Are EBA Banking Sector's Stress Test Results Country or Ownership Specific?

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Submitted: October 13, 2024 • Accepted: December 31, 2024

ABSTRACT: This paper presents the results of an assessment of the impact of country and ownership specific features of banks on the results of the EBA cyclical stress tests. For the purpose of panel model estimation a dedicated database has been built by the author. The results of the random effects panel model support some anecdotal evidence on the influence of local regulators. The model results also prove the efficiency of restructuring plans. They helped banks with the plan to better prepare for turbulent times. Ownership structure had a significant impact on stress-test performance. Being a bank with the state as the largest shareholder or being a cooperative bank significantly improved the performance of the bank in the EBA stress tests. The research focuses on qualitative characteristics assuming no impact of banks' finances or business cycle.

JEL classification: G21, G28, G01, C23.

Keywords: Banking Sector, Risk, EBA Stress Test, Ownership, Country Characteristics, Resilience.

1 Introduction

The European Banking Authority (EBA) conducts EU-wide stress tests to assess the impact of common shocks on the financial positions of large European banks. These

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DOI: 10.33119/ERFIN.2024.9.2.1

tests, which are coordinated with the European Systemic Risk Board (ESRB), assess the resilience of EU banks over a three-year horizon under both baseline and adverse scenarios.

These adverse scenarios describe severe negative shocks to economic growth and other macroeconomic variables (MEV), such as unemployment, interest rates, stock market indices etc. The purpose of this cyclical exercise is to promote market discipline and inform EU supervisors of weak elements in the financial system. If the result is poor, the supervisor can then decide on a mandatory additional capital buffer for a particular financial institution to provide a cushion against these risks.

Stress-testing has been used at an individual level by large, internationally active banks since the early 1990s. They are used to supplement the estimates derived from internal models. They are able to assess the impact of arbitrary extreme events (Quagliariello, 2009, p. 19).

Several studies have analysed the impact of stress test results. For example, Sahin et al. (2020) show that stress tests have an impact on systemic risk. More specifically, they examined the effects of the announcement and the disclosure of the clarification, methodology, and results of the U.S. bank stress tests on banks' equity prices, credit risk, systematic risk, and systemic risk. The results show that stress tests have moved stock and credit markets following the disclosure of stress test results and that banks' systematic risk, as measured by betas, has declined in almost all years following the disclosure of stress test results.

Much has been said in recent years about the need for a banking union. It is aimed at improving the resilience of banks to various shocks. Country and ownership specific risk mitigation could lead to better resilience of the whole European banking system.

But then the question arises, is the performance of banks in stress tests country specific or ownership specific? There is not much research on the country or ownership characteristics of European banks, especially when it comes to their stress test performance. Many of the European banks surveyed in the EBA exercise are global institutions, so does it really matter where their headquarters are located, as some anecdotal evidence might suggest?

The objective of this paper is to identify the statistically potential influence of the geography (home country) of European banks and their ownership, on the results of the EBA stress tests conducted from 2016 to 2023. Specifically, whether the state is the dominant shareholder or the bank is cooperative is a statistically significant feature. For this reason a dedicated database and an econometric panel model have been created.

The structure of this paper is as follows: Section 2 describes economic and non-economic drivers of stress test results, Section 3 of this paper outlines the performance of European banks after the global financial crisis, Section 4 presents the methodology of the research and Section 5 describes the database created for the purpose of this research and Section 6 shows the results of the empirical modelling. The last section presents the main conclusions of the research.

2 Economic and non-economic drivers of stress test results

In bank stress testing models (both top-down and bottom-up, regulatory and internal), macroeconomic drivers play a crucial role in assessing the impact of economic shocks on banks' capitalisation. Typical macroeconomic drivers considered include[1]:

- GDP growth. Economic growth affects loan demand, credit quality, and a bank's overall profitability, which helps to build a solid capital base. This parameter tends to have a strong impact on banks' wholesale portfolios.
- Unemployment rate. Higher unemployment can lead to loan defaults and reduced consumer spending. It affects consumer loans (retail portfolios).
- Interest rates. Changes in interest rates affect banks' net interest income, asset valuations, and funding costs. It has a strong impact on credit decisions and loan quality especially for mortgage loans.
- House prices. Fluctuations in the housing market affect mortgage portfolios and collateral values.
- Exchange rates. Currency movements impact foreign exchange exposures and international operations.
- Inflation. Inflation affects asset values and purchasing power, which in turn affects loan repayments.
- Market volatility. Stock market fluctuations impact trading book and investment banking revenues. It can also affect collateral consisting of securities.
- Commodity prices. Changes in commodity prices affect sectors with large infrastructures such as energy, industrial production, construction and mining.

But this is not the end of the list. For an interesting overview of top-down stress testing framework and macroeconomic conditioning see Borsuk and Krzesicki (2020). When comparing top-down and bottom-up stress testing models for credit risk, the type of risk that has a significant impact on the financial results of European banks, we could divide the economic drivers into the following representational groups:

- Debtors' earning potential (GDP, unemployment, industrial production)
- Cost of credit (interest rate, exchange rate)
- Leverage (debt ratios)

[1]The list of macroeconomic variables which scenarios are used for regulatory stress test (EBA) can be found in: *Macro-financial scenario for the 2023 EU-wide banking sector stress test*

- Collateral prices (house prices, commercial property, ship and car prices)

Sometimes additional variables, such as market indices: stock market indices or credit swap spreads, are used.

In the case of the bottom-up approach, the evaluation of the impact of shocks on macroeconomic variables is assessed at the most granular level of data. Specifically, shocks are considered at the individual client level, and the results are then aggregated to provide a portfolio view of the impact on the bank's capital levels.

This approach allows for a detailed assessment of how specific shocks affect different components within the organisation, ultimately contributing to a comprehensive understanding of risk exposure and capital resilience.

However, according to some anecdotal evidence or some implicit conclusions from various studies there may be other factors that can influence stress test results. Or at least influence the strength of the impact of the economic drivers. For example, the ownership structure of a bank can have a significant impact on its resilience.

There is a relatively large body of research on ownership structure especially on ownership concentration in banks, covering different time periods.

Yeyati et al. (2004) reviewed the existing evidence on the role of state ownership of banks, tested its robustness, and presented new evidence. Although there is some evidence that state-owned banks do not allocate credit optimally, the paper shows that the inhibitory effects of state ownership on financial development and growth are less robust than previously thought. The paper also discusses some new evidence suggesting that, at least in the case of Latin America, public banks can play a useful role in reducing credit procyclicality. In this context, public banks should be judged on the basis of their development and stabilising effect.

De Nicolo and Loukoianova (2007) conducted a relatively extensive study on a panel of individual bank data and ownership information, including more than 10,000 bank-year observations for 133 non-industrialised countries during the period 1993-2004. They found that the positive and significant relationship between bank concentration and bank failure risk is stronger when bank ownership is taken into account, and it is strongest when state-owned banks have large market shares. Second, conditional on country and firm-specific characteristics, the risk profiles of foreign (state-owned) banks are significantly higher than (not significantly different from) those of private domestic banks. Third, private domestic banks do take on more risk as a result of the larger market shares of both state-owned and foreign banks.

For another example, covering the period 1999-2004 and a sample of 181 large banks from 15 European countries, Iannotta et al. (2007) assessed the impact of alternative ownership models, together with the degree of ownership concentration, on their profitability, cost efficiency and risk. According to this research, mutual and state-owned banks have lower profitability than privately owned banks, despite their lower costs. Second, public banks have lower loan quality and higher insolvency risk than other types of banks,

while mutual banks have better loan quality and lower asset risk than both private and public banks. Finally, while ownership concentration does not significantly affect bank profitability, higher ownership concentration is associated with better loan quality, lower asset risk and lower insolvency risk.

A similar time span was examined by Barry et al. (2011). They used a panel of European banks over the period 1999-2005. They found that ownership structure is significant in explaining risk differences, but mainly for privately owned banks. Higher ownership by either individuals/families or banking institutions is associated with lower asset and default risk. In addition, institutional investors and non-financial corporations pursue the riskiest strategies when they hold higher stakes. For publicly owned banks, changes in ownership do not affect risk-taking. Market forces appear to be aligning the risk-taking behaviour of publicly held banks so that ownership structure is no longer a determinant in explaining differences in risk. However, higher ownership by banking institutions in publicly held banks is associated with lower credit and default risk.

This picture changes slightly for another time period and another research. Migliardo and Forgione (2018) examined the extent to which the type of shareholder and the degree of shareholder concentration affect banks' profitability, risk and technical efficiency. They used a sample of 1,459 banks operating in the EU-15 countries between 2011 and 2015. The conclusion was that banks with large block shareholders are more profitable, less risky and more profit efficient. Furthermore, ownership concentration reverses the negative effects associated with institutional, bank and industry ownership.

Veron (2017) formulated his findings on the ownership structure of European banks. He analysed the governance structures of euro area banks. He concluded that most of them are potentially vulnerable to some form of political interference, and only a minority are listed companies with dispersed ownership. In his view, this has implications for financial stability, resilience to shocks and other areas of public policy. He found that listed banks with dispersed ownership are the exception rather than the rule among the euro area's significant banks, especially when looking beyond the very largest banking groups. The majority of these significant banks are state-owned or cooperatives, or are uniquely influenced by one or more large shareholders, or are otherwise vulnerable to direct political influence. As a result, the public transparency of many banks is low, with correspondingly low market discipline; they have weak incentives to prioritise profitability; their ability to support their balance sheets either through retained earnings or by raising external capital is limited, resulting in insufficient capital flexibility; they take unnecessary risks because of political interference; and their links to governments perpetuate the vicious circle between banks and sovereigns that was a key driver of the euro area crisis. According to Veron, many of the ownership structures make it more difficult for euro area banks to raise fresh capital externally when they need it. Controlling or influential shareholders often don't want to see their stakes reduced and may therefore resist calls for more capital. In some cooperative or publicly-owned banking structures, it is difficult,

and in some cases impossible, to raise external capital in the form of common equity. This has long been a key challenge for many Spanish savings banks (*cajas de ahorros*), contributing to their chronic undercapitalisation. In the case of state-owned banks, their government shareholder is often reluctant to provide additional capital due to fiscal stress, the unpopularity of taxpayer-funded bailouts and/or the EU state aid control framework. Listed banks with diversified ownership have comparatively greater capital flexibility.

According to a very recent paper by Díez-Esteban et al. (2022), ownership concentration has an inverted U-shaped relationship with systemic risk. In other words, there's an optimal level of ownership concentration beyond which risk increases (non-monotonic relationship). Higher ownership concentration promotes systemic risk up to a certain threshold. Board size and gender diversity affect systemic risk, especially for smaller banks. Banks with high government ownership tend to have poorer performance and lower profitability, and banks with higher domestic private ownership tend to be more profitable. In sum, promoting better governance practices, including ownership and board structures, can enhance a bank's ability to control systemic risk. Practitioners and policymakers should consider these factors to ensure bank resilience.

3 European banks' performance after global financial crisis

Europe is still more bank-based than other parts of the world. Banking assets in the euro area have remained relatively stable over the last two decades: in 2002 they amounted to 240% of GDP, rising to 300% in 2011 and to 290% of GDP at the end of 2022. This compares with around 120% of GDP in the United States, where non-bank financial institutions play a more important role (European Central Bank, 2023).

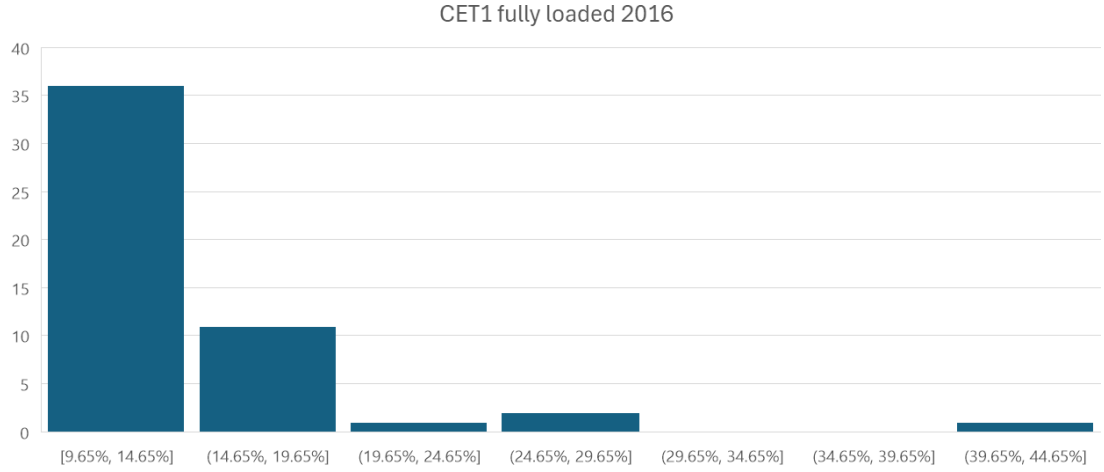
Research on the banking sector after the global financial crisis has revealed interesting patterns in banks' risk perceptions. The analysis of Basten and Sánchez Serrano (2019) shows that after the global financial crisis, the value of market-based indicators decreased, but still remained higher than pre-crisis levels. This would suggest that banks are less safe than before the global financial crisis. But the opposite is true for structural indicators. This contrast may signal that we have moved from a pre-crisis period characterised by high risks in the banking sector, which were not priced by market participants, to a period of lower risks in the banking sector, but with market participants fully aware of them.

The Basel III framework introduced Common Equity Tier 1 (CET1) as a precautionary measure following the 2007-2008 financial crisis. It is considered the highest quality and most loss-absorbing form of regulatory capital and is a component of Tier 1. CET1 consists mainly of common equity held by a bank or financial institution. It includes liquid assets such as cash and shares. In times of crisis, equity losses are first absorbed by CET1. Banks must meet minimum CET1 ratio requirements based on their risk-weighted assets (RWA). Recently, banks have been required to have a higher proportion of funding in their CET1 capital. As a result, the CET1 ratio for European banks increased from

12.7% of risk-weighted assets in 2015 to 15.7% at the end of 2023. Figures 1 and 2 show the distribution of the fully loaded CET1 ratio among the banks participating in the EBA stress test in 2016 and 2023. The bulk of the distribution is skewed to the right, implying an increase in capital in recent years.

The risk profile of banks is also determined by market conditions, competition between banks and lending policies. There has been some consolidation in the banking sector in recent years, including across borders, but it is still quite limited. As of 2024, the sources of financing for European companies are relatively stable, with banks providing around 30% of the total. At the same time, European banking markets are not fully integrated. The national implementation of European directives differs from country to country. There is little cross-border retail banking activity. Cross-border merger and acquisition activity in the banking sector is weak. Most lending takes place within national markets. Cross-border lending within the euro area accounts for 7% of total retail lending, while lending to borrowers outside the euro area accounts for 11%. The country of origin of the bank can still influence the resilience of banks, as national supervisors may have slightly different approaches to risk management (for example, the Polish Financial Supervision Authority, KNF, is perceived as one of the strictest in Europe). Lending standards may also differ between countries. Therefore, the country of origin is worth examining as a driver of the results of the bank's stress tests.

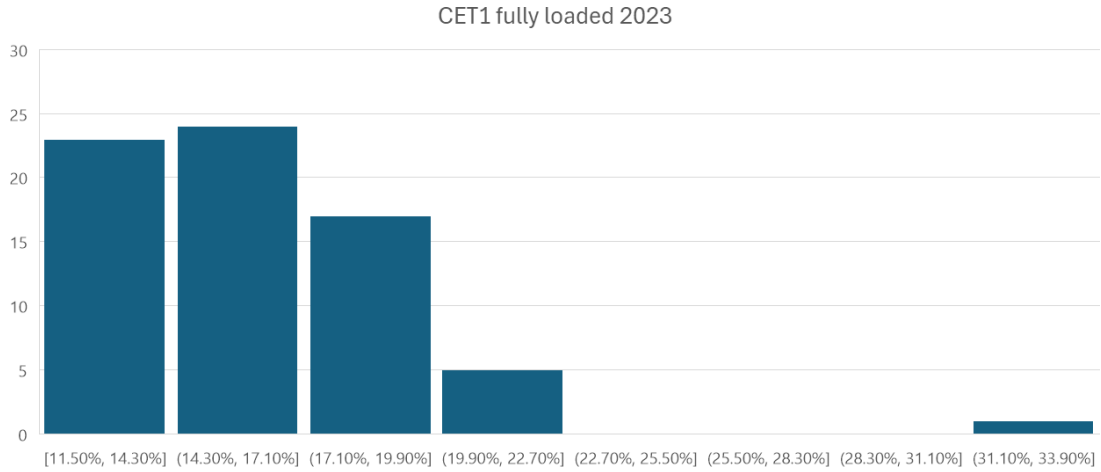
Figure 1: Fully loaded CET1 ratio (%) distribution: Banks participating in EBA stress test 2016



4 Methodology

Panel data models allow, the study of both cross-sectional variation, which is unobservable in time-series data, and time-series variation (which is unobservable in cross-sectional data). In this research, a one-way approach has been used, which means that the slope parameters are estimated both in time and in cross-section (as one single value). For more

Figure 2: Fully loaded CET1 ratio (%) distribution: Banks participating in EBA stress test 2023



on panel data techniques, see for example Wooldridge (2010). A typical, one-way panel model can be presented in the form:

$$y_{it} = \boldsymbol{\alpha}_i + \boldsymbol{\beta}\mathbf{x}_{it} + \varepsilon_{it}$$

where $\mathbf{x}_{it}$ is a vector of k regressors that can potentially change values in both dimensions, $i = 1, 2, \ldots, N$ and $t = 1, 2, \ldots, T$, $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$. $\boldsymbol{\alpha}_i$ it is a so-called individual effect that can be assumed to be fixed or random, depending on the estimation approach. The Hausman test 1978 can help to decide which estimator is more appropriate in terms of the trade-off between unbiasedness and efficiency. It compares the two estimators under the null of no significant difference: if this is not rejected, the more efficient random effects estimator is chosen. Some sample characteristics may also provide a signal as to which approach should be chosen. The larger the sample the more precise the population statistics (mean, standard deviation etc.), which is especially important for the random effects approach, which by design has a more efficient estimator (general least squares), but it needs a large N.

The incompleteness problem is solved by the $Tx1$ vector of selection indicators:

$$s_i = (s_{i1}, \ldots, s_{iT})'$$

where $s_{it} = 1$ if $(\mathbf{x}_{it}, y_{it})$ is observed and zero otherwise. These indicators are included in the estimator formula.

If $\boldsymbol{\alpha}_i = \boldsymbol{\alpha}$ then the equation represents the pooled approach, where no heterogeneity among groups is assumed. Usually the pooled approach is the starting point for later estimations. This approach was also used. The decision to use individual effects was made using F tests of effects based on the comparison of the within and the pooling model (pFtest from plm package).

An important issue is panel balance and attrition. The significant attrition effect was due to Brexit therefore the United Kingdom was excluded from the panel and is not the subject of this research. Balancedeness is important for the estimator's performance. Too many missing observations can affect the reliability of the model's output.

The one-way approach to panel modelling is very useful for our study, but it has some drawbacks. It is important to remember that each bank, regardless of its size or importance in the banking system, has the same weight on the parameter that is common to all banks over time. Some outlier banks may worsen the results. Therefore, an additional robustness check of the final estimates was carried out using weighted panel estimation.

5 Dataset

A panel dataset consists of consecutive results of the EBA stress test exercise from 2014 to 2023. The exercise is cyclical and is conducted every 2 years, but due to the pandemic in 2020, the stress test was cancelled and postponed to 2021. A total of 5 rounds are therefore included. Data were downloaded from official EBA documents available to the public. Each exercise included results from around 16 EU and EEA countries. The 2023 EU-wide stress test covered 70 banks, representing 75% of the EU banking sector assets (European Banking Authority, 2023, p. 10).

In addition, the database was enriched with additional variables constructed by the author on the basis of public information on ownership and other characteristics of the banks in the sample.

For the purpose of this study, the balance sheet structure of the banks covered by the EBA was not been taken into account. Therefore, some banks included in the sample may have a more retail or more wholesale profile, can have more or less credit exposure. This may have an impact on the stress test result. However, it has not been analysed here.

For the measure of full capital, CET1 was chosen as the most liquid and comparable measure of stress-absorbing capital across banks. UK banks that existed at the beginning of the sample (pre-Brexit) have been excluded, as they could potentially bias the results. The main dependent variable is the difference in basis points of full CET1 capital due to the adverse scenario at the end of the simulation scenario (after 3 years). The list of explanatory variables includes country, restructuring plan, ownership type.

Two binary variables are constructed that include information on the type of ownership. The first indicates whether the dominant shareholder is the state or not (i.e. the state has the largest stake among all investors), the second whether the bank is a co-operative (usually an association of cooperative banks) or not. Relevant information on the ownership and governance structure of each bank in the sample is publicly available. However, both variables represent the situation in September 2024. There are some banks that changed their status from state-dominated to private-dominated during the research

period (such as Bank of Ireland Group plc, which was sold by the state in 2022).

There is also a binary variable related to the existence of a restructuring plan after the global financial crisis and debt crisis. This information is included in the 2014 EBA stress test reports. The application of such a plan can theoretically affect a bank's risk performance.

All these observations create a potentially large dataset that can be used for panel modelling techniques. Table 1 provides a summary of the dataset.

Table 1: Database summary

Variable	Description	# banks covered	# obs. total
CET1 start	Common Equity Tier 1 at the start of stress test horizon (real value)	139	330
CET1 full start	Common Equity Tier 1 fully loaded at the start of stress test horizon (real value)	139	330
CET1 full adv	Adverse scenario of fully loaded CET1 capital at the end of stress horizon (+3yrs)	139	330
CET1 adv	Adverse scenario of CET1 capital at the end of stress horizon (+3yrs)	139	330
delta_adv	CET1 adv – CET1 start	139	330
full_delta_adv	CET1 full adv – CET1 full start	139	330
restrplan	"1" - restructuring plan in place noted in 2014 EBA ST, "0" otherwise.	98	161
Country (separate vars for countries)	ISO code for country of origin (head office)	139	330
state	"1" if biggest share is state owned, "0" otherwise. Status as of 2024.	70	123
cooperative	"1" if bank is cooperative, "0" otherwise.	139	330

The final panel imbalance has been measured using the popular panel metrics gamma and nu, which are equal to 0.6354756 and 0.6662017 respectively, implying that the level of imbalance is acceptable. However, some estimations have a reduced number of observations due to the use of "state" or "restrplan" variables, which are available for the respective point in time and therefore not for the whole list of banks in the database.

Figures 3, 4, 5 and 6 show histograms of the EBA ST results for the years 2016, 2018, 2021 and 2023. These years were used for the estimations. Although some data from 2014 EBA ST are used (such as information on restructuring), this year itself was not included in the estimates. The estimation sample starting from 2016 proved to be more consistent.

The explanatory variable used in the estimations is the 3-year difference between the CET1 at the end of the adverse ST scenario and the starting (real) CET1 of a given bank. The difference is measured in basis points of the capital ratio. There were such cases of banks that started with around 15p.p. of CET1 and ended with 0p.p. of CET1. This means that the difference was -1500 basis points. These are banks from the left tail of the distribution. The right tail includes the most robust banks. Estimations have been made for both CET1 and fully loaded CET1 to account for both measures used by the EBA.

Figure 3: EBA stress test results for European banks in 2016 for the adverse scenario (effect on fully loaded CET1 at the end of 3-year stress horizon)

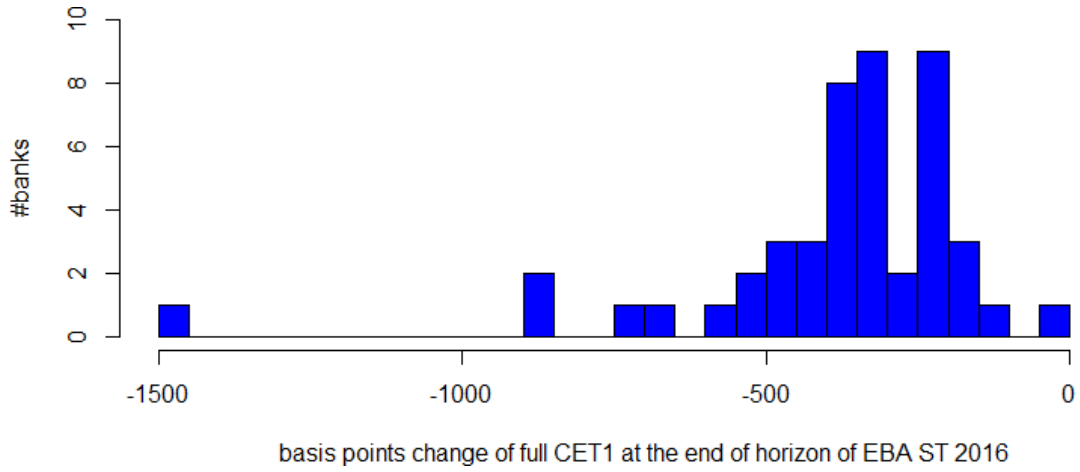
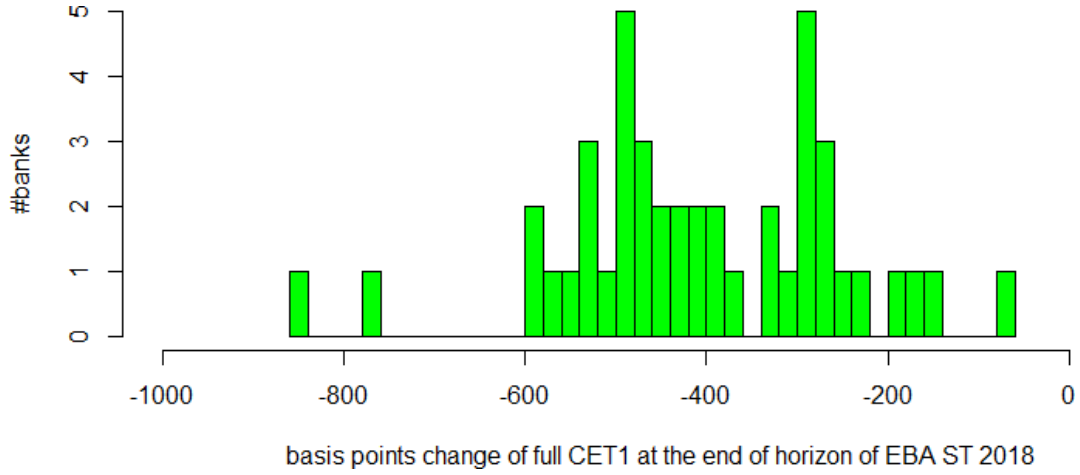


Figure 4: EBA stress test results for European banks in 2018 for the adverse scenario (effect on fully loaded CET1 at the end of 3-year stress horizon)



6 Empirical results

Panel estimation was done in R using the plm[2] package. The result of the initial 'pooled' estimation on the full sample indicated the need for a panel approach. The F-test for pooling indicated the rejection of the null hypothesis with p-value = 0.01385. Although the database itself covers many banks through successive waves of the EBA ST exercise, the final estimation sample shrank due to limited information on the ownership status (information available as of 2024, it requires additional effort to assign the status backwards and it is planned as the next round of the research).

Two approaches were considered - fixed and random effects. The Hausman test indicated that a random effects approach was more appropriate for such a panel (the fixed effects estimator proved to be inconsistent). Panel tests for serial correlation were per-

[2] `https://cran.r-project.org/web/packages/plm/vignettes/A_plmPackage.html`

Figure 5: EBA stress test results for European banks in 2021 for the adverse scenario (effect on fully loaded CET1 at the end of 3-year stress horizon)

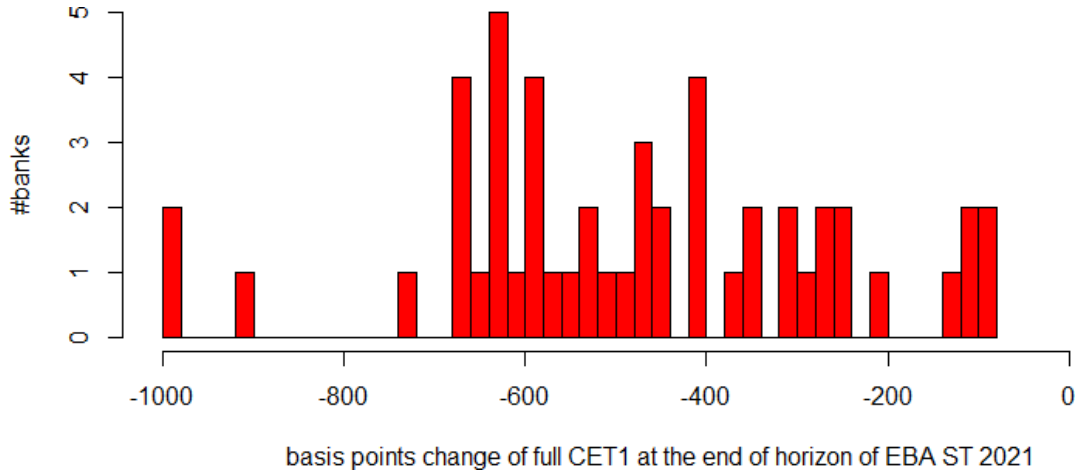
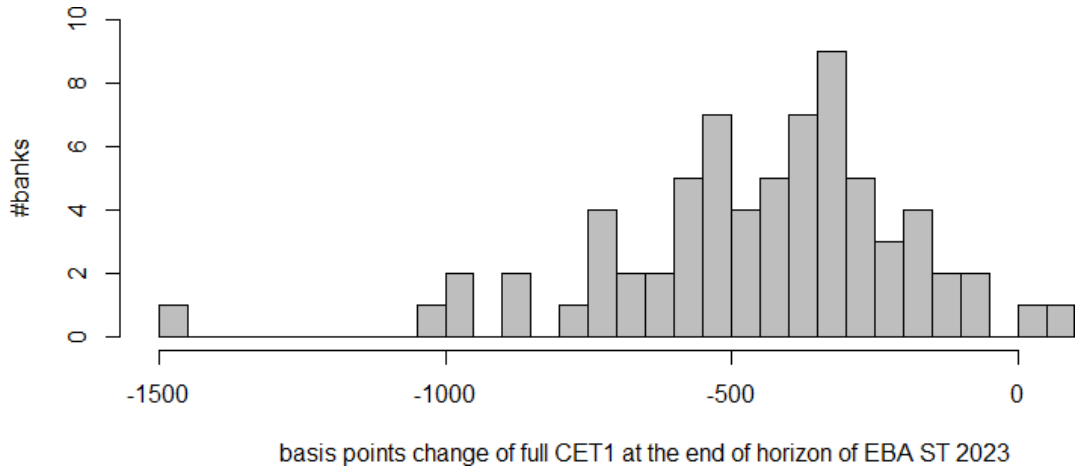


Figure 6: EBA stress test results for European banks in 2023 for the adverse scenario (effect on fully loaded CET1 at the end of 3-year stress horizon)



formed and the final RE models proved to be correlation robust.

No country systematic bias was found for the sample starting in 2014. This is probably because the 2014 sample is quite different (see Philippon et al., 2017). The European stress test was conducted under a general principle of static balance sheets. It assumes no asset growth over the three-year horizon of the test, and maturing assets are assumed to be replaced by similar exposures in terms of type, credit quality and maturity at the start of the exercise. No replacement or write-down of defaulted assets was allowed in the exercise. However, some banks subject to the exercise in 2014 underwent a restructuring plan approved by the European Commission before December 2013 - the start date of the stress test. These restructuring plans concerned 32 banks in the stress test exercise that received government support (e.g. recapitalisation by the government) after the 2008 financial crisis. They had to apply a dynamic balance sheet assumption to the troubled assets they were supposed to cut-off under the restructuring plans. Given the nature of

banks under this assumption and the fact that they could reduce their exposure to troubled assets in the exercise, this year has been omitted. It is also reasonable to omit this year, taking into account the fact that information on restructuring from 2014 onwards has been used for estimations dedicated to the next rounds of stress tests. Table 2 shows the results of the random effects estimation for the sample starting with the 2016 round.

Table 2: Results of panel (random effects) estimations on 2016-2023 data sample

	delta_adv (1)	full_delta_adv (2)	delta_adv (3)	full_delta_adv (4)
CountryBE	139.690	158.153	105.460	132.886
	(104.238)	(106.536)	(97.988)	(100.448)
CountryDE	−125.192	−91.351	−94.621	−60.223
	(91.220)	(93.601)	(90.155)	(93.877)
CountryDK	−127.833	−134.659	−109.887	−109.472
	(100.156)	(102.767)	(98.383)	(102.194)
CountryES	123.136	159.156	115.123	160.603*
	(95.559)	(98.062)	(93.347)	(97.146)
CountryFI	−30.620	−37.521	−5.024	−10.089
	(111.371)	(114.124)	(118.891)	(122.364)
CountryFR	−146.097	−154.846	−108.203	−116.810
	(94.674)	(97.217)	(91.252)	(95.345)
CountryGR	127.204	233.668*	79.619	190.629
	(133.802)	(137.070)	(123.542)	(127.791)
CountryHU	135.102	176.386	135.070	188.893
	(129.855)	(133.182)	(126.439)	(131.006)
CountryIE	−186.345	−156.614	−198.820*	−164.929
	(113.297)	(116.202)	(106.139)	(110.600)
CountryIT	−47.689	−32.076	−54.159	−27.012
	(95.047)	(97.390)	(92.906)	(96.483)
CountryNL	−178.957*	−182.505*	−70.715	−57.798
	(99.370)	(102.013)	(100.668)	(105.190)
CountryNO	234.731*	218.035*	281.127**	276.440**
	(128.143)	(131.294)	(125.967)	(130.011)
CountryPL	229.233**	245.921**	349.512***	361.377***
	(114.610)	(117.554)	(117.619)	(121.880)
CountryPT	203.249	190.377	176.609	170.415
	(149.395)	(153.186)	(139.152)	(144.831)
CountrySE	177.394*	164.499*	205.883**	201.117**
	(96.572)	(99.118)	(94.543)	(98.354)
restrplan	−95.707**	−92.344**		
	(43.211)	(43.912)		
state			−100.782**	−87.597**
			(40.468)	(41.223)
cooperative			12.011	30.092
			(45.635)	(46.757)
Constant	−410.666***	−403.898***	−426.147***	−428.954***
	(82.153)	(84.336)	(81.523)	(84.900)
Observations	210	211	195	196
R^2	0.370	0.360	0.385	0.368
Adjusted R^2	0.318	0.307	0.326	0.308
F Statistic	90.297***	89.730***	93.520***	88.826***

Notes: Due to some collinearities, "restrplan" was included in a separate equation without ownership characteristics (state, cooperative). Robust standard errors in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Some countries seem to have a significant bias in the result of the stressed CET1. Such as Poland, Sweden, Norway and the Netherlands. If we focus on the shorter sample starting from 2018 (see Table 3), only Dutch and Irish banks seem to have systematic bias. The strong significance and negative sign (lower required capital increase) seem to support

anecdotal evidence on the influence of local regulators. This effect in the case of Dutch banks was probably driven by preparations for Basel III requirements, and they have been increasing their core capital buffers since 2014, as they are potentially particularly vulnerable to Basel III effects. In the case of Irish banks, the effect of the stress scenario from 2018 onwards was not as severe as they had to raise their capital significantly before 2018.

Table 3: Results of panel (random effects) estimations on 2018-2023 data sample

	delta_adv (1)	full_delta_adv (2)	delta_adv (3)	full_delta_adv (4)
CountryBE	202.391*	245.208**	31.382	40.337
	(107.769)	(117.662)	(88.055)	(93.788)
CountryDE	−220.933	−220.460	−167.248	−155.430
	(171.477)	(172.402)	(153.060)	(149.448)
CountryDK	−220.712	−253.608	−213.847	−249.416
	(195.730)	(199.817)	(175.403)	(173.569)
CountryES	117.794	143.979	99.273	118.922
	(181.941)	(184.362)	(163.341)	(161.027)
CountryFI	77.992	58.855	76.642	57.665
	(260.935)	(260.296)	(221.895)	(215.605)
CountryFR	−243.113	−240.069	−175.867	−158.300
	(170.335)	(170.953)	(150.283)	(146.710)
CountryGR	106.768	303.730	−41.714	112.808
	(188.987)	(190.455)	(168.318)	(166.606)
CountryIE	−604.379***	−565.526***	−582.869***	−537.456***
	(198.987)	(205.717)	(185.708)	(187.376)
CountryIT	−85.290	−152.725	−51.395	−96.821
	(170.320)	(171.162)	(150.997)	(147.661)
CountryNL	−430.623**	−461.830***	−371.647	−338.551
	(175.390)	(178.134)	(245.301)	(240.193)
CountryPL	230.364	267.548	480.477***	567.518***
	(170.585)	(171.917)	(174.442)	(170.345)
CountrySE	203.762	206.217	221.973	229.429
	(179.198)	(182.008)	(160.511)	(158.759)
restrplan	−173.709**	−207.251***		
	(70.175)	(75.018)		
state			−227.211***	−279.284***
			(77.961)	(75.151)
cooperative			−85.444	−107.877
			(88.632)	(87.973)
Constant	−427.492***	−408.355***	−426.142***	−407.165***
	(152.815)	(152.931)	(131.015)	(127.842)
Observations	61	62	59	60
R^2	0.781	0.781	0.771	0.785
Adjusted R^2	0.720	0.721	0.698	0.718
F Statistic	143.884***	150.601***	117.039***	136.239***

Notes: The table presents regression results. Robust standard errors in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Models built on the dataset starting from both 2016 and 2018 show the effectiveness of restructuring plans. Banks that went through such a process proved to be more resilient, i.e. they needed less additional capital to absorb macroeconomic shocks compared to other banks.

In the case of the ownership profile, it should be noted that the fact of being a cooperative bank did not significantly affect the result of the stress test. However, if the largest share is owned by the state, it significantly reduces the impact of the stress test scenario

on capital. This is also confirmed for a shorter sample. This effect is ambiguous as the literature tends to support the opposite effect. For example, according to Veron (2017), such banks take unnecessary risks due to political interference. However, it may be that after the debt crisis and the lessons of "too big to fail", where governments had to support many European banks, these banks put more focus on becoming more resilient and they built up sufficient capital faster. They are therefore better prepared for shocks.

Another conclusion from the estimates presented is that the results are similar for both capital ratios, CET1 and fully loaded CET1.

As mentioned above, in the classical panel model estimation, each object (bank), regardless of its size or importance, has the same weight on the parameter that is common to all objects (banks) over time. Therefore, it is likely that some outlier banks may worsen the results. The question is therefore whether the above conclusions about the influence of ownership and country specificity are still valid when we consider the size of the banks.

A robustness check was carried out for this purpose. We now assume that each bank has the impact on the parameter according to its size measured by total assets. Figure 7 shows a histogram of the weights for the ST EBA 2023 sample of banks. About 64% of the banks have a weight below 1%.

Figure 7: Histogram of weights based on total assets: Sample of banks taken for ST EBA 2023 exercise; total assets as of the end of 2023

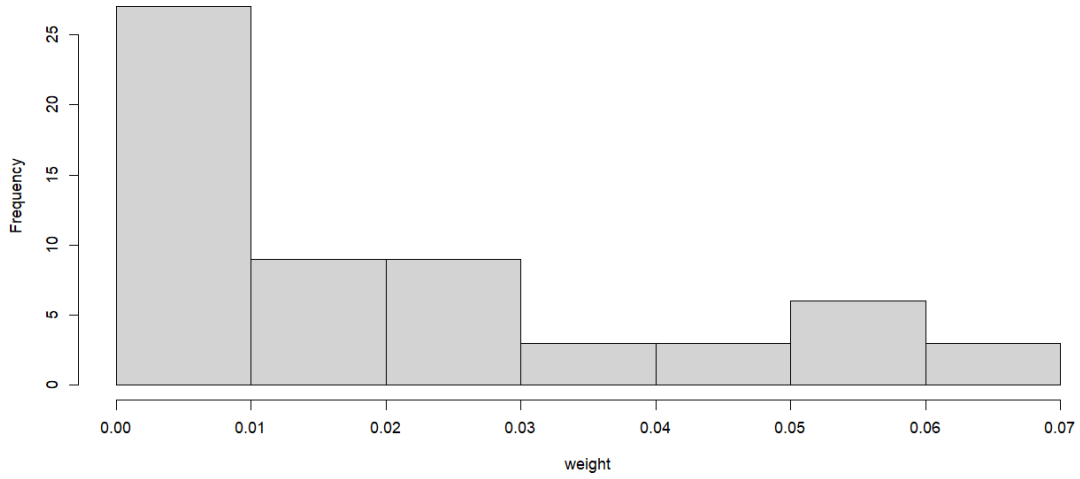


Table 4 presents the weighted panel model estimation results of models with ownership and country variables, which is the modification of the model presented in Table 3.

The results show that ownership characteristics are more important than country characteristics. The only country that is still significant is Poland (two banks in the sample - PKO BP and Pekao SA, both dominated by the government). In this regression, not only the "state" variable is highly significant, but also the "cooperative" variable, which was not observed in the unweighted approach. Both bank characteristics improve the bank's performance in the EBA stress tests by about 300 and 130 basis points on average, respectively.

Table 4: Weighted panel (random effects) estimations on 2018-2023 data sample

	delta_adv (1)	full_delta_adv (2)
CountryBE	32.063	40.700
	(110.925)	(108.282)
CountryDE	−148.538	−143.880
	(181.343)	(164.274)
CountryDK	−277.923	−314.501
	(219.756)	(201.251)
CountryES	120.746	138.005
	(179.306)	(162.638)
CountryFI	76.018	57.321
	(242.066)	(218.544)
CountryFR	−110.765	−100.489
	(179.925)	(162.199)
CountryGR	4.506	138.578
	(236.933)	(224.970)
CountryIE	−520.424	−480.984
	(317.305)	(301.527)
CountryIT	47.674	7.663
	(200.327)	(180.220)
CountryNL	−300.488	−269.833
	(488.547)	(444.199)
CountryPL	574.704**	679.797***
	(260.437)	(239.151)
CountrySE	261.506	255.417
	(209.310)	(190.863)
state	−298.995***	−348.346***
	(80.531)	(70.381)
cooperative	−128.303*	−140.934**
	(74.033)	(65.679)
Constant	−425.518**	−406.821***
	(169.726)	(153.702)
Observations	59	60
R^2	0.756	0.770
Adjusted R^2	0.679	0.699
F Statistic	84.650***	108.448***

Notes: Robust standard errors in parentheses. ***, ** and * stand for 1%, 5% and 10% significance levels, respectively.

It should be emphasised that the modelling approach and assumptions regarding the type and list of explanatory variables are very general and simplistic. Such a model, relying only on dummy variables, may be prone to potential problems such as increased bias, especially for the safest banks. The aim of this research was to focus on qualitative characteristics of European banks and to isolate the effect of region/country and ownership. However, it is generic and the next round of research should include information on the balance sheet structure of the banks surveyed, their financial ratios, and probably also the point in the macroeconomic cycle for a better comparison of different EBA ST rounds.

7 Conclusions

This research is a first assessment of the impact of country and bank ownership characteristics on the results of EBA cyclical stress tests. There is also the question of what

other controlling variables might describe the stress test performance of EBA banks. At this stage, however, the focus has been on these two. For the purpose of panel estimation, a dedicated database has been built by the author. The results of the estimations support some anecdotal evidence of some influence of local regulators such as the Dutch and Irish. Dutch and Irish banks had to increase their buffers earlier than their European peers, so they were probably better prepared for adverse scenarios. The model results also demonstrate the effectiveness of restructuring plans. They have helped banks to better prepare for turbulent times. When it comes to the ownership structure, however, the results are ambiguous. Being a cooperative bank did not have a significant impact on the stress test results when the size of the bank was not taken into account (unweighted panel estimation). However, it is highly significant in the weighted estimation. In addition, the impact of the stress test scenario on capital is significantly reduced if the largest share is owned by the state. Both characteristics, "government" and "cooperative" of the bank, improved the performance of the bank in the EBA stress tests by about 300 and 130 basis points on average, respectively.

The question is whether these patterns will change in the next rounds of EBA exercises. Progress towards banking union and the general tendency to build higher capital buffers may make banks more resilient to shocks. Regardless of what capital levels the average European banking system will reach, some banks from the survey would still need more attention.

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