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A study on the EBA stress test results: influence of bank, portfolio and country-level characteristics

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Abstract

The purpose of this paper is to investigate the main drivers of the change in the credit risk provisions at a portfolio level for the banks that have been subject of the 2018 EBA stress tests. Therefore, we perform a holistic review of the drivers of the three-year projections of credit losses. First, we define a model containing all the macroeconomic variables considered by the EBA methodological approach. By adding a three-dimension set of explanatory variables, entity-, banking sector- and portfolio-level aspects, we verify whether the published results show some kind of relation with these explanatory variables. Our results show that, although EBA variables explain most part of credit risk provisions, we obtain evidence about the role played by bank-level variables, banking sector features in each country, and the specific characteristics of the portfolio in explaining part of the provisions. Moreover, the results also indicate the existence of complementary/substitution effects of both bank- and portfolio-level variables with the characteristics of the banking sector when explaining credit risk provisions.

Keywords: Stress tests; credit risk; EBA; bank characteristics.
JEL codes: G20; G21; G28

Non-Technical Summary

In this paper, we investigate empirically the main drivers of the change in the credit risk provisions at a portfolio level for the sample of 48 European banks that have been subject of the 2018 EBA stress tests.

We first model the change in credit risk provisions on the set of macroeconomic variables defined by the EBA methodological approach. Afterwards, we analyze the existence of additional factors affecting projected losses and, thereby, credit risk provisions of the examined banks. Concretely, we assess the impact of different variables at bank-level (size, efficiency, risk, liquidity, leverage, or specialization); at country-level (size and financial soundness of the banking sector; market structure; efficiency or specialization of the banking activities); and at portfolio-level (size, risk, the use of the IRB models, or the originating country).

According to the expectations, we find a strong explanatory power of the EBA macroeconomic variables on the credit risk impact of stress tests. Moreover, our empirical findings also show that less efficient, risky, less liquid, more diversified, and highly leveraged individual bank entities are required to hold higher levels of credit risk provisions. Additionally, our results support the existence of a source heterogeneity that is related to the bank's country of origin.

Based on the observed heterogeneity related to the bank's country of origin, we include specific banking sector characteristics that could help to understand better the cross-country differences. As regards this, our empirical results are consistent with the fact that banks from larger, more concentrated and safer banking markets experience a lower increase on credit risk provisions. Moreover, banks from more efficient or less specialized banking sectors are more affected by the credit risk impact.

We also include a set of portfolio-level variables in order to complement our analysis. From the inclusion of these variables in the empirical model, we find that riskier portfolios are more affected by the change in credit risk provisions requirements, as well as domestic portfolios. Moreover, if an IRB approach to model internal credit risk is implemented by the bank, the credit risk impact for the portfolio is lower. This happens as well as in the case of large portfolios. The consideration of the country where each portfolio is booked is also a factor that affects the credit risk impact.

Finally, in addition to examining the relationship between bank-, country-, and portfolio-level characteristics on credit risk impact, we also aim to analyze whether and to what extent cross-country differences, in terms of banking sector characteristics, may shape the influence of bank-level variables and portfolio characteristics on projected provisions. In this sense, we find that specific banking sector characteristics also shape the influence of individual bank- and portfolio-level features on risk provisions requirements.

1. INTRODUCTION

The real effects as well as the costs provoked by banking crisis episodes have been on the spotlight of academics and policymakers during the last decades (Dell'Ariccia *et al*., 2008; Kroszner *et al*., 2007) and, particularly, during and after the Global Financial Crisis (GFC) in 2007/2008 (Laeven and Valencia, 2008; 2012; 2018). Concretely, previous academic research has aimed at studying the main factors underlying banking crises episodes. Economic recessions (Boyd *et al*., 2005), stock market declines (Dermine and Schoenmaker, 2010) or currency crises (Kaminsky and Reinhart, 1999) emerge as aspects that affect financial conditions in a country and are on the basis of financial distress episodes. For this reason, topics related to macroprudential policies are high on the practitioners' agenda.

In this respect, regulators and supervisors have developed many tools to prevent and deal with banking crises. For example, the Capital Requirements Regulation (CRR) and the European Directive (CRD IV)[1] include a subset of macroprudential instruments, such as risk buffers. Within this context, stress tests have emerged as a tool to identify potential risks affecting the banking sector and to help the regulators to implement measures and policies aiming at preventing crisis episodes. The use of stress tests not only strengthens the resilience of the banking system via mandatory capital increases and reductions in individual bank credit risk (Kok *et al*., 2021), but also by enhancing transparency and allowing investors to better discriminate among banks and, thereby, contributing to a more efficient market pricing of bank funding costs (BCBS, 2018)[2]. Hence, supervisors and central bankers have increasingly used stress tests during the last years also to foster confidence in the banking sector.

Nevertheless, stress tests approach diverges considerably across countries. These differences are especially remarkable when the European Union (EU) and the United States

[1] Article 133 of CRD IV.
[2] However, there is research that states that disclosing too much information could be not optimal (see, for instance, Goldstein and Leitner, 2013).

(US) are compared (Kovner and Philippon, 2016). The European Banking Authority (EBA) manages the stress tests in the EU. In the case of EU, each bank builds and runs its own models following a common methodology set by the EBA. Banks' results are published and the supervisor takes those results to evaluate banks' capital needs. Following the Dodd Frank Act[3], stress tests in the US are also based on bank-internal methodologies. However, the assessment of whether banks have enough capital is based on models that are developed and run by the Federal Reserve. Moreover, bank-internal stress tests remain confidential whereas the Federal Reserve ones are made public.

There is abundant literature aiming at linking accounting/prudential regulation and individual bank behavior (BCBS, 2015). Stoian and Norden (2013), for instance, study the spurious use of credit risk provisions to manage income statements. Jabbour and Sridharan (2020) propose a methodology to identify banks' balance-sheet determinants that explain the variation in bank capital under the European 2014 stress test exercise. Comprehensive Assessment data were also used to highlight the strong difference in asset densities with respect to risk-weighted assets (RWA) depending on whether or not internal models are used (Trucharte, *et al*., 2015). Furthermore, Tarancón (2017) finds similar biases in the Asset Quality Review (AQR) context. The transparency exercises were also used to flag national heterogeneity of RWA densities (Döme and Kerbl, 2017). The most relevant cause for this is the possibility of manipulation of regulatory parameters (Mariathasan and Merrouche, 2014; Behn, *et al*., 2016). In this line, Kok *et al*. (2021) found that banks that participate in the 2016 stress tests reduced their average risk weight density.

Since stress tests are a relatively new tool in banking supervision, specific literature on stress testing is still scarce but increasing nowadays. Goldstein and Sapra (2014) present a literature review on the results of stress tests disclosure. Schuermann (2016) compares stress

[3] Principle 9.

test objectives during crisis periods and normal times. The author concludes that stress tests modelling allows the bank to understand how much of its performance is driven by macro-risk factors, which are largely beyond management control. Hence, stress tests are useful to determine what "extra push" is needed to achieve desired performance goals beyond what the economy and the market can deliver organically. Schuermann (2014) examines the design and the governance practices associated with stress tests. More recently, Dees *et al*. (2017) and Baudino *et al*. (2018) provide a very detailed and complete description of all kinds of stress tests, stress tests tools and all the components defined for their implementation.

One of the common aspects emerging from the detailed study of stress tests is the policy objectives that are pursued when designing the specific features of the exercise. Supervisory targets could be macroprudential- or microprudential-oriented. In this last category, they could be general, as the EBA EU-wide stress test, or aiming at assessing specific risks. As example of the former one, it is worth noting the requirement for the leveraged lending portfolio (SSM, 2017a).

It is also important to mention that the definition of the different scenarios and the top-down *versus* bottom-up dichotomy are the key features in defining the stress test. In designing the scenarios, a crucial aspect is the objective of the stress test, so that they can capture emerging threats such as cybersecurity- and climate-related risks.

Moving to empirical papers, Philippon *et al*. (2017) examine the 2011 and 2014 EBA stress tests and concludes that the results of the stress tests are informative and there is no evidence for biases in the scenarios or in the estimated losses. Bird *et al*. (2020) study potential biases in the Federal Reserve's disclosures of the Comprehensive Capital Analysis and Review (CCAR) results and find that disclosed capital ratios are biased upwards to prop up systemically important banks, but downwards to discipline poorly capitalized banks. Niepmann and Stebunovs (2018) suggest that, as in the case of the EU-wide stress test, the flexibility that exists when banks use their own models in stress tests could be used to minimize projected losses.

It is also worth noting the criticisms of the stress test methodology for the use of the CET 1 ratio (Acharya *et al*., 2012) and for the possibility of handling the expected loss (Gross and Población, 2015). Moreover, in Quagliariello (2019) we can find abundant discussion on the possibility of shifting the stress test methodology. Finally, EBA has recently published a discussion paper to foster the debate on some aspects such as objectives, links of the results with the supervisory processes, methodological constrains, or the ownership of results (EBA, 2020).

Our paper aims to contribute to this debate on the future of the EBA stress test methodology by paying special attention to the additional drivers of projected losses on top of the macroeconomic variables included in the scenario. In particular, we analyze the existence of additional factors affecting projected losses and, thereby, credit risk provisions of examined banks. In doing so, we use the stress test dataset published by the EBA at a portfolio-level and complement this information with bank- and country-level data. Our objective is to explain empirically the relative variation of provisions during the scope of the exercise. We will assess the impact of different variables at bank-level (size, efficiency, risk, liquidity, leverage, or specialization); at country-level (size and financial soundness of the banking sector; market structure; efficiency or specialization of the banking activities); and at portfolio-level (size, risk, the use of the IRB models, or the originating country).

Our sample is composed of the 4,482 portfolio-level observations corresponding to the 48 banks from 15 countries that have been subject of the 2018 EBA stress tests. The results obtained suggest that the EBA methodology (and more concretely, the macroeconomic scenario) helps to explain the most relevant part of the change in credit risk provisions.

Furthermore, our empirical evidence is consistent with the existence of bank-level variables, such as bank efficiency, the risk level, leverage or the degree of activities specialization, that additionally affect the credit risk impact of the stress tests, as well as specific characteristics of the portfolio. Related to this last set of variables, our results indicate that the size of the portfolio and the use of IRB models would negatively affect the required amount of credit risk provisions, whereas its individual risk-level is positively related with the change in provisions. Our results also report the capacity of the characteristics of the banking sector in each country –such as its size in the economy, market structure, financial soundness, efficiency or specialization– to explain the variation in credit risk provisions partially and to shape the influence of both bank- and portfolio-level features on provisions requirements.

The empirical evidence obtained in this paper may have important policy implications. In particular, our findings suggest that, although the EBA methodological approach effectively explains the most important part of the credit risk impact of stress tests, it could be interesting to account for such additional characteristics when redesigning the supervisory stress test frameworks. Currently, EBA carries out bottom up stress tests relying heavily in quality assurance. In our paper, we flag the existence of additional aspects that could help to shed some additional light on the explanation of credit risk projected provisions of analyzed banks.

In fact, this is not entirely unexpected since banks are allowed to use their own models for the projections. In other words, the fact that banks are allowed to use their own models for the projections could be one of the reasons why additional characteristics could affect banks´ provisions projections.

In Section 2, we present a brief description of the EU-wide stress test methodology. In Section 3, we describe the dataset and the methodology applied in the empirical analysis. Our results are presented in Section 4. Finally, Section 5 concludes.

2. EU-WIDE STRESS TEST

In the EU context, the EBA coordinates the EU-wide stress test. In doing so, the EBA cooperates with the European Systemic Risk Board (ESRB), the European Commission, the European Central Bank (ECB), and the relevant national authorities. The EU stress tests are based on the simulation of the effects of certain adverse hypotheses on the financial and economic situation of credit institutions. The main goals are both to identify banking system vulnerabilities and to quantify their potential impact. Specifically, the EBA stress tests define two scenarios: the baseline and the adverse. Hence, banks have to estimate capital ratios under these scenarios over a three-year horizon following a common methodology. Banks should use their own bottom-up models and have to assume a static balance sheet and some other methodological constrains.

The national supervisory authorities carry out the quality assurance process. As an example, the Single Supervisory Mechanism (SSM) uses a comprehensive system based on benchmarks, a top down challenger tool and the assessment of individual banks projections (SSM, 2019). Therefore, final results are also come after a dialectic process with the supervisors in which banks projections can be overridden (EBA, 2020). This approach is one of the key trademarks of the EBA stress tests, especially when compared to top down models such as CCAR (Covas and Nelson (2016)) or the Spanish FLESB (Banco de España, 2013).

In the EU, stress test results are used by the SSM in the Supervisory Review and Evaluation Process (SREP). The SREP establishes individual bank's Pillar II capital requirements. As previously mentioned, this aspect has been flagged with a question mark for the future methodological reform (EBA, 2020).

The EBA publishes a very granular set of templates detailing the results for each of the individual 48 participating banks (EBA, 2017). The most important losses for banks in the adverse scenario have been demonstrated to come from credit risk exposure, being this the main reason why we will particularly focus on it in this paper. Moreover, the description and the data of the adverse macroeconomic scenarios is published at a country-level by the ESRB (ESRB 2018).

One of the key characteristics of the EBA stress tests is the additional level of transparency that is fostered in the EU environment when compared to other approaches, such as the CCAR (Quagliariello, 2019). In that sense, and directly related to the aim of this paper, the detailed credit losses disclosure for each of the individual bank-level portfolios, is considered a data point as described in Tables 2 and 3 of the methodological note (EBA, 2017).

3. METHODOLOGY

3.1. Sample

For the construction of our database, we follow an approach similar to the one applied in Philippon *et al*. (2017) and Niepmann and Stebunovs (2018). We use the information on the publicly disclosed European stress tests results in 2018. In particular, we focus on the dataset provided in the credit risk block of the EBA templates.

For each portfolio and bank, we have collected the information on the rate of bank expected losses at the starting point and under the adverse scenario defined by the EBA. The definition of the adverse scenario assumes an extreme, but plausible, deterioration in macroeconomic conditions over the same period.

The final number of observations included in our empirical analysis will be the result of taking into account the number of participating banks, the number of portfolios of each bank (domestic and non-domestic portfolios), and the number of countries of exposure. Our final sample is composed of 48 bank entities from 15 European countries and 4,482 portfolio observations[4].

Table 1 reports a more detailed description of the composition of the sample. As can be observed, there are countries such as Finland, Hungary and Norway that have just one bank in the sample, while other countries such as France or Germany, have 6 and 8 banks, included in the stress test analysis, respectively[5]. The representation of these two countries in terms of number of portfolios is also relevant, representing almost the 17.4% and 19.4% of total portfolios in the sample, respectively. As regards of the types of portfolios, our sample contains 1,346 corporate portfolios; 933 and 831 retail and mortgage portfolios, respectively[6]. Finally, in all the countries except Poland, most of the portfolios are located outside of the domestic market.

<INSERT TABLE 1 ABOUT HERE>

3.2. Econometric model and variables

The dependent variable is the expected loss for each of the portfolio, proxied by the relative change of provisions across the 3-year period of the time horizon of the EBA exercise (*ΔPROV*)[7]. Specifically, the dependent variable is defined as the change in provisions

[4]Finally, there are only four Spanish banks included in the sample. After initially consider 49 banks, EBA approved the exclusion of Bankia due to the merger with BMN (Banco de España, 2018).

[5]Banks representing more than 70% of the banking sector in the euro area. The inclusion threshold amounts to EUR 30 bn in total assets (EBA, 2017).

[6]Only for Table 1 and in order to get a final number of observations equal to 4,482, which is the final sample size, if a portfolio is retail and mortgage portfolio, it is only included in the mortgages group. The same happens if the portfolio is corporate and mortgage portfolio.

[7]According to the EBA methodological note (EBA, 2017), credit losses will stem from the following aspects: (i) the flow of exposures to stages 2 and 3; (ii) the worsening of the loss given default (LGD) for originally stage 3 exposures; and (iii) the worsening of the probability of default (PD) lifetime and LGD for originally flagged stage 2 exposures.

comparing the projected stock of provisions in 2020 with the one in 2017 relative to the exposure of the portfolio.

We regress change in credit risk provisions on different sets of variables capturing the impact of, not only the set of variables defined by the EBA methodology, but also of bank-, country- and portfolio-level characteristics. This approach will allow us to get a holistic view on the different drivers of the credit risk impact of macroeconomic shocks. Hence, the structural equation to be estimated is defined as follows:

$$\Delta PROV_{\mathrm{i,j,k}} = \beta_0 + \beta_1 EBA_k + \beta_2\, BANK_{j,k,t-1} + \beta_3 COUNTRY_k + \beta_4 PORTFOLIO_{i,j,k} + \varepsilon_{i,j,k} \qquad [1]$$

where i, j and k refer to the portfolio, bank and country respectively.

We build our set of explanatory variables with the information provided in the bank individual results templates from the EBA and also with the information about the adverse macroeconomic scenarios published by the ESRB (ESRB, 2018). We have completed our database collecting information at individual bank-level, using data from Orbis Bank Focus (Bureau Van Dijk) and at a country-level with variables defining the characteristics of the banking sector of each country from the World Bank Financial Development dataset. Annex 1 provides a detailed description of all the variables.

The size of the country-level sample of the macroeconomic data as well as potential multicollinearity problems among the EBA variables, call for an *ad hoc* solution to the approximation of the effect of these macroeconomic determinants of credit risk provisions. Our proposal is a principal components analysis (PCA), which will capture the common features of the various EBA macroeconomic determinants. Therefore, EBA_k is the vector that comprises a key set of explanatory variables based on the adverse macroeconomic scenarios.

According to the EBA methodology, we include the *GDP* variable, measured as the cumulative growth rate of the GDP under the adverse scenario. Similarly, *HICP* is the cumulative growth rate of the consumption prices indexes under the adverse scenario. We also consider the change in the unemployment (*UNEMP*) as from the 2018 baseline to 2020 in the adverse scenario. *RESTATEP* and *CRESTATEP* are referred to the cumulative growth of residential real estate prices, and commercial real estate prices, under the adverse scenario, respectively. Finally, the change in stock prices (*STOCK*) calculated as the deviation in stock prices in 2020 in the adverse scenario, and the long-term rates (*LTRATES*), as the change in trend in long-term rates as from the starting point (2017) to 2020 in the adverse scenario, are included.

It is interesting to notice that for the unemployment variable we have chosen a criterion that is different from the criterion used for the rest of the variables. The reason for it is that, unlike to the rest of the variables that we have used, in the case of the unemployment we do not have in the dedicated document (ESRB, 2018) the 2017 starting point. That is the reason why in the rest of the variables we have chosen the cumulative growth rate from 2017 whereas in the unemployment, as a proxy of the cumulative growth, we have chosen the change in the unemployment as from 2018 baseline to 2020 adverse.

It is worth noting to mention that we have not included neither the deviation from the baseline of foreign demand and commodity prices nor the EU corporate credit spread indices, as they are invariant across the EU countries. Moreover, we have not included the exchange rates as all the examined portfolios are denominated in euros. Finally, we have decided not to consider the SWAP rates because, although they vary across countries, their effect would be partially captured by the *LTRATES* variable.

According to the PCA methodology, if we calculate the principal components of the EBA macroeconomic variables, we find that the first and second components explain 63% and 79%

of the variance, respectively. The first three components explain 90% of the variance. Hence, EBA_k is the vector that consists of three variables, which are the three main principal components of the EBA macroeconomic variables.

Although the EBA macroeconomic variables mostly explain the change in credit risk provisions of examined banks, the inclusion of additional variables at bank-, country-, and portfolio-level may shed some additional light for the understanding of the stress test results. Hence, we take the EBA methodological approach as the most appropriate one and proceed to add the three additional dimensions into the analysis.

$BANK_{j,k}$ is a vector containing the information on bank-level characteristics potentially related to the credit risk impact of the stress tests. In particular, and following previous literature explaining credit risk, we include the size of the bank (*SIZE_B*) proxied as the natural logarithm of total assets in the balance sheet (Foos *et al*., 2010; Laeven *et al*., 2016). There could be opposite arguments as regards of the relation between bank size and risk. From the one side, large banks can be seen as too-big-to-fail banks. Moreover, larger banks could benefit from a more sophisticated risk management (Foos *et al*., 2010). From the other side, large banks tend to have lower capital ratios, less stable funding, and more exposure to potentially risky market-based activities (Laeven *et al*., 2016). We also consider the cost-to-income ratio as an inverse proxy for bank efficiency (*COST_B*). According to Berger and De Young (1997), there is not a clear prediction on the impact of bank cost efficiency on credit risk. From the one side, cost-inefficient banks may tend to have loan performance problems, as their reduced efficiency level may provoke bad management practices when dealing with loans screening processes (Podpiera and Weill, 2008; Chaibi and Ftiti, 2015). From the other side, banks that do not spend financial resources and effort on trying to screen bad and good loans properly, would present higher levels of efficiency. However, this effect would be compensated in the long-run with higher expected amounts of NPLs.

The proxy for bank risk exposure (*RISK_B*) is defined as the non-performing loans-to-total gross loans ratio (see, for instance, Cubillas *et al*., 2021). We expect higher levels of overall risk linked to the bank business activity, will positively affect the change in credit risk provisions. We consider the ratio liquid assets-to-total assets as a measure of bank liquidity (*LIQ_B*). Traditional literature has posted the existence of a relationship between liquidity and credit risk (Diamond and Dybvig, 1983). The idea of a positive relationship between liquidity and credit risk is supported by more recent studied that have been carried out particularly after the GFC 2007/2008. Imbierowicz and Rauch (2014) empirically investigate the relationship of liquidity and credit risk in US banks for the period of 1998-2010. They find a positive interconnection of liquidity and credit risk using bank specific measures, although the strength of this relationship seems to be not too high. However, they report evidence on a strong and positive relationship in terms of bank internal liquidity and bank-external credit risk.

The ratio total customer deposits-to-total funding is included in order to consider a proxy for bank leverage (*LEV_B*). We might expect that highly leveraged banks could be more prone to enroll into higher risk-taking activities, given their need to produce higher returns with lower levels of own capital. Hence, according to this, we would expect a positive relationship between bank leverage and the change in credit risk provisions. In a similar vein, the ratio non-interest income over operating revenues is computed for each bank in order to account for the potential impact of the degree of specialization of the banking entity (*NONINT_B*). We would expect banks with higher values for this ratio rely more on alternative types of income other than interest income. Hence, higher levels of activity diversification could be associated with lower levels of bank risk.

At this point, it is necessary to mention that even if the dependent variable is a projection, the contemporaneous values of some bank specific variables could not be strictly independent from the dependent variable. In fact, bank-level determinants are likely to be endogenously determined and reverse causality is arguably possible. In an attempt to ameliorate the impact of this potential econometric concern, in all our estimates all bank-level control variables are lagged to avoid simultaneity with the dependent variable.

Finally, we also aim to examine if the geographical area / country to where the bank belongs may have a role on explaining the impact on credit risk. To do so, we include three dummy variables identifying if the bank belongs to the Eurozone (*EURO_B*), to the set of GIPS countries (*GIPS_B*)[8], or if it is from one of the two largest European economies (*BIG2_B*), which are Germany and France.

The vector $COUNTRY_k$ comprises a set of variables that aims at capturing the specific features of the banking sector in each country. In particular, we include banking sector characteristics that could be potentially related to the change in credit risk provisions. In this respect, we consider the size of the banking sector, banking market structure, financial soundness, the degree of efficiency in the banking sector, and a proxy for the specialization of the business model in the banking industry (Barth *et al*., 2004; Schaeck and Cihák, 2014; Chiarella *et al*., 2019; among others).

We define the share of GDP that the credit provided by deposit money banks to the private sector represents in each economy (*CREDIT_BS*) as a proxy for the size of the banking sector. This variable has been widely used by previous literature as a proxy of financial development of each country and served as a predictor of stability (Beck *et al*., 2006; 2010). The variable *CONC_BS* is the proxy of banking market structure and it is defined as the share of assets of the banking sector that are held by the three largest banks in each country (Cetorelli and Gambera, 2001; Beck *et al*., 2006). According to prior literature, banking market structure and

[8] Notice that in the 2018 EBA stress tests neither Greek nor Portuguese banks were included. Hence, the dummy variable GIPS includes banks from Italy and Spain. Results also hold when including Ireland in the GIPS group.

competition could act as a relevant explanatory factor of risk-taking behavior and stability in the banking market (Beck *et al*., 2013; Fernández *et al*., 2016; among others).

The level of financial soundness of each banking sector is proxied by the annual value of the banking sector Z-Score (Laeven and Levine, 2009; Chiarella *et al*., 2019), with higher values of this variable indicating higher level of financial stability (*ZSCORE_BS*). Similarly to the bank-level proxies, we include the cost-to-income ratio (*COST_BS*) and the non-interest income to total assets ratio (*NONINT_BS*) as proxies for the level of inefficiency and specialization of the banking industry in each country, respectively (Cubillas *et al*., 2021). All these variables have been collected from the World Bank Global Financial Development dataset.

Similarly, $PORTFOLIO_{i,j,k}$ is a vector of variables referred to the main characteristics of each of the examined portfolios. These variables are specific to the portfolio which increase of provisions we are assessing. Since the EBA methodology requests for specific modelling per portfolio, one would a priori expect most information to be contained in portfolio variables. Particularly, we consider *EQ_COUNTRY*, defined as a dummy variable with value one if the country of origin of the bank is the same than the country of the portfolio. Particularly relevant to explain credit risk provisions is to account for the portfolio size (*SIZE_P*), proxied by the size of each individual portfolio over the size of the bank. We also include a dummy indicating if the bank applies an internal ratings-based approach for the modelling of their credit exposure in the portfolio or not (*IRB*). Moreover, we control for a proxy that captures the initial level of risk exposure of the portfolio (*RISK_P*) computed as the initial level NPLs of the portfolio relative to the portfolio total exposure. We have included different dummy variables that aim at identifying if the portfolio is located in the Eurozone (*EURO_P*), in a GIPS country (*GIPS_P*), or either in France or Germany (*BIG2_P*).

As described in the EBA methodological note (EBA, 2017), banks are supposed to model the impact in losses through the different macroeconomic scenarios. Thus, our assumption will be that there could be identified potential relationships with the previous sets of variables. Hence, in order to test the relevance of such kind of relationships, we run different specifications of the econometric model including –sequentially and jointly considered– the previously defined variables available at bank-, banking sector-, and portfolio-level. In all the estimates, we also control for the type of specific portfolio being analyzed. Specifically, we define three dummy variables identifying each of them, namely: *CORP*, *RETAIL*, and *MORTGAGE*[9], referring to corporate, retail and mortgage portfolios, respectively[10]. Table 2 and 3 report the descriptive statistics and the correlations among the main variables of interest, respectively.

<INSERT TABLES 2 AND 3 ABOUT HERE>

4. EMPIRICAL RESULTS

4.1. Credit risk impact: the effect of bank-level characteristics

In this section, we present the baseline results aiming to assess whether and to what extent the joint inclusion of the EBA variables with the variables that capture individual bank-level characteristics may add to the explanation of the change in credit risk provisions required to our sample of bank entities. Our premise is that, apart from taking into account the macroeconomic scenarios defined by the official authority expressed in the macroeconomic

[9]Some portfolios are classified as *RETAIL* and *MORTGAGE* at the same time; whereas some other portfolios belong to the groups *CORP* and *MORTGAGE* simultaneously. It is not possible for a portfolio to be classified as *CORP* and *RETAIL* at the same time but there are portfolios that are neither *CORP* nor *RETAIL* nor *MORTGAGE*.

[10]All variables are winsorized at the 10th and 90th percentiles to mitigate the impact of outliers. As can be seen in the robustness tests, the results are qualitatively similar when winsorization is applied at the 1th and 99th or at the 5th and 95th percentiles level.

variables previously referred, features of individual banks could be related, at least in part, to differences across entities in terms of changes in the level of provisions.

The results obtained are presented in Table 4. In column (1), we regress our main dependent variable on the set of macroeconomic factors considered by the EBA methodology by means of a PCA approach. In columns (2) to (5), we define a set of specifications of the baseline model including the different bank-level variables. Column (1) shows that the dummy variables that identify the type of portfolio, *CORP*, *RETAIL* and *MORTGAGE*, emerge as factors positively affecting the change in provisions, although only corporate and retail portfolios enter in the regressions with statistically significant individual coefficients.

We now examine more in depth if the inclusion of additional variables related to the individual characteristics of the examined banks may help to explain the changes in the required credit risk provisions, while controlling for the EBA variables. The results reported in columns (2) to (5) of Table 4 confirm that, apart from the macroeconomic characteristics defined by the EBA, there are bank-level features that also play a role when explaining the different required provisions to EU banks.

In fact, and according to the expectations, both the level of bank risk exposure (*RISK_B*) and the leverage ratio of the individual bank entity (*LEV_B*) present positive and statistically significant coefficients. This finding would indicate that those banks that are characterized by a relatively high-risk profile and banks with a relatively large amount of debt in their balance sheets are seen as high-risk profile banks and are, therefore, required to increase their level of credit risk provisions.

The cost-to-income ratio (*COST_B*), as an inverse proxy of bank efficiency, also presents a positive and statistically significant coefficient, indicating that inefficient banks experience a more relevant credit risk effect derived from the stress tests. The non-interest income-to-operating revenues ratio (*NONINT_B*), as a proxy of activities specialization by each bank, enters the regressions with a negative and statistically significant coefficient. This could suggest that more diversified banks are required to hold lower levels of credit risk provisions.

We obtain negative coefficients for *SIZE_B* in all cases, although they are only significant in columns (4) and (5). We have similar results (negative coefficients) in the case of the variable *LIQ_B*. However, it is only significant at conventional levels in column (2). This would suggest that larger and more liquid banks present a less relevant change in the amount of credit risk provisions. As stated above, the different impact observed between large and small banks could be related with the fact that larger banks could benefit from a more sophisticated risk management (Foos *et al*., 2010). Another explanation may be related to the different capacity to bear the quality assurance costs mentioned in (EBA, 2020). In that sense, bigger banks may have more resources to justify their projections during the quality assurance phase. As for the effect of liquidity, the results could be to some extent in line with Hugonnier and Morellec (2017) who demonstrate that combining liquidity and leverage requirements reduces both the likelihood of default and the magnitude of bank losses in default.

In columns (3) to (5) we sequentially include individual dummies that identify the country of origin of each of the banks considered in our sample. The purpose is to check the influence of this bank-level feature on the credit risk impact of the stress tests. The negative coefficient obtained for the dummy *EURO_B* and the positive one obtained in the case of *GIPS_B* suggest that there is a demonstrated source of heterogeneity across banks based on the country from which they come from. This idea is also corroborated when the negative coefficient of *BIG2_B* dummy variable is analyzed. It is interesting to notice that in all cases the coefficients are statistically significant.

<INSERT TABLE 4 ABOUT HERE>

4.2. Credit risk impact: the effect of banking sector characteristics

Once that we have analyzed the effect of the EBA variables and the bank-level aspects, we now go one step further and aim to empirically explore if other country-level characteristics related to the features of each banking sector may also help to explain the credit risk effect of the stress tests.

In particular, we now examine the influence of a set of variables directly related to the main aspects of the banking sector in each country. Given that a significant effect related to the country of origin of each bank has emerged in the results previously shown, our intuition is that the specific features of each banking sector could also help to have a more complete description on the factors underlying the differences in credit risk impact observed both across banks and across countries.

Hence, in a similar way to that considered for the individual bank-level variables, we include the size of each banking sector, proxied by the ratio private credit by deposit money banks over the GDP (*CREDIT_BS*). Moreover, we consider market structure, measured as the assets concentration ratio of the three largest banks in each country (*CONC_BS*). Banking sector soundness, defined as the banking sector Z-Score (*ZSCORE_BS*), and the cost-to-income ratio, as a measure of the level of efficiency of the banking market (*COST_BS*), are also included as banking sector features that could be related to the impact on credit risk. Finally, we account for the extent to which the level of specialization in the banking industry in each country, proxied by the non-interest income over total assets ratio, may affect the credit risk impact (*NONINT_BS*).

In columns (1) to (5) of Table 5, we include the banking sector variables in a sequential way. In column (6), we include all the variables in the same regression. Moreover, in all the estimates reported, we control for the PCA components referred to the EBA macroeconomic variables, for the type of portfolio, and for the individual bank-level characteristics previously examined. As can be seen, we obtain negative and statistically significant coefficients for most of the variables that capture different dimensions of the banking system of each country, while previous results for bank-level characteristics remain.

In particular, our empirical findings are consistent with a negative effect of banking development on the change in the amount of provisions required. This effect would be consistent with the fact that higher levels of development of the banking sector, proxied by the ratio of private credit to the GDP, may not necessarily imply higher levels of risk of individual bank entities and portfolios and, thereby, higher levels of provisions required. As quantity and quality are two different concepts, the inclusion of specific variables that better capture the quality of the bank investments is needed.

According to this last aspect and to the results reported in Table 4 for the effect of the bank's country of origin, we obtain a negative and significant coefficient for the Z-score indicator. This suggests that the financial soundness of the banking sector in each country emerges as an important factor to be accounted for in order to better define the provisions required to the bank entities. In fact, and according to our expectations, banking sectors characterized by higher levels of the ZSCORE variable are the ones with higher levels of financial stability. Hence, the negative sign obtained for this variable is consistent with the required credit risk provisions being lower in such perceived as safer environments.

The results for banking market structure suggest that higher levels of concentration in the banking market appear positively associated to the change in provisions. This result could be to some extent consistent to the *competition-stability view* (Mishkin, 1999; Boyd and De Nicoló, 2005). In fact, according to our results, if we assume market concentration to be a proxy for market power, higher levels of concentration in a country would reduce competition in the banking industry. Less competitive banking markets may result in higher bank risk as the higher interest rates charged to loan customers could make it harder to repay loans, and exacerbate moral hazard and adverse selection problems. Hence, in the case of countries with higher levels of banking market concentration, the perceived level of risk associated to each individual portfolio is higher and the need for additional provision requirements is increased. We should be cautious, however, with this result as the coefficient is only statistically significant at conventional levels in column (2)[11].

Our results also reveal a negative and statistically significant coefficient of the inverse proxy of the banking sector efficiency (*COST_BS*). According to this result, less efficient banking systems experience lower change in the risk provisions required. This result, although not consistent with our previous findings obtained for the bank-level measure of inefficiency (*COST_B*), could be to some extent related to those obtained by Altunbas *et al*. (2007). According to their results, it could be that cost constraints may inhibit the ability of banks in inefficient banking sectors to take on more risks. Possibly, banks in those environments are more reserve constrained and this may be bringing about this result.

Finally, the ratio that approximates the extent to which the business model of the banking sector in each country is more or less diversified across different activities (*NONINT_BS*) also shows a negative coefficient. According to the previous results obtained for the *NONINT_B* variable, banks from banking sectors characterized by a higher presence of non-traditional banking activities (credits and deposits) experience a lower change in the risk provisions.

<INSERT TABLE 5 ABOUT HERE>

4.3. Credit risk impact: the effect of portfolio characteristics

In this section, we examine the extent to which the characteristics associated to the individual portfolio could influence the change in credit risk provisions requirements to our sample of banks. To do this, we have proceeded by sequentially including the different variables that proxy for different dimensions defining each individual portfolio.

[11] In fact, in further tests run excluding French and German portfolios from the sample (Table 9), the effect of bank market structure is the opposite.

In particular, we have considered the fact that both the bank and the portfolio are located in the same country (*EQ_COUNTRY*). We have also included the size of the specific portfolio (*SIZE_P*), the IRB dummy in order to identify those portfolios over which an internal ratings-based approach (*IRB*) for the modelling of their credit exposure has been applied, and the portfolio-level risk measure (*RISK_P*). We have also defined a set of dummy variables identifying the geographical area and/or country at which the portfolio is located (*EURO_P; GIPS_P; BIG2_P*)[12]. We report this set of results in Table 6. Following a similar procedure to that used in previous sections, we first include each characteristic of the portfolio in an individual way. In column (8), we present the complete model specification that jointly reports the effect of all the variables at the same time. In all the estimates, the results referred to the individual bank-level variables as well as the impact of the banking sector characteristics remain invariant[13]. Apart from this, we obtain that the individual portfolio characteristics also matter to explain the change in the required risk provisions.

Concretely, we find a positive and statistically significant coefficient for the variable *EQ_COUNTRY*. This would suggest that, if the specific portfolio were booked in the same country that the bank, the credit risk impact in terms of changes in provisions is larger. This could be explained by the fact that banks that decide to invest outside of their domestic country could be seen as more prone to better select the type of portfolio. Hence, if in non-domestic markets the quality of the average portfolio is higher, the amount of required risk provisions would decrease compared to domestic portfolios.

As expected, portfolios characterized by higher initial levels of risk are seemed to be required to have higher provisions, as the coefficient of the *RISK_P* variable is positive and statistically significant. On the other hand, portfolios of relatively large size and portfolios

[12] Notice that the country of the portfolio is not necessarily the same that the one for the bank.
[13] In this set of results, the previously argued effect for the banking market concentration is no longer significant at conventional levels.

assessed under an IRB methodology are required lower levels of risk provisions. The main explanation could be related to the higher sophistication level in the study of relatively large portfolios and those evaluated under the IRB methodology[14].

We have also examined the extent to which the country at which the portfolio is booked may have an influence on the amount of provisions required. Hence, following a similar procedure to that used in the case of the country of origin of the bank entity, we have defined three different dummy variables that identify if the portfolio is located in a Eurozone country (*EURO_P*); in one of the GIPS countries (*GIPS_P*); or, alternatively, in one of the BIG2 countries (*BIG2*). As can be observed, in this case, the booking country of each portfolio does not seem to play a role in the heterogeneity observed for the change in credit risk provisions.

<INSERT TABLE 6 ABOUT HERE>

Overall, our results would be consistent with the fact that, accounting for the methodological approach defined by the EBA, bank-level characteristics, the features of the banking sector in each country, and the individual idiosyncratic aspects of each portfolio, play a role when explaining the differential credit risk impact of the 2018 EBA stress test.

4.4. Credit risk impact: the joint role of bank-, portfolio- and country-level characteristics

In addition to examining the relationship between bank-, country-, and portfolio-level characteristics on credit risk impact, we also aim to analyze whether and to what extent cross-country differences, in terms of banking sector characteristics, may shape the influence of bank-level variables and portfolio characteristics on projected provisions. In other words, we now aim at further exploring if the impact of this set of bank- and portfolio-level characteristics

[14] This could be to some extent consistent to the results obtained in Niepmann and Stebunovs (2018). These authors demonstrate that internal models are systematically adjusted by banks to lower credit losses in stress tests. Their empirical findings show that banks that would have seen credit losses increase the most due to macroeconomic scenario changes saw the strongest decreases in credit losses from model changes in 2016 stress tests.

may differ across countries due to certain domestic banking-specific characteristics. The influence of both bank- and portfolio-specific characteristics on risk impact, together with the influence of banking sector variables, justifies examining whether credit risk provisions are affected by bank- and portfolio-level features differently across countries.

To meet our objective, we develop two analyses. Firstly, we examine the role of banking sector characteristics on the influence of bank-level variables on credit risk impact. Secondly, we examine if the features of the banking sector shape the influence of portfolio characteristics on credit risk provisions.

Methodologically, we extend our basic model [eq. 1] and include the interactions of the banking sector variables with the different bank- and portfolio-level variables. The interaction terms (β_5 and β_6) would show whether the impact of bank- (β_5) and portfolio (β_6) – characteristics on credit risk provisions is higher (or lower) depending on the features of each banking system. The premise is that although individual global effects have been previously obtained for these variables, particular characteristics of the banking sector may modulate the relationship between those variables and projected provisions. Hence, the extended model is defined as follows:

$$\Delta PROV_{\mathrm{i,j,k}} = \beta_0 + \beta_1 EBA_k + \beta_2\, BANK_{j,k,t-1} + \beta_3 COUNTRY_k + \beta_4 PORTFOLIO_{i,j,k} + \beta_5\, BANK_{j,k} * COUNTRY_k + \beta_6\, PORTFOLIO_{i,j,k} * COUNTRY_k + \varepsilon_{i,j,k} \qquad [2]$$

The results obtained for the influence of bank-level characteristics on credit risk provisions across countries are reported in Table 7. As can be observed, in most of the estimates in Table 7, the individual coefficients for bank efficiency, risk and diversification, remain as in the baseline regressions, indicating that more inefficient, risky and less diversified banks are charged with higher credit risk provisions. However, the influence of these bank-level characteristics on projected provisions is shaped by the features of the banking sector. In particular, we obtain that, although on average riskier banks are required to hold more credit risk provisions, the characteristics of the banking system in terms of size (*CREDIT_BS*), stability (*ZSCORE_BS*), efficiency (*COST_BS*), and diversification (*NONINT_BS*) moderate this effect. In other words, risky banks from larger, safer, less efficient and more diversified banking systems are charged relatively lower levels of credit risk provisions. In the same line, results in Table 7 highlight that highly leveraged banks are relatively perceived as riskier and, thereby, their required provisions are higher. However, this effect is ameliorated if the bank belongs to a banking sector that is larger, safer and more diversified.

<INSERT TABLE 7 ABOUT HERE>

In Table 8, we report the results obtained for the extended model in which we test the role of banking system characteristics on the influence of portfolio-level variables on credit risk provisions. According to our baseline results, banks applying IRB methodologies are required lower levels of risk provisions. However, from the interaction terms coefficients it emerges the existence of substitution effect between IRB methodologies and the characteristics of the banking sector in terms of size and stability. Moreover, we obtain that the overall positive effect of portfolio risk on credit risk provisions is ameliorated in the case of banking sectors case of large and more competitive (less concentrated) banking sectors. In the same vein, portfolios characterized by higher levels of risk are required relatively lower levels of credit risk provisions if they are based on countries with banking systems perceived as safer (with higher levels of Z-score).

Overall, these results show that banking systems that present characteristics compatible with lower levels of overall risk (i.e, those that are larger, with high stability levels and high levels of diversification) lead to relatively lower credit risk perception and, thereby, ameliorate the individual bank- and portfolio-level features that could be positively influencing projected losses.

<INSERT TABLE 8 ABOUT HERE>

4.5. Robustness tests

In further analyses, we perform additional robustness checks on our results. The results are presented in Table 9. First, we check that the results hold when all variables are winsorized at the 1th and 99th percentiles (column (1)) and at the 5th and 95th percentiles (column (2)) to mitigate the impact of outliers.

Second, given that the composition of the main sample may be affected by an over-representation of German and French banks, we check the robustness of our results when banks from both countries are excluded from the analysis (column (3)).

Third, although in all the estimates reported we control for specific dummy variables identifying the type of portfolio –corporate, retail, mortgage–, it could be also interesting to check whether and to what extent the basic results by type of portfolio. Hence, in columns (4) to (6) of Table 9 we show the results obtained for the subsample of corporate, retail and mortgage portfolios, respectively.

Finally, in this paper the dependent and macro-economic variables are generated under the adverse scenario while bank specific variables are observed under normal time closer to the baseline scenario. This could be seen as a source of discrepancy as the set of variables are observed in different state of nature. Hence, in column (7) we report the results obtained when both the dependent and the macroeconomic variables are considered under the baseline scenario as robustness check.

Even they are not identical, in all cases the results are closely similar to those reported in the baseline estimations. Therefore, we can conclude that the results presented in this paper are robust.

<INSERT TABLE 9 ABOUT HERE>

5. CONCLUSIONS

In this paper, we investigate the main drivers of the change in credit risk provisions at a portfolio level for the sample of 48 European banks that have been subject of the 2018 EBA stress tests. We first model the change in credit risk provisions on the set of variables defined by the EBA methodology. According to what was expected, we find a strong explanatory power of the EBA macroeconomic variables on credit risk impact. We extend this analysis by sequentially including additional factors that could be affecting the credit risk impact of stress tests. Concretely, our approach is that these aspects could come from three different dimensions: bank, country, and portfolio.

The results obtained show that less efficient, risky, smaller, less liquid, more diversified, and highly leveraged individual bank entities are required to hold higher levels of credit risk provisions. Moreover, our results support the existence of a source heterogeneity that is related to the bank's country of origin. This last set of results motivates the inclusion of additional variables in our empirical analysis. In particular, we sequentially include banking sector characteristics that could help to understand better the different cross-country credit risk impact observed. As regards this, our results are consistent with the fact that banks from larger, more concentrated and safer banking markets experience a reduction on credit risk provisions. Banks from more efficient or less specialized banking sectors are more affected by the credit risk impact. Finally, the inclusion of the set of portfolio-level characteristics highlight that riskier portfolios are more affected by the change in credit risk provisions requirements, as well as domestic portfolios. Moreover, if an IRB approach to model internal credit risk is implemented by the bank, the credit risk impact of the stress test is lower, as well as it is in the case of large portfolios. Similarly, to what was obtained in the case of bank-level characteristics, the consideration of the country where each portfolio is booked emerges as factor that helps to understand the differential effect on credit risk impact.

Our empirical findings also indicate that the particular characteristics of each banking sector shape the influence of bank- and portfolio-level characteristics on credit risk provisions. Specifically, banking systems characterized by large size, lower levels of risk, and higher levels of diversification seem to ameliorate the positive impact of bank and portfolio characteristics on credit risk provisions.

We are conscious that the empirical evidence obtained in this paper could be to some extent related to potential non-linear relationship in the EBA explanatory variables, with the constrains in the EBA methodology or to potential complementary and/or substitute effects between the main explanatory variables. In fact, the capacity of the EBA variables to explain the impact of the stress tests of the examined banks is more than demonstrated in this paper. This is precisely why, in order to increase better the sources of those effects on the credit risk analysis, it could be useful to directly account for bank-, banking sector-, and portfolio-level characteristics.

We think that the results obtained in this paper could have important policy implications and could suggest the existence of additional factors that may help to better understand the credit risk impact of stress tests. Given that the main goal of the stress tests is to ensure the capacity and suitability of bank entities to overcome potential future adverse scenarios, the consideration of individual characteristics of both banks and portfolios, as well as, country-level factors related to the features of the banking sector on each country could be acknowledged.

Regarding future lines of research, we consider that it could be relevant to examine the path of our findings in future stress test exercises. This would be especially appropriate in light of the future evolution of EBA stress test methodology. These aspects could be studied for other stress test exercises. Our results should be confirmed in the case of stress test exercises in other regulatory environments such us, for instance, the CCAR in the US. In the same form and more related to the empirical perspective, different explanatory variables could be included. For instance, we would like to highlight the potential role played by both internal (at a bank-level) and external (referred, for instance. to national supervisory practices and legal frameworks) corporate governance mechanisms.

Annex 1. Definitions of the variables and data sources

This table describes the variables used in the paper and indicates the sources from which the data were retrieved.

Variable	Definition	Source
Panel A. Dependent variable		
ΔPROV	It is the change in provisions comparing the projected stock of provisions in 2020 with the one in 2017 relative to the exposure of the portfolio.	Own elaboration with data from the bank individual results templates (EBA).
Panel B. EBA variables		
GDP	It is the cumulative growth rate of the GDP under the adverse scenario.	Own elaboration with data from the EBA and ESRB scenario (ESRB, 2018).
UNEMP	It is the change in the unemployment as from the 2018 baseline to 2020 in the adverse scenario.	Own elaboration with data from the EBA and ESRB scenario (ESRB, 2018).
HICP	It is the cumulative growth rate of the consumption prices indexes under the adverse scenario.	Own elaboration with data from the EBA and ESRB scenario (ESRB, 2018).
RESTATEP	It is the cumulative growth of residential real estate prices under the adverse scenario.	Own elaboration with data from the EBA and ESRB scenario (ESRB, 2018).
CRESTATEP	It the cumulative growth of commercial real estate prices under the adverse scenario.	Own elaboration with data from the EBA and ESRB scenario (ESRB, 2018).
STOCK	It is the deviation in stock prices in 2020 in the adverse scenario.	Own elaboration with data from the EBA and ESRB scenario (ESRB, 2018).
LTRATES	It is the change in trend in long-term rates as from the starting point (2017) to 2020 in the adverse scenario.	Own elaboration with data from the EBA and ESRB scenario (ESRB, 2018).
CORP	It is a dummy variable that takes value 1 if it is a corporate-type portfolio and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
RETAIL	It is a dummy variable that takes value 1 if it is a retail-type portfolio and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
MORTGAGE	It is a dummy variable that takes value 1 if it is a mortgage-type portfolio and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
Panel C. Bank-level variables		
SIZE_B	It is the measure of bank size computed as the natural logarithm of total assets.	Orbis Bank Focus (Bureau Van Dijk).
COST_B	It is the measure of bank efficiency computed as the cost-to-income ratio.	Orbis Bank Focus (Bureau Van Dijk).
RISK_B	It is the measure of bank risk computed as the non-performing loans-to-total gross loans ratio.	Orbis Bank Focus (Bureau Van Dijk).
LIQ_B	It is the liquidity ratio proxied as the share of liquid assets over total assets.	Orbis Bank Focus (Bureau Van Dijk).
LEV_B	It is the level of leverage proxied as the total customer deposits-to-total funding ratio.	Orbis Bank Focus (Bureau Van Dijk).
NONINT_B	It is the non-interest income over total assets ratio.	Orbis Bank Focus (Bureau Van Dijk).

EURO_B	It is a dummy variable taking the value 1 if the bank belongs to a country from the Euro zone and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
GIPS_B	It is a dummy variable taking the value 1 if the bank belongs to a country from the GIPS group and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
BIG2_B	It is a dummy variable taking the value 1 if the bank belongs to either France or Germany and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
Panel D. Banking sector variables		
CREDIT_BS	It is computed as the total assets held by deposit money banks as a % of GDP.	Global Financial Development Dataset (World Bank).
CONC_BS	It is computed as the assets of three largest banks as a share of assets of all banks in each banking sector.	
ZSCORE_BS	It is the banking sector Z-Score as a proxy of the financial soundness.	
COST_BS	It is the cost-to-income ratio computed at a banking sector level.	
NONINT_BS	It is the non-interest income over total income ratio at a banking sector level.	
Panel E. Portfolio Variables		
EQCOUNTRY_P	It is a dummy variable that takes value 1 if the portfolio is booked in the bank's country of origin and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
SIZE_P	It is the size of each individual portfolio over the size of the bank.	Own elaboration with data from the bank individual results templates (EBA).
IRB_P	It is a dummy variable that identifies if the portfolio uses internal ratings-based methodology according the disclosure templates.	Own elaboration with data from the bank individual results templates (EBA).
RISK_P	It is the portfolio-level risk exposure computed as the initial level NPLs of the portfolio relative to the portfolio total exposure.	Own elaboration with data from the bank individual results templates (EBA).
EURO_P	It is a dummy variable taking the value 1 if the portfolio is booked in a country from the Euro zone and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
GIPS_P	It is a dummy variable taking the value 1 if the portfolio is booked in a country from the GIPS group and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).
BIG2_P	It is a dummy variable taking the value 1 if the portfolio is booked either in France or Germany and 0 otherwise.	Own elaboration with data from the bank individual results templates (EBA).

REFERENCES

Acharya, V., Richardson, M., Engle, R., (2012). Capital shortfall: a new approach to ranking and regulating systemic risks. *American Economic Review: Papers & Proceedings*, 102(3), 59–64.

Altunbas, Y., Carbo, S. Gardener, E.P.M., Molyneux, P., (2007). Examining the relationships between capital, risk and efficiency in European banking. *European Financial Management*, 13(1), 49-70.

Banco de España, (2013). Desarrollo de una herramienta para realizar análisis prospectivos de forma regular de los bancos españoles. Informe de Estabilidad Financiera (11).

Banco de España (2018). Spanish banks show a considerable degree of resilience in the stress test of the European Banking Authority. *Banco de España Presss Release (02 November 2018).*

Barth, J. R., Caprio, G., Nolle, D. E. (2004). Comparative international characteristics of banking. *Economic and Policy Analysis Working Paper 2004-1*.

Basel Committee for Banking Supervision (2018). Stress testing principles.

Basel Committee on Banking Supervision (2015). The interplay of accounting and regulation and its impact on bank behaviour: Literature review, Basel Committee on Banking Supervision Working Paper 28.

Baudino, P., Goetschmann, R., Henry, J., Taniguchi, K., Zhu, W., (2018). Stress-testing banks – a comparative analysis. FSI Insights on policy implementation No 12. *Bank for International Settlements.*

Beck, T., Demirgüç-Kunt, A., Levine, R., (2006). Bank concentration, competition, and crises: First results. Journal of Banking and Finance, 30(5), 1581-1603.

Beck, T., Demirgüç-Kunt, A., Levine,R., (2010). Financial institutions and markets across countries and over time: the updated Financial Development and Structure Database, *The World Bank Economic Review*, 24(1), 77–92.

Beck, T., De Jonghe, O., Schepens, G., (2013). Bank competition and stability: Cross-country heterogeneity, *Journal of Financial Intermediation*, 22(2), 218-244.

Behn, M., Haselmann, R., Vig, V. (2016). The limits of model-based regulation. E*CB Working Paper Series*, Issue 1928.

Berger, A., DeYoung, R., (1997). Problem loans and cost efficiency in commercial banks. *Journal of Banking and Finance*, 21, 849-870.

Bird, A., Karolyi, S., Ruchti, T., Sudbury, A. (2020). Bias and the efficacy of stress test disclosures. Mimeo, Carnegie Mellon University.

Boyd, J., Kwak, S., Smith, B., (2005). The real output losses associated with modern banking crises. *Journal of Money, Credit and Banking*, 37, 977-999.

Boyd, J. H., Nicoló, G. De. (2005). The theory of bank risk taking and competition revisited. *The Journal of Finance*, 60(3), 1329–1343.

Cetorelli, N., Gambera, M., (2001).Banking market structure, financial dependence and growth: International evidence from industry data. *The Journal of Finance*, 56, 617–648.

Chaibi, H., Ftiti, Z., (2015). Credit risk determinants: Evidence from a cross-country study. *Research in International Business and Finance*, 33, 1-16.

CRD IV (2013), Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC.

CRR (2013), Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012.

Chiarella, C., Cubillas, E., Suárez, N. (2019). Bank recapitalization in Europe. The informational content of the issuing method. *Journal of International Financial Markets, Institutions and Money*, 63, 101134.

Cubillas, E., Ferrer, E., Suárez, N., (2021). Does investor sentiment affect bank stability? International evidence from lending behavior. *Journal of International Money and Finance*, 113, 102351.

Dees, S., Henry, J., Martin, R., (2017). STAMP€: Stress-Test Analytics for Macroprudential Purposes in the euro area. Frankfurt: ECB. Available at www.ecb.europa.eu/pub/pdf/other/stampe201702.en.pdf.

Dell'Ariccia, G., Detragiache, E., Rajan, R., (2008). The real effect of banking crises. *Journal of Financial Intermediation*, 7, 89-112.

Dermine, J., Schoenmaker, D., (2010). In banking, is small beautiful? *Financial Markets, Institutions & Instruments*, 19, 1-19.

Diamond, D.W., Dybvig, P.H., (1983). Bank runs, deposit insurance, and liquidity. *The Journal of Political Economy* 91, 401-419

Döme, S., Kerbl, S. (2017). Comparability of Basel risk weights in the EU banking sector. *Financial Stability Report*. Oesterreichische Nationalbank (Austrian Central Bank), 34, 68-89.

European Banking Authority (EBA), (2017). 2018 EU-wide stress test - Methodological Note.

European Banking Authority (EBA), (2020). EBA consults on the future of the EU-wide stress test framework. EBA/DP/2020/01.

European Systemic Risk Board (ESRB), (2018). Adverse macro-financial scenario for the 2018 EU-wide banking sector stress test. https://www.esrb.europa.eu/mppa/stress/shared/pdf/esrb.20180131_EBA_stress_test_scenario__macrofinancial.en.pdf

Fernández, A. I., González, F., Suárez, N., (2016). Banking stability, competition and economic volatility. *Journal of Financial Stability*, 30, 28-36.

Foos, D., Norden, L., Weber, M. (2010). Loan growth and riskiness of banks. *Journal of Banking and Finance*, 34, 2929-2940.

Goldstein, I., Leitner, Y. (2013). Stress tests and information disclosure. Working Papers 13-26. Federal Reserve Bank of Philadelphia.

Goldstein, I., Sapra, H. (2014). Should banks' stress test results be disclosed? An analysis of the costs and benefits. *Foundations and Trends(R) in Finance*, 8(1), 1–54.

Gross, M., Población, J., (2015). A false sense of security in applying handpicked equations for stress test. *European Central Bank* Working Paper Series, Issue 1845.

Hugonnier, J., Morellec, E., (2017). Bank capital, liquid reserves, and insolvency risk. *Journal of Financial Economics*, 125 (2), 266-285.

Imbierowicz, B., Rauch, C., (2014). The relationship between liquidity risk and credit risk in banks. *Journal of Banking and Finance*, 40, 242-256.

Jabbour and Sridharan (2020), The ECB's in-comprehensive SSM-ent: the higher they go, the harder they fall. *European Journal of Finance*, 26(15), 1506-1528.

Kaminsky, G., Reinhart, C., (1999). The twin crises: the causes of banking and balance of payments problems. *American Economic Review*, 89, 473-500.

Kok, C., Müller, C., Ongena, S., Pancaro, C., (2021). The disciplining effect of supervisory scrutiny in the EU-wide stress test. *European Central Bank* Working Paper Series, Issue 2551.

Kovner, A., Philippon, T., (2017). Back-testing U.S. stress tests. Mimeo.

Kroszner, R.S., Laeven, L., Klingebiel, D., (2007). Banking crises, financial dependence and growth. *Journal of Financial Economics*, 84, 187-228.

Laeven, L., Levine, R., (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, 93, 259-275.

Laeven, L., Ratnovski, L., Tong, H. (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking and Finance*, 69, S25-S34.

Laeven, L., Valencia, F., (2008). Systemic banking crises: A new database. *IMF Working Paper 08/224*, 1–80.

Laeven, L., Valencia, F., (2012). Systemic banking crises database: An update. *IMF Working Paper 12/163*, 1–32.

Laeven, L., Valencia, F., (2018). Systemic banking crises revisited. *IMF Economic Review*, *61*(2), 225–270.

Mariathasan, M., Merrouche, O., (2014). The manipulation of Basel risk-weights. *Journal of Financial Intermediation*, 23, 300-321.

Mishkin, F. S. (1999). Global financial instability: framework, events, issues. *Journal of Economic Perspectives*, 13(4), 3–20.

Niepmann, F., Stebunovs, V., (2018), Modeling your stress away. *CEPR Discussion Paper* No. DP12624, Available at SSRN: https://ssrn.com/abstract=3106828

Philippon, T., Pessarossi, P., Camara, B., (2017). Backtesting European Stress Tests. Working Paper 23083. *National Bureau of Economic Research*.

Podpiera, J., Weill, L., (2008). Bad luck or bad management? Emerging banking market experience. *Journal of Financial Stability*, 4, 135-148.

Quagliariello, M., (2019). Are stress tests beauty contests? *EBA* Staff Papers (2019).

Schaeck, K., Cihák, M. (2014). Competition, efficiency, and stability. *Financial Management*, 215–241.

Schuermann, T., (2014). Stress testing banks. *International Journal of Forecasting*, 30(3), 717-728.

Schuermann, T. (2016). Stress testing in wartime and in peacetime. Included in "Stress Testing and Macroprudential Regulation: A Trans-Atlantic Assessment". *CEPR* eBook edited by R. W. Anderson.

Single Supervisory Mechanism (SSM), (2017a). Guidance on leveraged transactions.

Single Supervisory Mechanism (SSM), (2019). SSM-wide stress test 2018.

Stoian, A., Norden, L., (2013). Bank earnings management through loan loss provisions. *DNB* Working Paper, Issue 404.

Tarancón, J. (2017). Influencia de los factores externos e internos en los ajustes de carteras crediticias. https://burjcdigital.urjc.es/handle/10115/14823

Trucharte, C., Pérez Montes, C., Cristófoli, M. E., Ferrer A., Lavín, N., (2015). Credit portfolios and risk weighted assets: analysis of European banks. *Estabilidad financiera*, 29.

Table 1: Number of banks and portfolios per country

This table reports the number of banks included in the 2018 EBA stress tests per country and the number of each type of portfolios held by the examined banks in each country. It also shows the percentage of domestic and non-domestic portfolios.

	#Banks	#Portfolios of each domestic bank				% Domestic Portfolios				% Non-domestic Portfolios			
		Corporate	Retail	Mortgage	Other	Corporate	Retail	Mortgage	Other	Corporate	Retail	Mortgage	Other
Austria	2	98	60	60	94	10%	10%	10%	11%	90%	90%	90%	89%
Belgium	2	82	53	51	67	12%	15%	14%	16%	88%	85%	86%	84%
Denmark	3	48	36	45	42	29%	22%	24%	24%	71%	78%	76%	76%
Finland	1	15	13	13	16	27%	23%	31%	31%	73%	77%	69%	69%
France	6	230	169	140	241	12%	13%	16%	13%	88%	87%	84%	87%
Germany	8	265	174	130	301	14%	15%	18%	14%	86%	85%	82%	86%
Hungary	1	12	12	12	18	17%	17%	17%	17%	83%	83%	83%	83%
Ireland	2	30	15	13	20	33%	40%	38%	30%	67%	60%	62%	70%
Italy	4	102	73	73	91	19%	19%	22%	19%	81%	81%	78%	81%
Netherlands	4	112	72	67	97	15%	14%	19%	19%	85%	86%	81%	81%
Norway	1	21	20	19	12	14%	10%	11%	25%	86%	90%	89%	75%
Poland	2	4	4	4	4	100%	100%	100%	100%	0%	0%	0%	0%
Spain	4	106	87	67	108	18%	18%	24%	16%	82%	82%	76%	84%
Sweden	4	127	86	93	156	12%	13%	15%	13%	88%	87%	85%	87%
United Kingdom	4	94	59	44	105	20%	27%	32%	22%	80%	73%	68%	78%
Total #Portfolios (Per type)		1,346	933	831	1,372								
Total #Portfolios (All groups)							4,482						
Total #Banks							48						

Table 2: Summary statistics

This table shows the main descriptive statistics for each of the bank-, country- and portfolio-level variables included in the analysis. In Panel A, we report the bank-level variables. *SIZE_B* is the size of the bank measured as the natural logarithm of the total amount of bank assets. *COST_B* is the cost-to-income ratio. *RISK_B* is the measure of initial level of risk of the bank calculated as the non-performing loans-to-total loans ratio. *LIQ_B* is the proxy for bank liquidity calculated as the liquid assets-to-total assets ratio. *LEV_B* is the ratio total customer deposits-to-total funding. *NONINT_B* is computed as the ratio non-interest income over total income. In Panel B, banking sector variables are reported. *CREDIT_BS* is private credit by deposit money banks over the GDP. *CONC_BS* is the three-banks assets concentration ratio. *ZSCORE_BS* is the Z-Score of the banking sector proxying for the level of financial soundness in the country. *COST_BS* and *NONINT_BS* are the cost-to-income ratio and non-interest income-to-total income ratio in each banking sector, respectively. In Panel C, the mean values of the portfolio variables are presented. *ΔPROV* is the change in provisions comparing the projected stock of provisions in 2020 with the one in 2017 relative to the exposure of the portfolio. *EQCOUNTRY_P* captures if the portfolio and the bank are located in the same country. *SIZE_P* is the relative size of each portfolio. *RISK_P* is the level of exposure of each portfolio.

Panel A: Bank-level variables						
	SIZE_B	COST_B	RISK_B	LIQ_B	LEV_B	NONINT_B
Austria	12.52	0.6562	0.0536	0.3313	0.05	0.4144
Belgium	13.18	0.6288	0.0314	0.3148	0.05	0.4206
Denmark	12.48	0.4890	0.0142	0.2256	0.05	0.3892
Finland	12.54	0.5019	0.0105	0.2668	0.05	0.4992
France	13.32	0.6541	0.0353	0.3446	0.05	0.4396
Germany	13.12	0.6612	0.0350	0.3309	0.05	0.4423
Hungary	12.29	0.5822	0.0753	0.3114	0.07	0.4200
Ireland	12.39	0.6788	0.0586	0.3077	0.08	0.3242
Italy	13.36	0.6325	0.0603	0.3181	0.05	0.4557
Netherlands	13.26	0.6742	0.0239	0.3263	0.05	0.4184
Norway	12.63	0.4953	0.0127	0.2479	0.05	0.4262
Poland	12.85	0.7105	0.0350	0.2958	0.06	0.3969
Spain	13.46	0.6331	0.0416	0.3165	0.05	0.4156
Sweden	12.53	0.5060	0.0106	0.2587	0.05	0.4657
United Kingdom	13.20	0.6534	0.0373	0.3181	0.06	0.4156
Total	12.88	0.6104	0.0356	0.3009	0.054	0.4229
Maximum	13.98	0.8163	0.0875	0.4368	0.1013	0.6607
Minimum	11.44	0.3857	0.0049	0.1930	0.0393	0.2351

Panel B: Banking sector variables					
	CREDIT_BS	CONC_BS	ZSCORE_BS	COST_BS	NONINT_BS
Austria	0.8169	0.6250	0.2614	0.6516	0.4513
Belgium	0.6329	0.6765	0.1904	0.6708	0.5318
Denmark	1.6301	0.8961	0.1744	0.4983	0.4188
Finland	0.9250	0.9417	0.1390	0.5510	0.5324
France	0.9681	0.5710	0.2552	0.6717	0.5432
Germany	0.7548	0.7036	0.2640	0.8509	0.4814
Hungary	0.3241	0.5889	0.0696	0.7135	0.5136
Ireland	0.4478	0.5936	0.0966	0.6669	0.3385
Italy	0.8196	0.7110	0.1206	0.5821	0.4943
Netherlands	1.1094	0.8753	0.1086	0.5875	0.3958
Norway	1.2016	0.8927	0.1115	0.4214	0.2031
Poland	0.5169	0.4218	0.0898	0.5474	0.3288
Spain	1.0495	0.7316	0.1812	0.5965	0.3612
Sweden	1.2816	0.9111	0.1408	0.5228	0.4674
United Kingdom	1.3170	0.4911	0.0996	0.6873	0.3867
Total	0.9196	0.7087	0.1535	0.6146	0.4298
Maximum	1.3170	0.9417	0.2640	0.8509	0.5432
Minimum	0.3241	0.4218	0.0696	0.4214	0.2031

Panel C: Portfolio-level variables					
	ΔPROV	EQCOUNTRY_P	SIZE_P	IRB	RISK_P
Austria	0.02	0.29	0.01	0.47	0.03
Belgium	0.02	0.27	0.01	0.47	0.02
Denmark	-0.02	0.45	0.03	0.52	0.04
Finland	0.01	0.19	0.02	0.53	0.01
France	0.02	0.29	0.01	0.51	0.04
Germany	0.02	0.29	0.01	0.50	0.04
Hungary	0.05	0.12	0.01	0.42	0.09
Ireland	0.06	0.48	0.02	0.50	0.14
Italy	0.03	0.26	0.01	0.50	0.08
Netherlands	0.02	0.21	0.01	0.49	0.05
Norway	0.03	0.11	0.01	0.63	0.02
Poland	0.04	0.15	0.02	0.39	0.05
Spain	0.03	0.31	0.01	0.51	0.11
Sweden	0.02	0.61	0.02	0.53	0.01
United Kingdom	0.10	0.16	0.01	0.51	0.06
Total	0.03	0.12	0.0072	0.48	0.05
Maximum	0.4466	1	0.3796	1	0.786
Minimum	-0.4080	0	0	0	0

Table 3: Correlation matrix

This table shows the correlations among the main variables of interest. *ΔPROV* is the change in provisions comparing the projected stock of provisions in 2020 with the one in 2017 relative to the exposure of the portfolio. *SIZE_B* is the size of the bank measured as the natural logarithm of the total amount of bank assets. *COST_B* is the cost-to-income ratio. *RISK_B* is the measure of initial level of risk of the bank calculated as the non-performing loans-to-total loans ratio. *LIQ_B* is the proxy for bank liquidity calculated as the liquid assets-to-total assets ratio. *LEV_B* is the ratio total customer deposits-to-total funding. *NONINT_B* is computed as the ratio non-interest income over total income. *CREDIT_BS* is private credit by deposit money banks over the GDP. *CONC_BS* is the three-banks assets concentration ratio. *ZSCORE_BS* is the Z-Score of the banking sector proxying for the level of financial soundness in the country. *COST_BS* and *NONINT_BS* are the cost-to-income ratio and non-interest income-to-total income ratio in each banking sector, respectively. *EQCOUNTRY_P* captures if the portfolio and the bank are located in the same country. *SIZE_P* is the relative size of each portfolio. *RISK_P* is the level of exposure of each portfolio.

	ΔPROV	*SIZE_B*	*COST_B*	*RISK_B*	*LIQ_B*	*LEV_B*	*NONINT_B*	*CREDIT_BS*	*CONC_BS*	*ZSCORE_BS*	*COST_BS*	*NONINT_BS*	*EQCOUNTRY_P*	*SIZE_P*	*IRB*
SIZE_B	0.0047	1													
COST_B	-0.0133	0.2916	1												
RISK_B	0.0113	-0.0545	-0.2013	1											
LIQ_B	0.0041	0.3314	0.4379	0.0526	1										
LEV_B	0.0094	-0.3833	-0.1917	0.31	-0.0652	1									
NONINT_B	0.0051	0.2575	0.2583	-0.0522	0.4959	-0.1789	1								
CREDIT_BS	0.0002	0.0721	0.0015	-0.2602	0.0336	-0.1834	0.0574	1							
CONC_BS	-0.0158	-0.122	-0.1955	-0.1372	-0.1476	-0.0719	0.0451	0.3277	1						
ZSCORE_BS	-0.0268	0.1108	0.1014	-0.1418	0.1104	-0.1277	0.0564	-0.1395	-0.4053	1					
COST_BS	0.0006	0.0683	0.1851	-0.0482	0.1759	-0.0673	0.0408	0.2051	-0.0072	0.2245	1				
NONINT_BS	-0.0203	0.0529	0.0666	-0.1397	0.1055	-0.156	0.1302	0.3787	0.2192	0.1891	0.6302	1			
EQCOUNTRY_P	-0.0118	-0.0994	-0.0433	0.0632	-0.0451	0.0535	-0.0206	0.0899	0.2009	-0.0287	0.0724	0.0655	1		
SIZE_P	-0.0076	-0.115	-0.063	0.0482	-0.0502	0.0789	-0.0341	0.022	0.0793	-0.0336	0.0023	-0.0028	0.4029	1	
IRB	0.0038	0.0461	0.0095	-0.0534	-0.0311	-0.1077	-0.0111	0.0378	0.0065	0.0227	-0.0002	0.0055	-0.0323	0.0847	1
RISK_P	0.0248	0.0336	0.0081	0.0995	0.0308	0.051	-0.0268	-0.0261	-0.0051	-0.0628	0.256	-0.0261	-0.005	-0.0316	-0.0739

Table 4: Credit risk impact: the effect of bank-level characteristics

This table shows the results for the influence of bank-level characteristics on the credit risk impact of EBA stress tests, while controlling for EBA macroeconomic variables (PCA approach) and the type of portfolio. ***, **, and * indicate statistical significance at 1%. 5% and 10% level, respectively.

Dependent variable: ΔPROV	(1)	(2)	(3)	(4)	(5)
Panel A: EBA variables					
PCA1	-0.00009**	-0.00004	-0.00005	-0.00005*	-0.00008*
	(0.0422)	(0.3681)	(0.2671)	(0.0619)	(0.0949)
PCA2	-0.0004***	-0.0003***	-0.0004***	-0.00003***	-0.0004***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
PCA3	0.0001	0.0001*	0.0001*	0.0001**	0.0001**
	(0.1561)	(0.0696)	(0.0714)	(0.0443)	(0.0468)
CORP	0.0124***	0.0126***	0.0127***	0.0126***	0.0125***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
RETAIL	0.0141***	0.0140***	0.0141***	0.0140***	0.0140***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
MORTGAGE	0.0006	0.0004	0.0004	0.00004	0.0003
	(0.3321)	(0.4909)	(0.5355)	(0.4866)	(0.6086)
Panel B: Bank-level variables					
SIZE_B		-0.00003	-0.00009	-0.0014***	-0.0002**
		(0.9137)	(0.7856)	(0.0003)	(-0.014)
COST_B		0.00004*	0.00009***	0.00004*	0.0001***
		(0.0938)	(0.0000)	(0.0508)	(0.0000)
RISK_B		0.0014***	0.0016***	0.0008***	0.0013***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
LIQ_B		-0.0001***	-0.00007	-0.00002	0.00004
		(0.0096)	(0.1226)	(0.6465)	(0.3297)
LEV_B		0.00004*	0.00004*	0.00008***	-0.00003
		(0.0664)	(0.0533)	(0.0003)	(0.1469)
NONINT_B		-0.00008***	-0.0001***	-0.00006**	-0.00005**
		(0.0047)	(0.0000)	(0.0304)	(0.0457)
EURO_B			-0.0060***		
			(0.0000)		
GIPS_B				0.0076***	
				(0.0000)	
BIG2_B					-0.0105***
					(0.0004)
Adjusted R-Squared	0.1458	0.2052	0.2190	0.2155	0.2458
# Observations	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48

Table 5: Credit risk impact: the effect of banking-sector characteristics

This table shows the results for the influence of banking sector characteristics on the credit risk impact of EBA stress tests, while controlling for bank-lev characteristics. EBA macroeconomic variables (PCA approach) and the type of portfolio are included but not reported. ***, **, and * indicate statistical significan at 1%. 5% and 10% level, respectively.

Dependent variable: ΔPROV	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Bank-level variables						
SIZE_B	0.00001	-0.00004	0.00008	-0.00008	-0.00009	0.0002
	(0.7681)	(0.9990)	(0.8161)	(0.8118)	(0.9774)	(0.4837)
COST_B	0.00004**	0.00004*	0.00004*	0.00006**	0.00004**	0.00006**
	(0.0477)	(0.0567)	(0.0632)	(0.0110)	(0.0426)	(0.0103)
RISK_B	0.0014***	0.0014***	0.0013***	0.0014***	0.0014***	0.0013***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LIQ_B	-0.0001**	-0.00001**	-0.0001**	-0.00008*	-0.0001**	-0.00004
	(0.0406)	(0.0173)	(0.0449)	(0.0873)	(0.0273)	(0.3439)
LEV_B	0.00002	0.00004**	0.00003	0.00004*	0.00002	0.00005
	(0.3442)	(0.0399)	(0.1388)	(0.0658)	(0.2116)	(0.8143)
NONINT_B	-0.0001***	-0.00005***	-0.00008***	-0.00009***	-0.00007***	-0.0001***
	(0.0004)	(0.0025)	(0.0019)	(0.0005)	(0.0075)	(0.0000)
Panel B: Banking sector variables						
CREDIT_BS	-0.00005***					-0.00005***
	(0.0000)					(0.0000)
CONC_BS		0.00003**				-0.00001
		(0.0372)				(0.9495)
ZSCORE_BS			-0.0002***			-0.0002***
			(0.0000)			(0.0000)
COST_BS				-0.0001***		-0.00005
				(0.0000)		(0.1025)
NONINT_BS					-0.0002***	-0.00005*
					(0.0000)	(0.0664)
EBA Variables	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.2113	0.2059	0.2184	0.2142	0.2160	0.2321
# Observations	4,482	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48	48

Table 6: Credit risk impact: the effect of portfolio characteristics

This table shows the results for the influence of portfolio-level characteristics on the credit risk impact of EBA stress tests, while controlling for bank-level and banking sector characteristics. EBA macroeconomic variables (PCA approach) and the type of portfolio are included but not reported. ***, **, and * indicate statistical significance at 1%. 5% and 10% level, respectively.

Dependent variable: ΔPROV	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Bank-level variables								
SIZE_B	0.0003	0.0001	0.0003	0.0002	0.00002	0.0002	0.00002	0.0003
	(0.3470)	(0.6871)	(0.2694)	(0.4836)	(0.4693)	(0.4365)	(0.4830)	(0.3216)
COST_B	0.00006**	0.00006**	0.00006***	0.00006**	0.00006**	0.00005**	0.00006**	0.00005**
	(0.0141)	(0.0115)	(0.0086)	(0.0133)	(0.0105)	(0.0101)	(0.0106)	(0.0176)
RISK_B	0.0012***	0.0013***	0.0012***	0.0013***	0.0013***	0.0013***	0.0013***	0.0012***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LIQ_B	-0.00004	-0.00004	-0.00005	-0.00004	-0.00004	-0.00005	-0.00004	-0.00005
	(0.4034)	(0.3409)	(0.2543)	(0.3347)	(0.3464)	(0.3193)	(0.3445)	(0.2519)
LEV_B	0.00003	0.00005	0.00002	0.00006	0.00006	0.00005	0.00005	-0.0001
	(0.8950)	(0.8255)	(0.9182)	(0.7698)	(0.7866)	(0.8193)	(0.8140)	(0.9939)
NONINT_B	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.00001***	-0.00001***	-0.00001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Panel B: Banking sector variables								
CREDIT_BS	-0.00006***	-0.00005***	-0.00005***	-0.00005***	-0.00005***	-0.00005***	-0.00005***	-0.00005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CONC_BS	-0.00009	0.00007	-0.00001	-0.00002	0.00003	-0.00009	-0.00009	-0.00004
	(0.6453)	(0.9996)	(0.9413)	(0.9119)	(0.9003)	(0.9613)	(0.9621)	(0.8648)
ZSCORE_BS	-0.0002***	-0.00002***	-0.0002***	-0.0002***	-0.0002***	-0.00002***	-0.00002***	-0.0002***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
COST_BS	-0.00005	-0.00005*	-0.00005*	-0.00005	-0.00005	-0.00005*	-0.00005	-0.00006*
	(0.1009)	(0.0946)	(0.0932)	(0.1077)	(0.1046)	(0.0890)	(0.1669)	(0.0953)
NONINT_BS	-0.00005	-0.00006*	-0.00007**	-0.00006**	-0.00006*	-0.00006*	-0.00007*	-0.00006*
	(0.1009)	(0.0683)	(0.0495)	(0.0726)	(0.0912)	(0.0815)	(0.0664)	(0.0906)
Panel C: Portfolio-level variables								
EQCOUNTRY_P	0.0028***							0.0038***
	(0.0001)							(0.0000)
SIZE_P		-0.0236***						-0.0302***
		(0.0007)						(0.0000)
IRB			-0.0061***					-0.0055***
			(0.0000)					(0.0000)
RISK_P				0.0062***				0.0077****
				(0.0036)				(0.0000)
EURO_P					-0.00002			-0.0002
					(0.7696)			(0.7416)
GIPS_P						-0.0005		-0.0007
						(0.6339)		(0.5087)
BIG2_P							-0.00005	-0.0001
							(0.9526)	(0.9008)
EBA Variables	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.2347	0.2340	0.2562	0.2335	0..2319	0.2320	0.2319	0.2647
# Observations	4,482	4,482	4,482	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48	48	48	48

Table 7: Credit risk impact: the joint role of bank- and country-level characteristics

This table reports the results testing if the effect of bank-level variables on credit risk impact is shaped by the characteristics of the banking system. In all the estimates, we control for EBA macroeconomic variables (PCA approach) and all other bank-, country- and portfolio-level characteristics. Their coefficients are not reported for save space. ***, **, and * indicate statistical significance at 1%. 5% and 10% level, respectively.

Dependent variable: ΔPROV	*SIZE_B * CREDIT_BS*	*COST_B * CREDIT_BS*	*RISK_B* CREDIT_BS*	*LIQ_B* CREDIT_BS*	*LEV_B* CREDIT_BS*	*NONINT_B* CREDIT_BS*
Bank-level variable	0.0003	0.00008	0.0021***	-0.00007	0.0001**	-0.0002***
	(0.6271)	(0.1223)	(0.0000)	(0.4578)	(0.0233)	(0.0004)
CREDIT_BS	-0.00005	-0.00003	-0.00001	-0.00009*	0.00001	-0.0001***
	(0.6320)	(0.2886)	(0.2460)	(0.0323)	(0.5752)	(0.0000)
Interaction Term	-0.00004	-0.00003	-0.00001***	0.00001	-0.00001**	0.00001**
	(0.9529)	(0.5621)	(0.0000)	(0.8479)	(0.0124)	(0.0446)
EBA Variables	YES	YES	YES	YES	YES	YES
Portfolio Variables	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.2645	0.2646	0.2676	0.2645	0.2656	0.2652
# Observations	4,482	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48	48
Dependent variable: ΔPROV	*SIZE_B * CONC_BS*	*COST_B * CONC_BS*	*RISK_B* CONC_BS*	*LIQ_B* CONC_BS*	*LEV_B* CONC_BS*	*NONINT_B* CONC_BS*
Bank-level variable	0.0019	0.00006	0.00007*	0.0058***	0.00007	-0.0002**
	(0.1018)	(0.9457)	(0.0526)	(0.0000)	(0.9259)	(0.0124)
CONC_BS	0.0003	-0.00005	-0.00002	-0.00001**	0.00001	-0.00006
	(0.1661)	(0.4438)	(0.4239)	(0.0185)	(0.9788)	(0.2572)
Interaction Term	-0.00002	0.00008	0.00007	0.00004**	-0.00001	0.00001
	(0.1587)	(0.4513)	(0.2057)	(0.0120)	(0.9203)	(0.2369)
EBA Variables	YES	YES	YES	YES	YES	YES
Portfolio Variables	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.2648	0.2646	0.648	0.2656	0.2645	0.2647
# Observations	4,482	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48	48
Dependent variable: ΔPROV	*SIZE_B * ZSCORE_BS*	*COST_B * ZSCORE_BS*	*RISK_B* ZSCORE_BS*	*LIQ_B* ZSCORE_BS*	*LEV_B* ZSCORE_BS*	*NONINT_B* ZSCORE_BS*
Bank-level variable	0.00003	0.00001**	0.0017***	0.00006	0.00001***	-0.0001***
	(0.9540)	(0.0176)	(0.0000)	(0.9608)	(0.0035)	(0.0009)
ZSCORE_BS	-0.0004	-0.00007	-0.0001**	-0.0001	0.0001	-0.0003***
	(0.2565)	(0.5885)	(0.0295)	(0.2704)	(0.1781)	(0.0005)
Interaction Term	0.00001	-0.00002	-0.00003***	-0.00003	-0.00006***	0.00002
	(0.5749)	(0.2052)	(0.0003)	(0.3142)	(0.0006)	(0.1818)
EBA Variables	YES	YES	YES	YES	YES	YES
Portfolio Variables	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.2645	0.2648	0.2667	0.2647	0.2666	0.2648
# Observations	4,482	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48	48
Dependent variable: ΔPROV	*SIZE_B * COST_BS*	*COST_B * COST_BS*	*RISK_B* COST_BS*	*LIQ_B* COST_BS*	*LEV_B* COST_BS*	*NONINT_B* COST_BS*
Bank-level variable	0.0034*	0.0012	0.0024***	0.00001	0.0004***	-0.0002
	(0.0547)	(0.2941)	(0.0000)	(0.3822)	(0.0003)	(0.1090)
COST_BS	0.0005	0.00005	0.00009	0.00005	0.0002***	-0.0001
	(0.1138)	(0.9618)	(0.8428)	(0.6068)	(0.0048)	(0.1908)
Interaction Term	-0.00004*	-0.00001	-0.00002**	0.2189	0.0002	0.4817
	(0.0782)	(0.5644)	(0.0123)	(0.2692)	(0.2713)	(0.2690)
EBA Variables	YES	YES	YES	YES	YES	YES
Portfolio Variables	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.2650	0.2646	0.2656	0.2648	0.2668	0.2646
# Observations	4,482	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48	48
Dependent variable: ΔPROV	*SIZE_B * NONINT_BS*	*COST_B * NONINT_BS*	*RISK_B* NONINT_BS*	*LIQ_B* NONINT_BS*	*LEV_B* NONINT_BS*	*NONINT_B* NONINT_BS*
Bank-level variable	0.0015	0.0003	0.0022***	-0.00007	0.0001**	-0.00008
	(0.2285)	(0.9970)	(0.0000)	(0.6084)	(0.0423)	(0.3518)
NONINT_BS	0.0003	-0.0001	0.00001	-0.00007	0.0001	-0.0004
	(0.4238)	(0.2359)	(0.7516)	(0.4469)	(0.1525)	(0.6612)
Interaction Term	-0.00002	0.0001	-0.00002**	0.0003	-0.0004**	-0.0005
	(0.3295)	(0.4960)	(0.0069)	(0.8969)	(-0.0353)	(0.7707)
EBA Variables	YES	YES	YES	YES	YES	YES
Portfolio Variables	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.2647	0.2646	0.2658	0.2645	0.2653	0.2645
# Observations	4,482	4,482	4,482	4,482	4,482	4,482
# Banks	48	48	48	48	48	48

Table 8: Credit risk impact: the joint role of portfolio- and country-level characteristics

This table reports the results testing if the effect of portfolio-level variables on credit risk impact is shaped by the characteristics of the banking system. In all the estimates, we control for EBA macroeconomic variables (PCA approach) and all other bank-, country- and portfolio-level characteristics. Their coefficients are not reported for save space. ***, **, and * indicate statistical significance at 1%. 5% and 10% level, respectively.

Dependent variable: ΔPROV	*SIZE_P * CREDIT_BS*	*IRB * CREDIT_BS*	*RISK_P* CREDIT_BS*
Portfolio-level variable	-0.0478**	-0.0082***	0.0136***
	(-0.0334)	(0.0000)	(0.0004)
CREDIT_BS	-0.00005***	-0.00007***	-0.00005***
	(0.0000)	(0.0000)	(0.0000)
Interaction Term	0.0001	0.00003**	-0.00006*
	(0.4077)	(0.0289)	(0.0987)
EBA Variables	YES	YES	YES
Bank Variables	YES	YES	YES
Adjusted R-Squared	0.2646	0.2653	0.2650
# Observations	4,482	4,482	4,482
# Banks	48	48	48
Dependent variable: ΔPROV	*SIZE_P * CONC_BS*	*IRB * CONC_BS*	*RISK_P* CONC_BS*
Portfolio-level variable	0.0043	-0.0083***	-0.0167***
	(0.8831)	(0.0000)	(0.0061)
CONC_BS	0.00001	-0.00002	-0.00002
	(0.9600)	(0.3374)	(0.4077)
Interaction Term	-0.0004	0.00004	0.0004***
	(0.2218)	(0.1179)	(0.0000)
EBA Variables	YES	YES	YES
Bank Variables	YES	YES	YES
Adjusted R-Squared	0.2648	0.2649	0.2676
# Observations	4,482	4,482	4,482
# Banks	48	48	48
Dependent variable: ΔPROV	*SIZE_P * ZSCORE_BS*	*IRB * ZSCORE_BS*	*RISK_P* ZSCORE_BS*
Portfolio-level variable	-0.0124	-0.0074***	0.0124***
	(0.4905)	(0.0000)	(0.0001)
ZSCORE_BS	-0.00002***	-0.00002***	-0.00002***
	(0.0000)	(0.0000)	(0.0000)
Interaction Term	-0.0011	0.0001**	-0.0002*
	(0.2794)	(0.0493)	(0.0984)
EBA Variables	YES	YES	YES
Bank Variables	YES	YES	YES
Adjusted R-Squared	0.2647	0.2652	0.2650
# Observations	4,482	4,482	4,482
# Banks	48	48	48
Dependent variable: ΔPROV	*SIZE_P * COST_BS*	*IRB * COST_BS*	*RISK_P* COST_BS*
Portfolio-level variable	0.0155	-0.0065**	0.0195**
	(0.6999)	(-0.0245)	(0.0451)
COST_BS	-0.00005	-0.00006	-0.00005
	(0.1491)	(0.1112)	(0.1635)
Interaction Term	-0.0007	0.00001	-0.0001
	(0.2469)	(0.7277)	(0.2133)
EBA Variables	YES	YES	YES
Bank Variables	YES	YES	YES
Adjusted R-Squared	0.2647	0.2645	0.2648
# Observations	4,482	4,482	4,482
# Banks	48	48	48
Dependent variable: ΔPROV	*SIZE_P * NONINT_BS*	*IRB * NONINT_BS*	*RISK_P* NONINT_BS*
Portfolio-level variable	0.0505	-0.0075***	0.00005***
	(0.1638)	(0.0005)	(0.0048)
NONINT_BS	-0.00004	-0.00009*	-0.00006*
	(0.2112)	(0.0536)	(0.0798)
Interaction Term	-0.0019**	0.00004	0.00006
	(0.0229)	(0.3449)	(0.6341)
EBA Variables	YES	YES	YES
Bank Variables	YES	YES	YES
Adjusted R-Squared	0.2654	0.2647	0.2645
# Observations	4,482	4,482	4,482
# Banks	48	48	48

Table 9: Robustness tests

This table reports robustness tests for the influence of bank-, banking sector- and portfolio-level characteristics on the credit risk impact of EBA stress test. Columns (1) and (2) present the results obtained when the outliers are winsorized at 1%-99% and 5%-95%, respectively. In column (3), the results are obtained when French and German banks are excluded from the regression. Columns (4) to (6) show the results for the individual regressions run over the subsamples of corporate, retail and mortgage portfolios. In column (7), we report the results when both the dependent variable and the macro-economic variables are under the baseline scenario. EBA macroeconomic variables and the type of portfolio are included but not reported. ***, **, and * indicate statistical significance at 1%. 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable: ΔPROV	Outliers winsorized at 1% and 99%	Outliers winsorized at 5% and 95%	Without France and Germany	Corporate Portfolios	Retail Portfolios	Mortgage Portfolios	Baseline
SIZE_B	0.00002	0.0003	-0.0004	-0.0002	0.0019***	0.0003	0.0001
	(0.9717)	(0.4436)	(0.4492)	(0.7183)	(0.0064)	(0.6594)	(0.2355)
COST_B	0.00002	0.0004	0.0009**	0.00003	0.00007*	0.00007	0.00008***
	(0.6887)	(0.1490)	(0.0208)	(0.4816)	(0.0978)	(0.1211)	(0.0000)
RISK_B	0.0017***	0.0015***	0.0012***	0.0016***	0.0010***	0.0014***	0.0004***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LIQ_B	0.00002*	0.00002	0.0001**	0.00001	-0.0001	-0.0001	-0.0001***
	(0.0658)	(0.9694)	(0.0194)	(0.9859)	(0.1319)	(0.1416)	(0.0000)
LEV_B	0.00004	0.00001	-0.0004	-0.0006	0.0001***	0.00004	0.00002
	(0.4238)	(0.6679)	(0.1990)	(0.1613)	(0.0060)	(0.3740)	(0.8409)
NONINT_B	-0.0001***	-0.0001***	-0.0001***	-0.0002***	-0.0001***	-0.0001**	0.00001
	(0.0064)	(0.0000)	(0.0035)	(0.0000)	(0.0034)	(0.0161)	(0.4030)
CREDIT_BS	-0.0001***	-0.00008***	-0.00004***	-0.00008	-0.00009***	-0.0001***	-0.00003***
	(0.0000)	(0.0000)	(0.0018)	(0.6504)	(0.0000)	(0.0000)	(0.0000)
CONC_BS	0.00004	-0.0006	-0.0007**	-0.00007	-0.0002	-0.0008	0.00001
	(0.4512)	(0.8620)	(0.0439)	(0.8786)	(0.6305)	(0.8749)	(0.2933)
ZSCORE_BS	-0.0003***	-0.00003***	-0.0003***	-0.0001**	-0.0003***	-0.0004***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0139)	(0.0000)	(0.0000)	(0.0000)
COST_BS	-0.0004	-0.00006	-0.0003	-0.0001	-0.0008	-0.0004	-0.0007***
	(0.5670)	(0.2067)	(0.5427)	(0.1030)	(0.9088)	(0.5640)	(0.0000)
NONINT_BS	-0.0002***	-0.00001**	-0.00009*	-0.0001***	-0.0007	-0.0005	0.0004**
	(0.0009)	(0.0162)	(0.0892)	(0.0089)	(0.3217)	(0.9474)	(0.0108)
EQCOUNTRY_P	0.0030*	0.0039***	0.0026**	0.0055***	0.0058***	0.0001	0.0009***
	(0.0885)	(0.0003)	(0.0307)	(0.0004)	(0.0001)	(0.9113)	(0.0070)
SIZE_P	-0.0513***	-0.0403***	-0.0382***	-0.0135	-0.0344***	-0.0147	-0.0164***
	(0.0028)	(0.0001)	(0.0001)	(0.4998)	(0.0032)	(0.1642)	(0.0000)
IRB	-0.0122***	-0.0081***	-0.0078***	-0.0035***	-0.0090***	-0.0041***	-0.0030***
	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0000)	(0.0002)	(0.0000)
RISK_P	0.0342***	0.0136***	0.0158***	0.0107***	-0.0042	0.0216***	0.0019***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.1464)	(0.0002)	(0.0099)
EURO_P	-0.0013	-0.0002	0.0007	0.0002	-0.0013	0.0013	-0.0011***
	(0.5012)	(0.8229)	(0.5676)	(0.8982)	(0.4392)	(0.4892)	(0.0072)
GIPS_P	-0.0023	-0.0021	-0.0010	-0.0058***	-0.0001	0.0022	-0.0001
	(0.3793)	(0.1932)	(0.5918)	(0.0075)	(0.9647)	(0.3708)	(0.7905)
BIG2_P	0.0017	-0.0003	-0.0008	-0.0021	0.0003	0.0005	0.0009**
	(0.4579)	(0.9980)	(0.6136)	(0.2521)	(0.8441)	(0.8100)	(0.0481)
EBA Variables (PCA Component)	YES	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.1715	0.2376	0.2758	0.1961	0.2205	0.2787	0.2554
# Observations	4,482	4,482	2,832	1,346	1,348	831	4,482
# Banks	48	48	46	48	47	47	48

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