate credit losses in EUR million, based on the methodology of Niepmann and Stebunovs (2018).

Note: Numbers presented for this 2016 scenario deviate from the numbers reported in Niepmann and Stebunovs (2018), since the sample was adjusted to the banks that participated in the 2017 transparency exercise in order to obtain exposures for 2018.

Further implications of analysing model changes by banks between the 2014 and 2016 EU-wide stress tests. Banks changed their loss forecast models between 2014 and 2016. An analysis of these adjustments allows us to draw conclusions on the credibility of the bottom-up approach applied in the EU-wide stress tests. The counterfactual analysis provided by Niepmann and Stebunovs (2018) allows us to investigate the role of banks' internal model designs in the European stress tests. To do so, we show how forecasted credit losses change, when the 2016 forecast models are applied to the 2014 scenario versus the 2016 scenario. Equivalently, we apply the 2014 models to both the 2014 and the 2016 scenarios. Table 4 reveals an interesting pattern. The models used by banks for forecasting credit losses seem to be tailored to each year's scenario and exposures. Starting with the upper part of Table 4, the 2014 models produce lower losses than the 2016 models with 2014 exposures and scenarios. Interestingly, the 2016 models produce lower losses than the 2014 models with 2016 exposures and scenarios. The tailoring of bank internal models has a considerable impact on the stress test results. If banks had used the 2014 models during 2016 stress test, credit losses would have translated into a 1.7 % lower common tier 1 capital ratio. Niepmann and Stebunovs (2018) document further evidence for strategic adjustment of the models. Banks that have higher credit losses due to the new scenario conduct stronger (greater) smoothing of their models (after controlling for portfolio risk). Furthermore, a higher share of IRB usage results in more reduction in losses due to model adjustment, and banks with smaller capital buffers experience bigger improvements in their model performance.

Overall, we conclude that the quality of European stress test results seems to suffer from a larger than warranted degree of freedom for the participating banks, as regards the choice models that forecast scenario implied credit losses. It is important to note that the above analysis was conducted for the two previous stress tests and not the current 2018 test. Given that the results will only be published in November this year, it is not yet possible to replicate the analysis for the 2018 scenario. However, there is little reason to expect that these patterns will not be present during the 2018 exercise, given that the basic methodology has not been changed. Importantly, this analysis reveals a major weakness of the European stress test design. The bottom-up approach to forecast scenario implied losses provides banks with too much flexibility, which adversely impacts the credibility of the stress test results.

	Bank models 2014	**Bank models 2016**
Analysis of 2014 exposures/scenario		
Adverse	253,764	387,484
Baseline	124,580	172,433
Analysis of 2016 exposures/scenario		
Adverse	236,138	178,866
Baseline	100,679	102,165

Table 4: Counterfactual credit losses of the 2014 and 2016 stress tests, EUR million
Source: Niepmann and Stebunovs (2018)

7. PROPOSALS FOR CHANGES IN THE DESIGN OF EUROPEAN STRESS TESTS

As a response to the financial crisis in 2008, macro prudential stress tests were introduced in the US and in Europe, in order to re-establish public confidence in the capital adequacy of banks. Low stock prices of banks and high Credit Default Swap premia sent out a clear message that the market had lost faith in the Basel 2 capital adequacy regime. The design of the European stress test has been adapted from similar exercises in the US, most importantly the Supervisory Capital Assessment Program in 2009. The goal was to determine whether the largest U.S. financial organizations had sufficient capital buffers to withstand a severe recession. If not, these institutions were recapitalized by the government. There are two major differences between the design of European and US macro prudential stress tests:

- *Fiscal power:* In the US, the main goal of a stress test is to identify capital shortfalls of banks. The US government was in a position to credibly enforce a recapitalization by the government if a capital shortage should become visible. In contrast, the European Banking Union has no fiscal measures available to coordinate such a recapitalization. It is unclear how useful/problematic it is to publish negative outcomes of these exercises.

- *Political Struggle:* Different from the US set-up, the design of European stress tests is coordinated by regulators from several countries. All else being equal, the incentive of a national supervisor is to design a scenario that protects home country banks from failing the test. Even if the scenario is provided by a European institution, conflicts of interest do not go away. A European institution will presumably try to design a scenario such that failing banks are located in states that could afford a recapitalization.

These differences between the European and the US design of stress tests might partially explain why the existing academic literature on the outcomes of European stress tests is rather negative (see e.g. Acharya et al. (2014) and Camara et al. (2017)).

Given the large amount of efforts and costs of the stress test exercise for both authorities and banks, an analysis of costs and benefits seems warranted. In a potential redesign of the stress test, the test should be clearly tailored to satisfy the information needs of both regulators and capital market investors.

We believe that the translation of the ESRB macro-financial adverse scenario into risk parameters affecting bank balance sheets has to become more transparent and standardized. Without this information, market participants cannot evaluate whether an adverse scenario has been consistently applied to all banks or whether the outcomes are affected by political influence. In our view, the aim of the stress test exercise should be to improve market discipline - the lack of transparency of many stress test details clearly restricts its function in this respect.

Capital market investors would presumably prefer the stress tests in the US and in Europe to become more comparable and similar. One striking difference is the greater involvement of the authorities in the derivation of stress test results in the US ("top-down" approach in the US versus "bottom-up approach in Europe). A convergence of the two systems would lead to increased comparability und may further support market discipline.

Finally, given the high amount of resources involved in stress testing, the prominence of the EU-wide stress tests could be enhanced. One suggestion would be to fully incorporate the stress test in the SREP Supervisory Review and Evaluation Process (and not just as part of the soft "capital guidance" as is currently the case). Given that the ECB applies a "holistic SREP approach" that is hardly transparent to the outside world, capital needs implied by the stress test might not even be counted in full for Pillar 2 Guidance, let alone Pillar 2 Requirements. Thus, if SREP results were to be published systematically, the ECB could be asked to clearly mention what share of the overall capital need derived from the stress test has been allocated to Pillar 2 Requirements, what share has been allocated to Pillar 2 Guidance, and what share has been considered "futile" for other holistic considerations.

8. PROPOSED QUESTIONS FOR THE Q&A SESSION

I. The US stress test is often described as "top down" in the sense that the authorities play a prominent role in the derivation of the stress test results of individual banks, thereby increasing comparability and credibility of stress test results. European stress tests are described as "bottom-up" exercises that rely on banks' internal calculations of stress test results and leave great discretion to the participating banks.

   Why do European authorities leave considerably more discretion to the participating banks? Which of the two approaches ("top down" or "bottom-up") is preferred by capital market investors? Do the European authorities consult capital market investors in order to tailor the stress test design towards their information needs?

II. Why do the EBA and ECB refuse to publish the details of the benchmark risk parameters that they provide to banks in order to assess the stress test implications for credit portfolios (and other areas), thus preventing public observers from assessing the true severity of the stress test?

III. As explained in section 4, the transitional rules of the IFRS 9 introduction may have the effect of making the 2018 stress test less severe. (the EBA has raised a concern that these rules could actually increase the CET ratio.) Is it true that the transition rules might allow a bank to show improved stress test results?

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APPENDIX

Source of risk	Financial and economic shocks
Abrupt and sizeable repricing of risk premia in global financial markets – triggered e.g. by a policy expectation shock – leading to a tightening of financial conditions	- Upward shift and steepening of the yield curve and increase in risk premia in the United States and other advanced economies - Global equity price shock - Increase in the Chicago Board Options Exchange Volatility Index (VIX) and spillover to emerging market economies - Foreign demand shocks in the European Union - Exchange rate shocks - Negative oil and commodity price shocks - Shocks to financing conditions for small and medium-sized enterprises in EU countries due to limited hedging against a rise in interest rates in some segments of the banking sector (via shocks to the user cost of capital)
Adverse feedback loop between weak bank profitability and low nominal growth, amid structural challenges in the EU banking sector	- Investment and consumption demand shocks in EU countries - Residential and commercial property price shocks in EU countries - EU-wide uniform shock to interbank money market rates due to higher credit risk of the banking sector
Public and private debt sustainability concerns amid potential repricing of risk premia and increased political fragmentation	- Country-specific shocks to sovereign credit spreads - Shocks to corporate credit spreads - Shocks to financing conditions for small and medium-sized enterprises in EU countries due to limited hedging against a rise in interest rates in some segments of the banking sector (via shocks to the user cost of capital)[4]
Liquidity risks in the non-bank financial sector with potential spillovers to the broader financial system	- Shocks to EU financial asset prices - Shocks to financing conditions in EU countries (via shocks to household nominal wealth) - Shock to Moody's KMV Expected Default Frequency (EDF) of the largest non-bank financial sector institutions - EU-wide uniform shock to interbank money market rates

Appendix Table 1: Main financial stability risks and assumed financial and economic shocks

Source: European Systemic Risk Board (2018): Adverse macro-financial scenario for the 2018 EU-wide banking sector stress test

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