Is the Comprehensive Assessment really comprehensive?

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Abstract

Analyzing the database made available by the European Central Bank (ECB) we evaluate the Comprehensive Assessment (asset quality review and stress test). We provide some insights on the supervisory approach of the ECB and on banking regulation. In a nutshell the main results are: i) risk adjusted capital ratios are negatively related to the asset quality review shortfall but not to the stress test shortfall, instead the leverage ratio always plays a significant role; ii) the comprehensive assessment was mainly concentrated on the traditional credit activity rather than on the financial assets of the banks; iii) there is evidence of manipulation in the computation of risk weighted assets by the use of internal rating based models; iv) the comprehensive assessment seems to be characterized by double standards: non-core countries have been penalized by the asset quality review; medium size banks are either more risky or have been penalized in both exercises; a non diversification-home bias effect (including government bonds) has penalized banks in the asset quality review; the use of national discretion helped core countries and was not of help for peripheral countries. As far as the methodology is concerned, several pitfalls emerge. However, we show that the capital adjustment performed by the stress test is positively related to a market based risk measure (historical volatility) and that the leverage ratio post adjustment, but not before the adjustment and not the risk adjusted capital ratio, is related to it.

Keywords: bank regulation, stress test, capital, sovereign risk, European Central Bank

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1. Introduction

The Comprehensive Assessment (CA) performed by the European Central Bank (ECB) and the European Banking Authority (EBA) in 2014 was intended to accomplish two main tasks: define a level playing field harmonizing different (national) approaches to bank supervision; quantify the riskiness of the European banks.

The first task was mainly addressed through the Asset Quality Review (AQR), the second one though the Stress Test (ST) analysis based on two different scenarios: a Baseline Scenario (BS) and an Adverse Scenario (AS).[1]

In this paper we aim to evaluate the AQR and the ST exercises, that yield together a capital shortfall (SF) of 24.6 billion of euro (bln) across 25 banks, see Figure 1. In particular we would like to answer three main questions.

The first one is about the supervisory approach of the ECB and the degree of harmonization/continuity with respect to national authorities' standards. This point is mainly addressed looking at the determinants of the AQR shortfall.[2] This exercise sheds some light on the degree of coherence between the ECB approach and those of the national authorities and on the approach that the ECB intends to follow in the future.

We show that the ECB supervisory approach is coherent with the standards adopted by national authorities, however some distinctive features emerge. First of all, the AQR exercise was mainly concentrated on the traditional credit activity rather than on the assets detained by banks: as a matter of fact, only €1.4 bln of the AQR SF is due to asset evaluation adjustments, while €3.1 bln come from CVA values revision and €43 bln come from the credit adjustments. There is some evidence of double standards depending on the country where the bank group is incorporated. Although we cannot exclude that something is missing in the picture, it seems that the ECB has played bold versus non-core country banks and soft versus core country banks. The supervisory

[1] Note that the two scenarios are country specific, the baseline scenario is derived from the European Commission three years forecast, the adverse scenario is provided by a downward perturbation of the baseline scenario. This feature may be at the root of a poor performance in the ST of banks located in countries in a bad economic shape (mostly classified as non-core in what follows), see also Bank of Italy (2014).

[2] A shortfall in the AQR emerges if after the review a bank shows a CET1 ratio less than 8%. In the BS, a shortfall is recognized if the CET1 ratio is less than 8% in 2016, while in the AS the threshold, in the same year, is equal to 5.5%.

approach also depends on bank size: medium size banks (large but not too large) are characterized by the strongest adjustments. As the effect is confirmed also in the ST exercise, we may conclude that very large banks are less risky and are characterized by a better asset evaluation/risk management. However, there is also some evidence that the SF is negatively related to an indicator of the systemic role of the bank.

Addressing this point, our analysis provides insights on several issues that are at the core of the recent debate on banking regulation/supervision. We show that Common Equity Tier 1 (CET1) ratio represents a cornerstone also for the new supervisory authority, i.e., banks with a strong capital position are characterized by a low AQR adjustment. However, something is missing: the risk density (risk weighted assets over total assets) and, coherently with the new Basel III regulation, also the leverage ratio (common equity over total exposure measured according to the Capital Requirements Regulation, CRR) turn out to be important indicators for the ECB, with a high adjustment in case of a highly leveraged bank.

The second point concerns the riskiness of European banks. This point is addressed analyzing the determinants of the shortfall of the ST. The main goal of our analysis is to understand what are the risks to which European banks are exposed. Results confirm the evidence provided by the AQR with some significant differences. First of all, it is not anymore true that a bank with a high CET1 ratio is characterized by a low capital shortfall, the most informative capital indicator to predict the capital shortfall turns out to be the leverage ratio.

Comparing the evidence of the AQR with that of the ST some other differences emerge. The AQR SF is negatively affected by the use of an internal rating based model, but this evidence is not confirmed by the analysis of the ST, in which the adoption of an internal model (marginally) increases the SF. This result suggests that the ECB recognizes that an internal model provides a more refined risk representation, but its adoption does not imply that the bank is effectively less exposed to risks. Also the coverage ratio of non-performing exposures is recognized by the ECB (it negatively affects the AQR SF), but it does not affect the ST SF. A similar result holds for the incorporation in a core versus non-core country, which does not affect the ST shortfall significantly.

The third question is about the capacity of the CA to capture the riskiness of European banks. To address this point, we provide a discussion of the CA methodology. We highlight two main weaknesses on the information set adopted (analysis of complex financial assets, treatment of off-sheet items) and on the methodology (revision of internal rate model parameters). We also compare the ST SF to a market based risk measure (historical volatility) and we look for its determinants. On one hand, we show that the SF is positively related to the volatility and therefore we can conclude that the CA is aligned with a historical (backward looking) measure of bank's riskiness; on the other, we observe that the volatility is related to the post adjustment leverage ratio but not to a post adjustment risk adjusted capital ratio. This evidence confirms that the leverage ratio is more significant than the CET1 ratio to represent bank's risk.

The paper is organized as follows. In Section 2 we provide a review of the literature, highlighting the main strands to which our analysis contributes. In Section 3 we describe the database. In Section 4 we present our main results both on the AQR and the ST. In Section 5 and 6 we provide some further results on bank's features that may affect the AQR and the ST shortfall. In Section 7 we try to understand to what extent the CA was able to capture bank's riskiness. In Section 8 we conclude.

2. Research Questions and Related literature

This paper aims to contribute to several strands of the literature on banking regulation.

The paper is related to the literature on stress testing and bank soundness in Europe and, more generally, to the literature on European Banking Union (EBU). As is well known, the EBU is part of a road map designed by European authorities to improve the soundness of the European financial system and to break the vicious circle between banks and public debts. On this perspective, the AQR provides interesting insights. The exercise helps us to understand what is the approach of the ECB towards the classification of loans (performing versus non-performing), the level of provisions, risk weighted capital ratios, the use of internal models, government bond portfolios, bank and country specialization, the evaluation of complex assets. It also sheds light on the use of national discretionary rules adopted during the phase in period before the full adoption of Basel III.

As far as the literature on stress tests is concerned, our analysis adds to the bulk of papers claiming that stress tests performed by the EBA in 2011 on European banks were not severe enough compared to what happened later on during the sovereign crisis and compared to the stress tests performed in US, see Acharya et al. (2012), Acharya et al. (2014), Steffen (2014). On the evaluation of the CA, see Montesi (2014), Acharya and Steffen (2014), Vestergaard (2014). In Acharya et al. (2014) it is shown that the shortfall of the EBA stress tests performed in 2011 based on the risk weighted asset capital ratio was not able to capture the bank risks (measured as the realized volatility after the disclosure of the results and through the SRISK indicator), instead a shortfall computed with respect to a non-risk weighted asset capital ratio (leverage) would be related to bank risk, the result is confirmed in the case of the SF obtained through the CA in 2014, see Acharya and Steffen (2014). Adopting the SRISK shortfall measure or a SF based on the leverage, the adjustment turns out to be much higher than the one computed by the CA exercise, see Acharya and Steffen (2014), Vestergaard (2014). These papers show that a market based SF and the market volatility are correlated with a SF computed according to a target for the leverage ratio rather than to a target for a risk adjusted capital ratio. In this paper we shed light on the capability of ST to capture adequately bank's riskiness.

The AQR and the ST exercises also provide insights on bank capital, on the capability of risk based capital ratios to guarantee the safety of a bank, and in particular on the long standing dispute about the performance of leverage ratios and risk based ratios to capture the riskiness of a bank. The financial crisis showed that banks very well equipped in terms of Tier 1 capital ratio failed miserably. After the turmoil, the financial community (columnists, regulators, academicians, bankers) became skeptical about the reliability of risk weighted measures and ratios, e.g. see European Banking Authority (2011), Haldane (2012), Acharya et al. (2014). The doubt was reinforced by the fact that the large variation observed in the risk weighted assets is not driven by banks' business models and risk profiles: there is a residual room for supervisory practices, opening the door to harmonization, and for managerial practices, see Basel Committee on Banking Supervision (2013a), Basel Committee on Banking Supervision (2013b), European Banking Authority (2013), Le Leslé and Avramova (2012), Haldane (2011), Cannata et al. (2012).

The evidence in the literature on this point is mixed depending also on the metrics used to measure bank's riskiness: state support during the crisis, probability of default, market return/volatility. Considering recapitalization during the financial crisis, Mariathasan and Merrouche (2012) show that a higher Tier1 capital ratio negatively affected the probability of that event; looking at the Troubled Asset Relief Program (TARP) experience, a low capital ratio induced banks to apply for the program, but this was not a variable affecting the decision for the injection of capital from the Treasury, see Bayazitova and Shivdasani (2011).

Looking at European banks, Haq and Heaney (2012) find a negative relation between the capital ratio and bank risk (measured in terms of volatility, market and interest rate beta exposure, loan loss provisions), while no relation with leverage is established. Vallascas and Hagendorff (2011) find a statistically significant relation between risk density and bank's volatility, but the magnitude is limited and the sensitivity has only marginally increased after the adoption of Basel II.

Using the market return metrics, Beltratti and Stulz (2012) find that a higher capital ratio (but also a higher leverage ratio) is related to a better market performance during the crisis. Demirguc-Kunt et al. (2013) confirm the result on market return during the crisis and risk adjusted capital ratios, with a weak statistical significance, and notice that the relation is stronger when higher quality forms of capital are considered. On the full sample leverage is not significant, but restricting the attention to large banks it turns that the capital ratio is not significant and leverage is. The result is confirmed by Das and Sy (2012), where it is observed that the performance during the crisis is positively affected by the leverage ratio (the higher the leverage ratio is, the higher the market performance is) and by the risk weighted assets over total assets ratio. The relation is weaker for European banks probably because, according to the authors, they are regulated according to the Basel II agreement. The relation between the risk weighted assets over total assets ratio and bank market volatility is significant and positive before the financial crisis and then vanishes. On the other hand, volatility is negatively affected by the leverage ratio.

As far as predicting bank distress is concerned, Betz et al. (2013), Haldane (2012), show that leverage has a greater predictive power of bank distress and failure than risk weighted asset measures, Estrella et al. (2002) and Mayes and Stremmel (2013) show that their performance is similar (with a preference for the leverage ratio).

The CA, and in particular the ST, allows to evaluate the bank's resilience to shocks depending on different measures of capital ratios (risk adjusted or not).

The literature on the ability of risk based ratios to capture bank's riskiness is strictly related to the one on risk weights optimization/manipulation. There is a large evidence showing that banks use the discretion of Basel II agreements (mostly the internal rating based approach) to reduce the risk weighted assets. Beltratti and Paladino (2013) find that banks located in a country adopting Basel

II, with a high cost of equity, so facing eventually an expensive capital increase, are also characterized by lower risk weighted assets. Mariathasan and Merrouche (2014) and Benh et al. (2014) find evidence that the adoption of the internal rating based model is related to lower (unjustified) risk weights and risk weighted assets. According to their interpretation, banks exploit the flexibility of the internal model of Basel II to underestimate their risk (e.g. probability of default), on this interpretation see also Le Leslé and Avramova (2012) and Das and Sy (2012). Accounting standards provide a further source of manipulation: Huizinga and Laeven (2012) and Bushman and Williams (2012) document accounting discretion during the financial crisis by banks. In particular, loan provisioning, designed to smooth earnings, dampens discipline over risk taking. Basel III system allows for country specific discretionary measures in the phase in period, this may introduce a further ‘‘manipulation’’ at the country level, see Visco (2014).

The analysis of the AQR and of the ST exercise allows us to contribute to this literature by observing the effect of the adoption of the internal rating based model and checking whether the risk weighted assets level plays a role in determining the AQR and ST shortfall. We may also evaluate how the SF is affected by the regulatory environment and by national discretionary measures.

Considering the role of state aid to the banks occurred during the banking crisis, we aim to contribute to the literature on the effect of public intervention/bail-out on banking activity. The main thesis discussed in the literature is that the bail-out of banks is inefficient as it induces them to take more risk (moral hazard thesis). The financial crisis provides an interesting experiment to evaluate the validity of this thesis. The empirical evidence mostly shows that state aids induced banks to take more risk, see Dam and Koetter (2012), Gropp et al. (2010), Mariathasan et al. (2014). In particular, some of these papers show that the TARP program induced banks to take more risk, see Black and Hazelwood (2013), Duchin and Sosyura (2014). Notice that this result may be biased by the fact that in many cases state aids are explicitly linked to an increase in bank lending.

Mainly for public finance restrictions and institutional features, European countries adopted very different approaches towards helping their banking sector, the European Commission monitored the plans, but they are characterized by a high degree of heterogeneity. The AQR and the ST exercise help us understanding the riskiness of banks that received state aids.

3. The data set

We use data at bank level from the ECB, with respect to the AQR and the shortfalls after ST. The CA involves 130 banks for the AQR part with total assets for 22 trillion of euro (tr) and risk weighted assets for 8.5 tr, which account for the 81.6% of the banking system in the Single Supervisory Mechanism according to ECB, see e.g. European Central Bank (2014a) for banks' complete list; 103 of these financial institutions are involved also into the ST analysis.[3] The AQR focuses on bank's assets on the 31 December 2013, while ST performs a scenario analysis on a 3 year window up to 2016. Our sample is made up of 129 banks operating in the euro area (see Table 1), the dataset is provided by the ECB.[4] The dataset includes some general information of each bank before and after the CA (sections A, B, C and F) and a breakdown for the credit exposure, CVA and Level 3 component of market exposure (section D); furthermore, related to banks' credit exposure, ECB provides also a detailed analysis on non-performing exposures (NPE) and coverage ratio of NPE (CR) in section E. We also take into consideration data from EBA with respect to the credit risk and the market risk information relevant to the ST.

Moreover, from the World Bank database, we include macroeconomic data and indexes of the quality of the bank regulatory framework, see Barth, Caprio and Levine (2001) for more details. We also consider two indicators of the government support to the European financial institutions after 2007-08 crises: one at bank level based on Mediobanca (2014) database; the other at country level taken from Eurostat.

Finally, for the 41 banks' in the ST set that are listed in financial markets, we consider some market data (e.g. historical volatility, price-to-book-value) from Thomson-Reuters info provider. Definitions and descriptive statistics of all the variables used in the empirical analysis are reported in Table 2.

4. The reference model and the main results

[3] The difference between AQ and ST samples are due to banks that are controlled either by larger banking groups (in 25 cases) and by the two main clearing houses (in 2 cases).

[4] We drop data from Deutsche Bank Malta because of the abnormal CET1 ratio (281%).

Our research strategy is to estimate the AQR and the ST SFs considering a set of exogenous variables that are available from the ECB and EBA database and other sources. We employ a reference model for both AQR and ST; we also analyze several different specifications including a different set of exogenous variables. The equation for the reference model is:

$$SF\_Y_i = k + \beta_1 \cdot cet1_i + \beta_2 \cdot lasset_i + \beta_3 \cdot lasset_i^2 + \beta_4 \cdot npe_i + \beta_5 \cdot cr_i \\ + \beta_6 \cdot sys_i + \beta_7 \cdot marketcap_j + \beta_8 \cdot Drestruct_i + \underline{\gamma'} \cdot \underline{X} + \varepsilon_i. \quad (1)$$

SF_Y_i denotes the AQR or the ST SF of bank *i*. In order to investigate the determinants of the SF, we consider separately the AQR (Section 4.1) and the ST (Section 4.2). We include two types of exogenous variables: bank specific variables (lower case *i* in the eq.(1)) and a country specific variable (lower case *j*) that refers to the country in which the bank holding company is located. We control for the size of the bank considering the logarithm of total assets (*lasset*), we allow for nonlinearities including also the square of this variable (*lasset*^{2}). Bank's size provides a control variable for the level of the SF: *ceteris paribus*, the SF is likely to be positively affected by the size of the balance sheet. The size of the bank is also an indicator bank's relevance. The attitude of the supervisory authority towards banks may depend on their size for several different reasons: on one hand, a large bank is more likely to be supervised by the market and therefore the need of intervention from the supervisory authority could be less intense; moreover the supervisory authority is more likely to be captured by a large bank; on the other hand, large banks are riskier in a systemic risk perspective and therefore supervision may be stronger. To fully investigate how the bank's relevance affects the CA exercise we also consider the ratio of the assets of the bank over the nominal GDP of the home country (*sys*). This ratio should explicitly capture the systemic risk associated with a bank.

The debate on risk weighted capital requirement leads us to introduce the CET1 ratio (*cet1*) as an exogenous variable. If the capital ratio is a reliable indicator of the bank's solidity, then it should have a negative effect on the size of the SF both for the AQR and the ST. In the AQR exercise, if the ECB is coherent with the standards applied by national authorities and with the actual regulatory setting, then the *cet1* should negatively affect the SF, i.e., banks with a higher capital ratio are less likely to go below the 8% threshold for the capital ratio itself after the AQR. The denominator of the capital ratio is made up of risk weighted assets, this implies that banks detaining risky assets are obliged to detain a large amount of capital. If the risk weighted assets computation effectively reflects assets' riskiness, then banks with a higher capital ratio should also be more resilient to shocks, and therefore also the ST SF should be smaller.

If the regulation and the supervisory activity properly work, then the capital ratio should provide an exhaustive information about the soundness of the bank and other indicators of capital solidity should be redundant. To evaluate this point, in some specifications of the reference model we also consider two non risk adjusted ratios that are related to total assets: the leverage ratio computed as CET1 capital over total exposure measured according to the CRR (*lr*) and the risk density, i.e. risk weighted assets over total assets (*rwa*). *rwa* can be interpreted both as an indicator of the riskiness of the assets and as a risk adjusted leverage measure. The debate and the empirical evidence on risk adjusted vesus non-risk adjusted capital ratios is not conclusive, see results and papers reported in Section 2. In particular, there are some papers showing the risk density is an indicator of riskiness and some others claiming that it is an indicator of good risk reporting. On the other hand, the Basel III regulation, introducing a cap on the leverage ratio, explicitly recognizes that leverage is an important risk indicator.

As far as the country specific variables are concerned, we consider the stock exchange market capitalization over the nominal GDP (*marketcap*). Our goal is to control for a market discipline effect that may substitute supervisory scrutiny. Our hypothesis is that an economy with a well-developed financial market should be characterized by lower AQR and ST SFs because the market has already imposed impairments and an adequate capitalization/risk management to banks.

The AQR concentrates on the quality of credit activities and of the assets difficult to evaluate (level 3 assets). As we will discuss in Section 7, the analysis of the credit activities is to some extent exhaustive, instead the analysis of the banking/trading book suffers of significant limits. To capture how the credit quality has impacted the AQR and ST SF, we consider the ratio of non-performing exposures over performing and non-performing exposures (*npe*) and the coverage ratio for non-performing exposure (*cr*), i.e., the ratio between credit loss provision funds and non-performing exposures. In the AQR and ST we expect the same effect for these variables: a higher non-performing ratio should lead to a higher adjustment either because the balance sheet is exposed to more credit risk and the ECB asks for further provisions; on the other hand, a higher coverage ratio should induce a smaller adjustment because banks have already aligned their books to the quality of credit. As far as the asset component is concerned, we consider the fraction of level 3 assets to total assets (*level3*): the higher the ratio is, the higher the SF of the AQR and of the ST should be.

The reference model is completed by the dummy variable *Drestruct* which takes value equal to 1 in case of a bank that is under a restructuring process before 31 December 2013, 0 otherwise. A restructuring plan for a bank usually goes together with a tougher activity by the supervisory authority, deleveraging/cleaning of the books, public or private capital injections. The combined effect of these features for the purposes of the AQR and ST exercises is unpredictable.

Banks may choose to evaluate risk weights according to an internal model instead of the standard formula. To capture this feature, we include the dummy variable *Dirb* which takes value equal to 1 in case of a bank that has more than 50% of the risk weighted assets computed according to the internal rating model, a value quite similar to the median in the sample analyzed. We expect a negative (positive) effect from this variable if the supervisor is (not) confident about the capacity of internal rating model to capture the real riskiness of banking activities and/or suspects a manipulation of risk weights, see Mariathasan and Merrouche (20014).

$\underline{X}$ in eq. (1) is a vector of variables including *lr, level3, rwa*.

It can be useful to observe that SF is either null, in case the bank is above the threshold, or positive, when the bank is below the threshold after the AQR or the ST (see footnote 2 for more details). As a consequence, we estimate eq. (1) by a Tobit estimator, which overcomes the problem of inconsistent results using the ordinary least squares estimator when the dependent variable is bounded (Wooldridge, 2002).[5]

Some words should be spent on the importance of controlling for the size of the financial institution. Considering exogenous variables that express the balance sheet composition as a fraction (of total assets or of risk weighted assets, for example) with a SF expressed in euro, we may observe spurious relations with size: *ceteris paribus* a large bank should have a larger adjustment. To cope with this effect we control for the size through the variable *lasset*. Another way to address this problem would be to consider the SF in terms of basis points (bps). We opted to present our results for the level of the SF rather than for the basis point SF because in the latter

[5] We also estimated eq. (1) by ordinary least squares estimator considering not the shortfall but the adjustments (positive and negative values). We also restricted our sample to the 103 banks included in the EBA sample. Furthermore, we included country dummies in eq. (1).

case the capital is at the denominator yielding a possible bias with the exogenous variables that are also related to capital (*cet1, rwa, lr)*. Nevertheless, we also performed regressions for the SF in bps, the main results are confirmed. In the next sections we comment on them only when relevant discrepancies appear.

It is important to stress that the AQR mainly concerns the ECB supervision and the ST is about bank's riskiness. The two exercises accomplish different tasks and the outcomes may be different.

4.1 Determinants of capital shortfalls in the AQR

As stated above, AQR results are informative about the harmonization of different supervisory approaches and about the direction of the ECB supervisory activity in the euro area.

In Table 4 we provide the regression results of the reference model for the AQR SF.

As expected, we find that a high CET1 ratio is considered positively by the ECB analysis and the shortfall turns out to be decreasing in the level of this ratio (models I-VI). The result is somehow obvious because the threshold considered to evaluate shortfalls is based on CET1 ratio, but it is important to have a confirmation that the CET1 ratio is fully endorsed as a soundness indicator by the ECB.

Considering the risk density (*rwa*) as an indicator of the level of riskiness of the assets, we observe that the variable is only marginally statistically significant with a positive coefficient (models IV and V). The result can be interpreted in a sense that the level of riskiness of the bank is not fully captured by the CET1 ratio, and therefore the risk density positively influences the AQR adjustment. Instead, the leverage ratio coefficient is negative and statistically significant (models VI and VII), showing that the ECB tends to penalize leveraged banks. Somehow, the ECB anticipates the Basel III regulation and its emphasis on the leverage indicator.

There is no evidence that the supervisor discovers any kind of manipulation because of the discretion provided by the adoption of an internal rating based (IRB) approach to compute the risk weighted assets. Our analysis shows that the fact that a bank relies on internal rating approach, measured by *Dirb*, negatively impacts the AQR SF. From this evidence we can deduce that, for the ECB, the adoption of the internal rating model reinforces the reliability of the capital ratio as a solidity measure (models III, IV and VI). We can conclude that, on the basis of the supervisor's view, the IRB approach provides a more accurate assessment of riskiness.

The effect of the adoption of the IRB model strictly depends on the level of the risk density. Overall, interacting *Dirb* with *rwa,* we find that the supervisor's confidence on the IRB approach is not statistically significant (model V). A much clearer picture on the adoption of the IRB model is obtained computing the derivative of the SF with respect to the use of the IRB as a function of *rwa*. We provide this information in Figure 2a. Only for a level of *rwa* higher than 45th percentile (high enough risk weighted assets), the effect of *Dirb* is negative and statistically significant. For a low level of *rwa,* the adoption of the IRB does not have a statistical significant effect. It seems that only when the riskiness density is high enough the supervisor relies on the IRB approach as a value added. Nevertheless, the supervisor does not penalize banks with a low risk density that may have used the IRB model to reduce their level of reported risk. We may conclude that the supervisor does not interpret the adoption of the IRB as a signal of risk weights manipulation.

As far as bank size is concerned, we observe a U-reversed shape: the AQR SF is higher for medium/large, but not too large banks.[6] This outcome is confirmed by the negative and significant coefficient associated with the variable capturing the systemic nature of the bank (*sys*). We can interpret this evidence as showing that either the supervisor is captured by a large bank, or that a large bank is able to evaluate its assets more carefully. These results are robust and significant in all the models analyzed in the paper.

A result, confirmed in all the specifications, is about the role of financial markets. A well-developed financial market (represented by the variable *marketcap*) negatively affects the AQR SF. This result points out the role of market supervision (Basel II's third pillar) as a complement to the activity of the supervisory authority. Also the role of restructuring plans (*Drestruct*) is significant and robust as the specification varies: a bank under restructuring is characterized by a higher AQR SF.[7]

Looking at the balance sheet composition, our analysis provides reasonable results on the credit side. The SF is inflated by the ratio of non-performing loans (*npe*), the ratio measuring the quality

[6] It should be noticed that medium banks (belonging to the second or third quartile for total assets) have similar characteristics in terms of CET1 ratio (14.4% in average, 9.5 percentage points of standard deviation) with respect to banks with different size (14.6%, 8.1 percentage points of standard deviation).

[7] To check whether the effect of *Drestruct* could be due to an endogeneity problem, we run a robustness test in which all the banks under restructuring plans (24 institutions) are excluded from the analysis. The main results are confirmed.

of credit: a lower quality (higher ratio) induces a more significant shortfall. The phenomenon is balanced by a high coverage ratio, which negatively affects the SF level. The coefficients of these variables are statistically significant in all the specifications. Surprisingly, the fraction of level 3 assets over total assets negatively affects the AQR SF. In some specifications the variable is statistically significant. It is difficult to explain this results. As a matter of fact, it turns out that the assets that are most difficult to evaluate are not a source of evaluation adjustment.

4.2 Determinants of capital shortfalls in the adverse scenario

ST regressions confirm some of results provided by the AQRwith few relevant differences (Table 5). We provide our analysis only for the adverse scenario, as a matter of fact the baseline scenario differs only in the intensity and, by and large, the results are in the middle between the AQR and the adverse scenario ST.[8]

Results on size are fully confirmed highlighting that very large banks evaluate their assets more carefully and manage their risks more carefully and therefore are less exposed to risks. This result rationalizes, at least in part, the ‘‘softer’’ attitude of the ECB in performing the AQR. Moreover, the role of the level of market capitalization is confirmed: not only the market induces banks to correctly assess their assets, it also induces them to take less risk.

The main difference with respect to the AQR is that the level of CET1 ratio is not anymore a significant variable in predicting the SF: it is not true that having a high CET1 ratio leads to a low adjustment after the adverse ST (models I-IV). On the other hand, the leverage ratio confirms all its role: leveraged banks are characterized by a higher capital SF (models IV and V). This evidence confirms the outcomes provided in Haldane (2012), Mayes and Stremmel (2013), Estrella et al. (2022) on the relevance of leverage rather than the risk adjusted capital ratio in predicting the SF. Our results show that the risk adjusted shortfall computed by the ECB depends on the leverage ratio. Differently from AQR results, the risk density negatively affects the SF.

With respect to risk weighted computation, we find that *Dirb* is positive but not significant, both with *cet1* and *lr* considered as control variables (models II and V, respectively). However, interacting *Dirb* with *rwa* we find that the coefficient of the dummy for the use of IRB model

[8] The results on the ST BS are available upon request.

becomes positive and significant, while the interaction is negative and significant (models III and VII). Calculating the derivate of the ST SF with respect to *Dirb* for different percentiles of *rwa*, we find that the *Dirb* effect is positive and significant only up to 35th percentile (see Figure 2b). This outcome means that those banks with a small risk density relying on the IRB model are more exposed to risks. This result confirms the analysis contained in Mariathansan and Merrouche (2014) showing risk weighted manipulation through the internal rating based model mostly in case of weakly capitalized banks and confirms that a high risk density should be interpreted as a sign of solidity. As observed by Visco (2014), the evaluation of the criteria to compute risk weighetd assets and the validation of IRB models emerge as one of the main points of attention for the future supervisory activity.

The other significant difference concerns the credit activity. While it is confirmed that a high non-performing credit exposure is positively related to the SF, no statistically significant effect is associated with the level of coverage ratio. A plausible explanation for this result lies on the weak (positive) correlation between the non-performing credit exposure and the coverage ratio and on the possible nonlinearities characterizing the default event in a stressed scenario. Finally, we notice that the fraction of level 3 assets does not affect the SF.

5. Inside the balance sheet

To further analyze the CA, we consider the balance sheet structure looking for determinants of the SF. We develop our analysis in three directions: i) risk composition of the balance sheet, ii) balance sheet composition differentiating for company size, iii) home bias effect.

5.1 Balance sheet risk decomposition

In Tables 6 and 7 we investigate how the risk weighted asset composition affects the AQR and the ST shortfall.

We consider several different measures of balance sheet composition. As a risk adjusted indicator, we consider the fraction of risk weighted assets associated with credit exposure (*rwacr*). Among non-risk adjusted measures, we consider the following: i) the ratio of corporate credit risk exposure over total credit risk exposure (*corpexpsh*), ii) the ratio of retail credit risk exposure over total credit risk exposure (*retexpsh*), iii) the share of risk exposure on banking book over securities (*bankbook*), and iv) the gross direct exposure on government bonds over total asset (*gov*). These five variables represent indicators of the bank's specialization on some banking activities: credit (large and small corporates), banking book securities, government bonds.

Table 6, models I-V, shows that the AQR SF results are not affected at all by the composition of the bank's activity. It is confirmed that the non-performing exposures and the coverage ratio play a role, but credit specialization is not relevant, also assets on the banking book and government bonds are not a specific source of evaluation adjustments. We may conclude that the ECB analysis has not been influenced by the business model adopted by banks.

Table 7 on ST SF provides different results. As the fraction of credit risk weighted assets increases, we observe a lower SF (model I), mainly driven by small-medium banks as shown in Table 9, model V. This result shows that credit specialization mitigates the overall bank riskiness. With respect to the type of counterpart, we find that, in the case of ST SF, a higher focus on corporates has a negative and significant effect (Table 7, model II), while the focus on the retail sector has a positive and significant effect (model III). Probably this result is due to the fact that creditworthiness of large corporates is better than the one of small medium size companies and that the criteria adopted for the revision of the exposures do not capture well enough the ''soft information'' that characterizes the bank-company relationships in case of small companies, see Visco (2014).

5.2 Balance sheet composition and bank size

In Tables 8 and 9 we investigate how the balance sheet composition affects the AQR and ST SF depending on the size of the bank. We perform this analysis because size seems to affect outcome. We analyze this point controlling for the size (*lasset*) and allowing exogenous variables to interact with a dummy variable for large banks (banks with total assets belonging to the fourth quartile of the overall distribution – *Dlarge*).

The trading component – identified by the fraction of level 3 assets over total assets (*level3*) – positively and significantly affects the AQR SF for large banks, while a negative and significant effect is observed for small and medium banks (Table 8, model I). When the ST SF is analyzed, only the positive effects for large banks turns out be positive (Table 9, models I-III). Non-derivative assets over total asset (*noderexp*), a component of *level3* variable, confirms this outcome.[9]

The non-performing exposure component positively and significantly affects the shortfall independently of the bank's size (see Tables 8 and 9, model IV). The magnitude is statistically higher for larger banks than for medium and small size banks.

The coefficient of the risk density in the credit activities, equal to the ratio between risk weighted assets on credit risk and total assets (*rwacr*), is negative and significant only for small and medium banks with the ST SF as dependent variable (Table 9, model V). This outcome, in line with the previous result on complex financial assets, means that supervisory authority considered the focus of smaller banks in the banking core business as a way to mitigate the overall bank riskiness.

5.3 Home bias

In Tables 10-11 we provide an analysis on the effect on the AQR and ST SF associated with the non-diversification of credit activity/assets due to the concentration of the banking activity in the country where the banking holding company has its headquarter.

We consider three different indicators of non-diversification: i) (non-risk adjusted) credit exposures to the country where the bank is incorporated over total credit exposures (*cred_homebias*); ii) gross exposure to government bonds of the country where the bank is incorporated over total gross government exposures (*gov_homebias*); iii) overall exposures (credit and government bonds) to the country where the bank is incorporated over total exposures (*homebias*). These variables are included in the reference model considering the leverage ratio in the AQR exercise and in the ST analysis. These variables are also interacted with the dummy variable assuming a value equal to 1 for large banks and 0 otherwise (*Dlarge*).

Curiously enough, the ST SF is not affected by the non-diversification of the banking activity (Table 11), while the AQR SF is positively and significantly affected by the concentration of the banking activity in the country where the bank is incorporated (Table 10). The effect is mostly concentrated on large banks (models II, IV and VI) and concerns both the credit exposure and

[9] The variable *noderexp* is only interacted with *Dlarge* in order to reduce the collinearity problem.

government bonds.[10] Notice that the latter were not part of the AQR but only of the ST analysis. This result is surprising. On one hand a ST should fully capture a non diversification effect, on the other the AQR should be insensitive to the concentration of the bank's activity in a specific country.

Visco (2014) observes that the harmonization adopted by the ECB on prudential filters (a mechanism reducing the effect of the variations of government bonds on the bank account) may be the origin of significant adjustments for government bonds holding by Italian banks. This statement is well grounded, but from our analysis it emerges that there is no evidence of different treatment on home government bonds.

The result deserves two comments. The fact that a ST analysis is not affected by the concentration of the bank's activity may be a signal that it is not well designed; the sensibility of the AQR to this feature is similar to what is observed for core and non-core countries: although the AQR should be immune to home bias considerations, it seems that the ECB has taken them into consideration.

6. Further Results

To get a full picture of the CA exercise we look at several other topics. We performed a set of regressions covering the following points: core versus non-core euro area countries, role of state aids, regulatory environment, and national discretion effects.

6.1 Core versus non-core countries

The CA exercise has been followed by a dispute about the possibility that the ECB and the EBA adopted different approaches with respect to banks depending on their origin country. To address this point, we perform some regressions considering a dummy variable (*Dcore*) assuming a value equal to 1 in case of a bank/holding incorporated in Austria, Belgium, Germany, Finland, France, Luxembourg and the Netherlands, and 0 otherwise (peripheral countries). In Tables 12 and 13 we provide some regressions on this point for the AQR and the ST, respectively.

[10] The same results are obtained when we consider the CET1 ratio instead of the leverage ratio.

In models II-VI we introduce the variable *1-Dcore* on the level and then we interact it with five different exogenous variables: i) CET1 ratio; ii) leverage ratio; iii) non-performing exposure; iv) coverage ratio; v) the systemic risk associated with a bank (*sys*). In order to check if the effect on core countries is statistically different from that of non-core ones, in Tables 12 and 13 we report the Wald test for the equality of coefficients. In the tables we also report the derivate of the four exogenous variables evaluated at the median value for the two different groups of countries.

First of all, we observe that the effect of *1-Dcore* variable, without interactions, on the AQR SF is positive and significant (Table 12, model I), while for the ST SF is positive but not significant (Table 13, model I). Moreover, looking at the AQR SF, we notice that the coefficients for exogenous variables (*cet1*, *npe*, *cr* and *sys*) interacted with core and with non-core dummies are statistically different. These results suggest that the ECB, performing the AQR, has played bold (soft) with banks based in peripheral (core) countries, on this point see also Visco (2014). In particular, a higher level of the CET1 ratio of 100 bps yields implies, *ceteris paribus*, a smaller AQR SF of around €5.5 bln in the case of core countries and €3.5 bln in the case of peripheral ones (model II). With respect to non-performing exposures, we find that the effect is positive and significant in the case of peripheral countries, while is negative and significant for core countries (model IV). This outcome can be interpreted in two different ways: either as a signal of “favor” (severity) of country regulators in peripheral (core) countries towards domestic banks, or as an evidence that the ECB was benevolent (tough) towards banks incorporated in core (non-core) countries. Confirming this evaluation, the effect of the coverage ratio in core countries is negative and significant, while in peripheral countries is not significant. Overall these results suggest that the ECB considered the balance sheets of banks operating in core markets to be cleaner than those of other countries. Finally, we notice that the systemic risk associated with a large bank implies a milder impact for credit institutions operating in core countries than for those located in peripheral ones (model VI).

Considering the ST SF, we find that the only difference between the coefficients for core and non-core countries that is significant is that referring to the systemic risk associated with a bank (Table 13, model VI). In particular, the net effect of the *sys* variable on ST SF is positive and significant only in case of core countries. This result seems to show that systemic banks operating in core countries are riskier, taking also into account their larger size with respect to the peripheral countries (in average they have a total asset more than two times larger).

Contrary to what has been observed in the press, we may interpret the outcomes of Table 13 as an evidence that the ST adverse scenario has not penalized peripheral countries. There is some evidence in this direction for the AQR, but not for the CA as a whole.

6.2 State aids

During the financial crisis, in front of the financial distress in a bank, the states reacted in a very different ways. The European Commission supervises and approves state interventions, but it is difficult to say that the approach was homogeneous as they were mainly approved before strict rules were introduced in 2013. As a matter of fact, state interventions crucially depended on the public finance status of a country.[11]

The debate on the press concentrated on the fact that the CA results may differ because of the amount of state aids in different countries. In particular in some countries (like Italy), it was argued that the financial system did not pass the exam because it received a small state support during the crisis.

To analyze this issue, in Tables 14 and 15 we provide some regressions of the reference model considering three different indicators of state aid: i) a dummy variable assuming value equal to 1 in case the bank has received public support as equity, capital injection, guarantees, loans or other measures, 0 otherwise (*Dbailout*); ii) the variable *bailout* representing the amount of government interventions to support the financial system as a whole in a country over the nominal GDP; iii) *cet1_gov* representing capital instruments eligible as CET1 capital subscribed by government over total assets.

State aids have different effects on the AQR and the ST exercises. As far as the AQR is concerned, state support does not affect the SF, only direct capital injections have a negative effect on the shortfall (Table 14). The latter result agrees with the fact that state capital injection increased the CET1 ratio and this is associated with a smaller SF. Instead, the SF of the ST is positively affected by state intervention, the result is confirmed for all the three measures of state aids, the coefficients

[11] The impact of state aids is estimated to be €250 bln in Germany, €60 bln in Spain, €50 bln in Ireland and the Netherlands, €40 bln in Greece.

are always statistically significant (Table 15).[12] This evidence seems to confirm that state aids induced a moral hazard effect with a riskier balance sheet, see Dam and Koetter (2012), Gropp et al. (2010), Mariathasan et al. (2014). However, as we already noticed, it is difficult to interpret these results, as they can be the outcome of the deliberate endogenous decision of the bank (moral hazard), or of the state aids pack that often include prescription to the bank to lend money to the private sector.

6.3 Regulatory environment

The regulatory environment may have played a role on the outcome of the AQR and ST exercises. The indicators of the regulatory environment are from the World Bank database. We consider four different indexes: i) the fraction of banking system's assets that are under foreign control (*foreign*); ii) an indicator of capital requirement stringency (*capstring*); iii) an indicator of financial conglomerates restrictions (*restrict*); iv) an indicator of the independence of the supervisory authority (*supind*). We expect all the indicators to negatively affect the AQR and ST SF, in particular the first and the second should reduce possible negative liaisons in traditional credit activity. On the AQR (Table 16), it turns out that an independent supervisory authority is associated with a smaller SF (model IV), instead a stringent capital regulation and restrictions on financial conglomerates lead to a higher SF (models II and III). The former result is expected, instead it is difficult to interpret the latter results, probably at least in part they are related to the fact that with a stringent regulation national discretions didn't apply. Results on the ST exercises show that strict rules on capital regulations and restrictions on the activity of financial conglomerates (including shareholding participation in non-financial companies) are associated with a lower SF (Table 17, models II and III).

6.4 National discretion

One of the main topic in the discussion of the AQR and ST results concerns the role of country specific discretionary measures in the transition to Basel III, see Visco (2014). We measure their

[12] In order to control for potential endogeneity problem among regressors, we run a robustness test in which *Drestruct* is not included in Tables 14 and 15. The effect of state aids variables are robust to this test.

relevance from the capital point of view considering the variable *natdiscr*, which is equal to the difference between the fully loaded CET1 ratio, i.e., the ratio obtained on the basis of the fully applied rules of Basel III, and the CET1 ratio in the transitional period, i.e. based on the national exceptions allowed by CRR/CRD (Capital Requirement Directive), as result of the adverse scenario in 2016.[13]

The regressions show that national discretion helped to pass the AQR (Table 18, model I). Interacting *natdiscr* with *Dirb* we find a positive and significant coefficient (model II). In our view, this outcome signals that the ECB has considered banks taking advantage both of national discretions and of an IRB model as more risky, because of the tendency to use the IRB approach in order to reduce the capital absorption, see Beltratti and Paladino (2013), Mariathasan and Merrouche (2014) and Benh et al. (2014).

Moreover, we find that national discretion have a different effect in the AQR depending on the country. In Table 12 we interact *natdiscr* with two dummies that select core and peripheral euro area countries (model III). We find that the overall negative effect of the national discretion in the AQR, showed in models I and II, depends mainly by core countries: while in peripheral countries the effect is not significant, the effect is negative and significant for core countries (the Wald test shows a statistical difference between the two coefficients). We notice that the average value of the *natdiscr* variable, in the two group of countries, is quite similar (33 bps in terms of CET1 ratio for core countries, 36 for the others), and therefore the different effect should not be attributed to the attitude of national supervisors. This result, in line with those of Section 6.1, seems to show that the ECB has allowed only the core countries to mitigate the effect of the AQR shortfall thanks to national discretions.

Taking into account the ST SF, we find different results. The *natdiscr* coefficient is positive and statistically significant (models IV and V) showing that banks located in countries with a higher freedom to set rules that allow for a smaller capital absorption are also more risky. Looking at the interaction with *Dcore* and *1-Dcore* (model VI), we find that the effect is mainly driven by peripheral countries, an outcome that is the opposite to what is observed in the AQR. As a consequence, the national discretions have implied a higher SF in the ST only for banks in

[13] Unfortunately the fully loaded CET1 ratio in 2013 is not available from ECB and EBA. However, ECB (2014b) shows a chart on the national discretions, at country level, that are in line with the *natdiscr* variable. As a consequence, we consider *natdiscr* as a good proxy.

countries in bad macroeconomic shape, while banks operating in core countries have not been affected by the possibility to use national discretions.

7. Was the Comprehensive Assessment really Comprehensive?

One of the main objectives of CA is to enhance transparency, see e.g. page 2 of European Central Bank (2014b); in this section we try to understand whether ECB has fulfilled this goal.

The two main limits of CA are related to the use of an inadequate information set and to some features of the methodology.

With respect to the first issue, two key elements, probably not adequately analyzed in the CA, are level 3 assets and off-balance sheet items. As is well known, both elements have played a crucial role in the current financial crisis.

Level 3 assets should have been analyzed in detail during work block 8 in AQR phase 2, e.g. see figure 1 at page 10 in European Central Bank (2014c). They amount to €178 bln for the 130 banks that underwent the AQR. The Fair Value (FV) analysis has divided level 3 assets in two sets: Non-Derivative assets (NDL3) and Derivatives (DL3). The FV of NDL3 for the banks in the panel amounts to €83 bln; the AQR impact has been of €1.4 bln (1.5% of NDL3 assets). ECB declared that "the vast majority of positions in-scope for independent revaluation were priced using cash flow discounting methodologies" and "the main differences in value were identified as a result of an increase in spreads used for cash flow discounting", see page 97 in European Central Bank (2014b). On this evaluation approach we observe the following: the valuation revision seems to be inadequate for assets that present scanty liquidity or that could involve rather complex modeling features (e.g. dependency structure for defaults in securitization assets), furthermore impacts on FV seem quite limited considering the characteristics of these assets. The results of the CA are even more astonishing considering the Derivatives' set: the total impact is about €0.2 bln. If we consider that more than 60% of this amount comes from a single bank (Banque Populaire Caisse d'Epargne) the impact for the other banks is negligible. Let us recall that this set includes the most complicated derivatives with some parameters that cannot be calibrated through market data. For these assets, changing the valuation method can significantly impact the value. The AQR on this points does not appear to be deep enough also considering that some banks in the panel have created and commercialized some of the most complicated derivatives in the market place. Furthermore, we notice that differently from the credit part of the CA there has been no statistical projection outside the selected portfolio.

Off-balance sheet items are taken into account by the CA only via the Total Assets according to Capital Requirement Regulation (TACRR) and the related leverage ratio. Unfortunately, the interpretation of the regulation does not appear adequate to enhance balance sheet transparency. An example helps to clarify the point. We refer to a bank whose off-balance sheet exposures amount to €200 bln (four times bank's CET1), the bank's TACRR is equal to €1440 bln, the bank's "Total Assets based on prudential scope consolidation" (the basic measure of total assets in the CA) is €1580 bln. Curiously enough, the measure of total assets including off-balance sheet items is smaller than the basic measure of total assets. Analyzing in detail the bank's balance sheet, we observe that the decrease is due in particular to nettings for about €400 bln and a set of "adjustments" (e.g. the supervisory volatility adjustments approach) for further €160 bln. This example shows that it is not straightforward to isolate off-balance sheet items in the CA database, however their size is remarkably more significant than the total AQR credit provisions that, for the previously mentioned bank, amounted to €0.2 bln. In conclusion, the off-balance sheet represents an opaque area in the CA. A major UK bank has recently admitted an incorrect CET1 in the ST exercise due to a not-correct inclusion of Deferred Tax Assets (DTA) in the ST, see Fleming and Dunkley (2014). The rules on DTA are quite simple; if a major bank can impact significantly its results just with improper calculations on DTA, the possibility of miss reporting on complex off-balance sheet structures that involves a significantly larger amount of funds can be really relevant.

From a methodological point of view, CA results are likely to be incomplete on Probabilities of Default (PD) and Losses Given Default (LGD) of banks' counterparties. It seems that these parameters have been adjusted in the AQR process for the CVA part, but not in the computation of risk weighted assets according to IRB models.[14] The AQR has analyzed in detail the Credit Value Adjustments (CVA) in banks' balance sheets. On a CVA that amounts to more than €11.4 bln, the impact has resulted in a 27% increase, see European Central Bank (2014b). The most of the impact is related to the PD and the LGD parameters used in the CVA that the supervisor considered to be inadequate, see page 98 of European Central Bank (2014b). We recall that PD and LGD of banks' clients are also the main ingredients in IRB models for risk weighted assets computation: there is

[14] The only exception is related to the so called "Join-up", see also page 35 of European Central Bank (2014b).

no rationale for the different approach to these parameters on CVA and IRB computation. This fact also explains why market considers a more reliable measure of risk the *lr* with respect to *cet1*.

As already mentioned, CA appears to be more focused on banks' credit risk than to market risk: market risk that has been analyzed mainly for the level 3 component. Potentially, this fact may negatively affect future transparency and balance sheet strength. As a matter of fact, financial engineering allows modifying one kind of risk into the other via balance sheet management techniques; techniques that generally increase the complexity either within the balance sheet or using complicated off-balance sheet structures. A biased assessment by the supervisor could spread the use of such regulatory arbitrage techniques with very negative drawbacks.

To evaluate the capability of the CA to capture bank risk, we match the capital deficit that emerges from CA scaled by the common equity Tier 1 with a market risk measure represented by the market volatility. We restrict our attention to listed banks. In Figure 3 we report the capital deficit, taking into account the 5.5% CET1 ratio threshold in the AS ST,[15] in percentage of the CET1 by the end of 2013, and the historical volatility of stock returns, for the 41 listed banks in the EBA sample, for the period January-October 2014 (*vol*). In contrast with Acharya and Steffen (2014), who find a negative relation between the adjustment and a market risk measure represented by SRISK, we find a positive relation between capital deficit and volatility.[16] This evidence suggests that some market risk is caught by the CA capital deficit, although evaluated on a risk weights-based threshold.

In order to check the capability of capital requirements (risk weights-based versus leverage-based) and of the CA to capture market risk, we estimate the following equation

$$vol_i = k + \gamma_1 \cdot cap_i + \gamma_2 \cdot lasset_i + \gamma_3 \cdot npe_i + \gamma_4 \cdot ptbv_i + \varepsilon_i \quad (2)$$

[15] The capital deficit could be also negative in the case of banks that have a level of CET1 ratio higher than the threshold.

[16] Notice that our market risk measure (historical volatility) is backward looking, while SRISK being based on a stress test is more a forward looking measure. We observe that the result may be spurious because the historical volatility reflects the market perception of the lack of balance sheet transparency and of the need of capital intervention driven by the CA.

The model in (2) is a simplified version of the reference model,[17] we follow Acharya et al. (2013) controlling for the price-to-book value (*ptbv*) as an index of market/accounting based risk measurement. *cap* is either the CET1 ratio or the leverage ratio (Table 19 and 20, respectively). For both these indicators we consider three different values: i) the one that is derived from the bank's balance sheet by the end of 2013 (*cet, lr*), ii) a measure that includes in the CET1 the capital issuances between January and September 2014 (*cet1_set14* and *lr_set14*, respectively), iii) a measure including the effects of the CA on CET1, and on risk weighted assets (*cet1_nov14* and *lr_nov14*, respectively). The first measure provides a capital indicator pre-CA, the third one post-CA. The volatility is computed for the whole period (January-October) and for a restricted and more recent period (April-October).

We observe that the CA analysis is based on a CET1 ratio threshold and not on a threshold on the leverage ratio. However, we have shown that the CET1 shortfall both in the AQR and in the ST depends on the leverage ratio. Our goal is to evaluate how capital ratio indicators (*cet1* and *lr*) pre- and post-CA are able to capture a market risk indicator represented by volatility. If the regulation/supervisory activity properly works, then we expect the market volatility to be related to capital ratio indicators. Notice that Acharya et al. (2014) show that the market volatility is related negatively and in a significant way to the leverage ratio post EBA ST in 2011, but not to the risk density post ST.

In Table 19 we report regression results with the CET1 ratio as capital requirement measure. We find that the coefficients of *cet1* and *cet1_set14* are positive but not statistically significant (models I and II). Restricting the volatility period to April-October 2014, the most recent interval, we find that the coefficient of *cet1_set14* is positive and marginally statistically significant (model III). Surprisingly, according to this result, a high capital ratio (low risk weighted assets compared to capital) is negatively evaluated by the market leading to a high stock return volatility. With respect to the CET1 ratio after capital raising and AQR adjustments, we find that the effect is positive but not significant in the overall period (model IV) and marginally statistically significant in the restricted period (model V). Interacting *cet1_nov14* with the dummy for the state aid support (*Dbailout*), we find a positive and statistically significant effect in the restricted period for those banks that did not received public assistance and therefore had to reach the regulatory targets

[17] Due to the smaller sample, we reduce the explanatory variables with respect to the equation (1). However, we also tested an extended version of equation (2). Results are robust to this test.

with their own resources. Overall we can conclude that the CET1 ratio is not able to explain a market based risk measure such as the volatility. [18]

Table 20 reports the estimates for the regressions with the leverage ratio as capital index. We find that the coefficient of *lr* is negative but not statistically significant (model I). However, looking at the ratio that includes the capital issuances (*lr_set14*), we find that the coefficient is negative and significant both in the overall and in the restrict period (models II and III). The effect is even stronger when we take into account the AQR adjustments (models IV and V). In line with Acharya et al. (2014), we interpret this evidence as showing that markets are more aligned with leverage-based capital measures. Moreover, looking at the interaction with *Dbailout*, we find that the mitigation effect on return volatility of the leverage ratio is higher for those banks that did not receive state aids (models VI and VII). Those banks, in fact, are considered stronger because they reach a higher and more stable level of capital.

8. Conclusions

We performed an analysis of the Comprehensive Assessment with two main goals: understand to what extent the ECB succeeded in defining a level playing field harmonizing different (national) approaches to bank supervision, evaluate the capability of the CA to capture the riskiness of banks. The asset quality review and the stress tests exercise have shown several results on regulation (bank capital) and on the supervisory activity.

On the banking capital-regulatory activity we have shown that risk weighted capital ratio measures are not really informative to evaluate the riskiness of a bank. The criteria to compute risk weighted assets is an area where the supervisory activity should work on because there are some signals of manipulation mostly by not very well capitalized banks.

On the supervisory activity, our analysis has shown that the ECB analysis was mainly concentrated on the traditional credit activity rather than on the financial assets. A much more refined analysis is required on this point in the future. There is evidence of double standards: non-core countries have been penalized by the AQR; medium size banks are either more risky or have been penalized

[18] We also test the effect of risk density on return volatility. The *rwa* effect is negative but not significant both for the overall period and for the restricted one, as well as the interactions with *Dbailout*.

by both exercises; a non diversification-home bias effect (credit and government bonds) has penalized banks in the AQR; national discretion has a positive effect for core countries and a negative effect for peripheral countries. It seems that the ECB performing the AQR has tried to capture some risk factors not included in the evaluation revision, but some of them are not captured by the ST probably because the scenarios for peripheral countries were not so severe.

These results shed a grey light on the CA exercise also because of some pitfalls in the methodology. However, we show that the capital adjustment performed by the stress test is positively related to a market based risk measure (historical volatility) and that the leverage ratio post adjustment, but not before the adjustment and not the risk adjusted capital ratio, is related to it.

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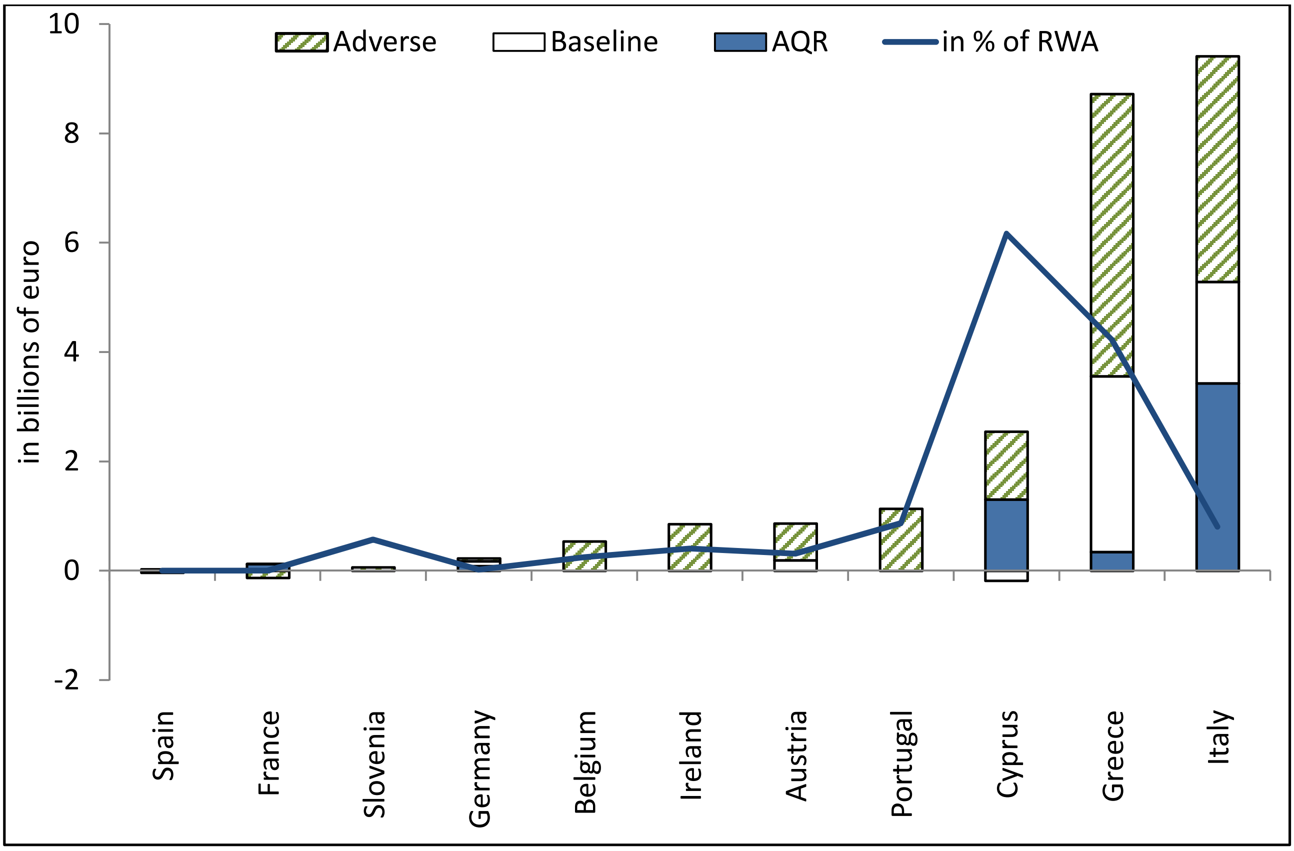
Figures and tables

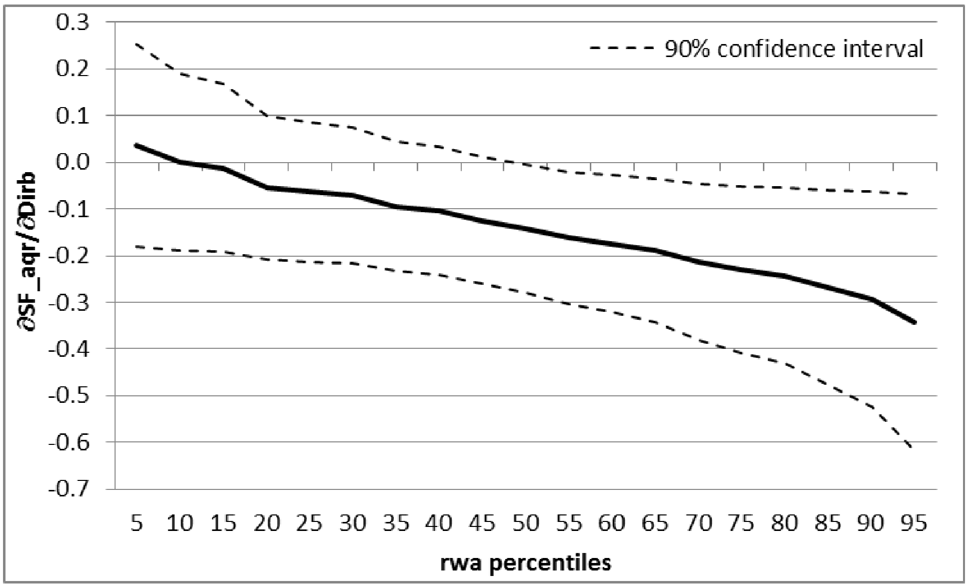
Figure 1. Comprehensive assessment capital shortfall by country



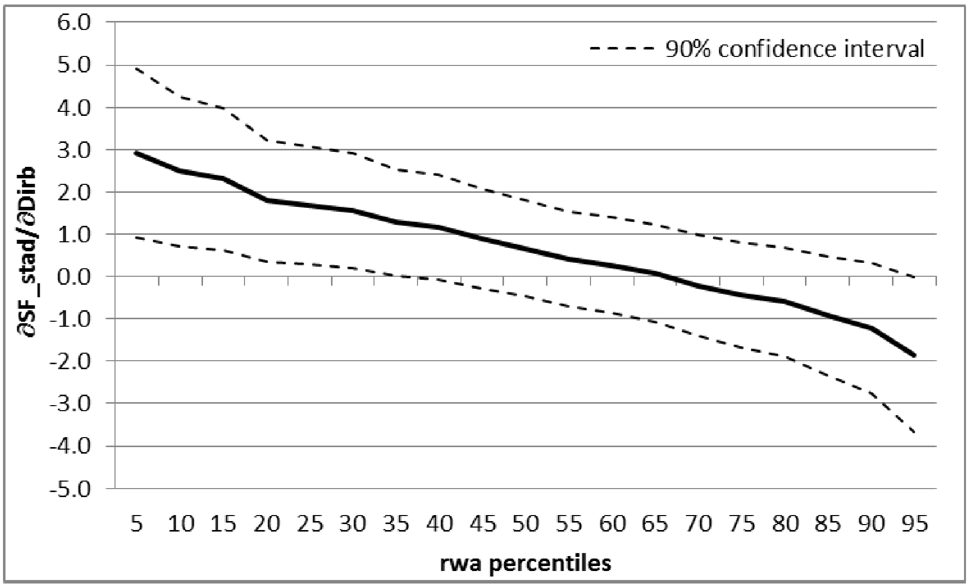
Source: our elaborations on ECB data.

Figure 2 – Derivate of capital shortfalls with respect to the use of IRB approach

a) AQR

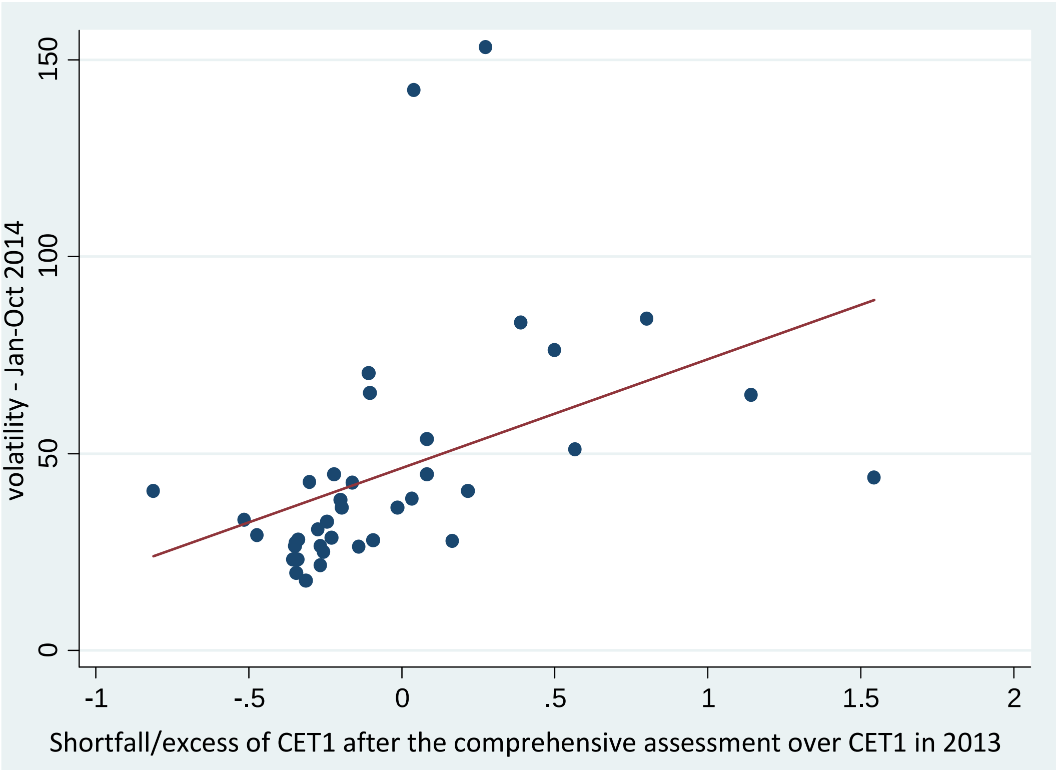


b) Stress test - adverse scenario



Notes: Plot of the derivative of SF with respect to *Dirb*, evaluated at the *rwa* percentiles, based on the estimate results of Table 4, model (V), for SF AQR, and Table 5, model (III), for SF AS.

Figure 3. Volatility vs CET1 shortfall/excess



Source: our elaborations on ECB and Thomson-Reuters data.

Table 1 – Sample by country

	Number of banks		
	ECB data	EBA data	Listed
Austria	6	6	3
Belgium	6	5	2
Cyprus	4	3	1
Estonia	3	0	0
Finland	3	1	0
France	13	11	3
Germany	25	24	4
Greece	4	4	4
Ireland	5	3	3
Italy	15	15	11
Latvia	3	1	0
Lithuania	3	0	0
Luxembourg	6	2	0
Malta	2	1	1
Netherlands	7	6	1
Portugal	3	3	2
Slovakia	3	0	0
Slovenia	3	3	0
Spain	15	15	6
Total	129	103	41

Source: Authors' computations

Table 2 - Summary Statistics and Definitions of Variables

Variable	Description	Source	Mean	St.dv	Min	Max	Obs
bailout	Government interventions to support financial institutions over nominal GDP (in %)	Eurostat and World Bank	6.820	6.840	0.000	29.500	126
bankbook	Risk exposure values on banking book on total risk exposures on securities (in %)	EBA	96.000	14.000	0.000	100.000	84
capstring	Index of capital requirement stringency (higher values indicate greater stringency; range: 0-7)	World Bank	5.430	1.080	2.000	7.000	129
cet1	Common Equity Tier 1 ratio (in %)	ECB	14.500	8.790	-3.700	75.600	129
cet1_gov	Capital instruments eligible as CET1 Capital subscribed by government on total assets (in %)	EBA	0.715	3.420	0.000	34.700	129
cet1_nov14	CET1 ratio including capital raisings between January and September 2014 and after AQR corrections (in %)	ECB	14.500	8.400	5.220	72.500	129
cet1_sep14	CET1 ratio including capital raisings between January and September 2014 (in %)	ECB	15.200	8.490	7.630	75.600	129
corpexpsh	Credit risk exposure, not adjusted for risks, on Corporates over total credit risk exposure (in %)	EBA	25.700	14.400	0.000	79.200	103
cr	Coverage ratio for non-performing exposure (in %)	ECB	42.000	17.700	0.000	99.800	129
cred_homebias	Credit risk exposure, not adjusted for risks, on home domestic country over total credit risk exposure (in %)	EBA	71.800	24.200	0.000	100.000	103
credsh	Risk exposure amount for credit risk over total Risk exposure amount	EBA	87.200	6.320	62.600	99.900	103

	(in %)						
Dbailout	Dummy equal to 1 for banks that received, up to 2013, public supports as equity injections, guarantees, loans or other measures; 0 otherwise	Our elabs. on Mediobanca	0.256	0.438	0.000	1.000	129
Dcore	Dummy equal to 1 for banks operating in Austria, Belgium, Germany, Finland, France, Luxembourg and the Netherlands (euro area core countries); 0 otherwise	Our elabs.	0.512	0.502	0.000	1.000	129
Dirb	Dummy equal to 1 for banks with a credit risk exposure, not adjusted for risks, on IRB models (F-IRB and A-IRB) over 50% of total credit risk exposure; 0 otherwise	ECB and EBA	0.465	0.501	0.000	1.000	129
Dlarge	Dummy equal to 1 for banks with total assets belonging to the fourth quartile of the distribution; 0 otherwise	ECB	0.256	0.438	0.000	1.000	129
Drestruct	Dummy equal to 1 for banks with restructuring plans approved before 31 December 2013 (dynamic balance sheet assumption); 0 otherwise	ECB	0.186	0.391	0.000	1.000	129
foreign	Banking system's assets that are 50% or more foreign owned (in %)	World Bank	32.600	29.900	8.000	99.000	122
gdp	Real GDP growth rate (in %)	World Bank	-0.306	1.760	-5.400	4.110	129
gov	Gross direct exposure on government bonds over total asset (in %)	EBA	13.700	8.670	0.000	60.100	103

gov_homebias	Gross direct exposure on home domestic government bonds on total gross direct exposure on government bonds (in %)	EBA	70.600	28.400	0.801	100.000	100
homebias	Credit risk exposure, not adjusted for risks, and government bonds gross direct exposure on home domestic country on total assets (in %)	EBA	81.600	28.600	1.930	135.000	103
lasset	Natural log of total assets	ECB	4.110	1.490	-0.567	7.400	129
level3	Level 3 instruments on total assets (in %)	ECB	0.789	1.530	0.000	10.000	129
lr	Leverage ratio (common equity tier 1 divided total exposure measure according to Article 429 CRR) (in %)	ECB	5.950	3.340	0.590	21.400	129
lr_nov14	Leverage ratio including capital raisings between January and September 2014 and after AQR corrections (in %)	ECB	5.760	3.190	1.060	21.300	128
lr_sep14	Leverage ratio including capital raisings between January and September 2014 (in %)	ECB	6.100	3.360	1.060	21.400	128
marketcap	Stock exchange market capitalization over nominal GDP (in %)	World Bank	48.300	29.700	3.930	128.000	129
natdiscr	Difference between the fully loaded CET1 ratio and CET1 ratio in the transitional period as result of the adverse scenario in 2016 (in p.%)	EBA	0.884	1.980	-4.710	11.600	129
noderexp	Non derivative exposures on total assets (in %)	ECB	0.491	1.680	0.000	15.200	129

npe	Non-performing exposures ratio (in %)	ECB	7.580	9.010	0.000	44.700	129
ptbv	Price-to-book ratio	Thomson-Reuters	0.888	0.855	-0.013	5.560	41
restrict	Index of financial conglomerates restrictiveness (higher values indicate more restrictive; range: 3-12)	World Bank	6.300	1.350	4.000	9.000	104
retexpsh	Credit risk exposure, not adjusted for risks, on Retail over total credit risk exposure (in %)	EBA	30.100	19.000	0.000	74.600	103
rwa	Total risk exposure (RWA) over total assets (in %)	ECB	45.400	20.000	0.143	110.000	129
rwacr	Risk exposure (RWA) on credit risk over total assets (in %)	ECB	38.200	18.700	0.023	103.000	129
SF_aqr	Capital shortfall to threshold of 8% for AQR adjusted CET1 Ratio (bln EUR)	ECB	0.041	0.166	0.000	1.030	129
SF_stad	Capital shortfall to threshold of 5.5% in Adverse Scenario (bln EUR)	ECB	0.188	0.671	0.000	4.630	129
SF_stba	Capital shortfall to threshold of 8% in Baseline Scenario (bln EUR)	ECB	0.081	0.311	0.000	2.280	129
supind	Index of independence of supervisory authority (higher values indicate greater independence; range: 0-3)	World Bank	2.070	0.859	1.000	3.000	129
sys	Total assets over nominal GDP (in %)	ECB and World Bank	28.600	35.900	0.491	180.000	129
vol	Volatility of daily stock returns between January and October 2014 (in %)	Thomson-Reuters	45.500	29.200	17.700	153.000	41

Notes: all data, with the exceptions of capital shortfalls, refers to 2013. For Dexia *lr* variable equal to CET1 capital over total assets due to missing data on the total exposure measured according to Article 429 CRR.

Table 3 – Correlation matrix

	cet1	cr	Dirb	Drestruct	finasset	lasset	lr	marketcap	npe	rwa	sys
cet1	1.00										
cr	-0.27	1.00									
Dirb	0.02	0.07	1.00								
Drestruct	-0.12	-0.02	0.07	1.00							
level3	0.03	0.05	-0.10	0.00	1.00						
lasset	-0.13	0.07	0.26	0.20	0.01	1.00					
lr	0.23	0.23	-0.06	-0.21	0.11	-0.48	1.00				
marketcap	0.13	-0.05	0.07	0.14	0.02	0.35	-0.29	1.00			
npe	-0.27	0.10	-0.20	0.10	-0.06	-0.10	0.20	-0.38	1.00		
rwa	-0.30	0.38	-0.17	-0.09	-0.03	-0.34	**0.61**	-0.45	0.50	1.00	
sys	-0.09	0.08	0.05	0.02	-0.02	0.30	0.01	0.13	0.22	-0.08	1.00

Note: in bold correlations higher than 50%.

Table 4. Regression results – reference model for capital shortfall in the AQR

In the table are reported the estimation results of eq. (1) using Tobit estimator.
Dependent variable: SF_aqr

	Model						
	I	II	III	IV	V	VI	VII
cet1	-0.103***	-0.099***	-0.099***	-0.100***	-0.101***	-0.102***	-
	[0.025]	[0.022]	[0.020]	[0.018]	[0.018]	[0.016]	
lasset	0.722**	0.918**	0.786**	0.731**	0.703**	0.622**	1.143**
	[0.318]	[0.357]	[0.343]	[0.331]	[0.308]	[0.279]	[0.560]
lasset2	-0.082*	-0.106**	-0.082	-0.067	-0.062	-0.069	-0.174**
	[0.048]	[0.052]	[0.052]	[0.051]	[0.048]	[0.043]	[0.083]
npe	0.031***	0.031***	0.031***	0.032***	0.034***	0.029**	0.065***
	[0.010]	[0.010]	[0.011]	[0.011]	[0.012]	[0.012]	[0.018]
cr	-0.015**	-0.016***	-0.019***	-0.025***	-0.025***	-0.009	-0.022**
	[0.006]	[0.006]	[0.006]	[0.008]	[0.008]	[0.007]	[0.009]
sys	-0.010***	-0.011***	-0.012***	-0.012***	-0.012***	-0.009**	-0.015***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
marketcap	-0.014***	-0.016***	-0.018***	-0.015***	-0.014***	-0.021***	-0.024***
	[0.004]	[0.004]	[0.005]	[0.004]	[0.005]	[0.005]	[0.007]
Drestruct	0.549**	0.632***	0.696***	0.696***	0.679***	0.702***	0.737***
	[0.233]	[0.223]	[0.234]	[0.226]	[0.228]	[0.225]	[0.273]
level3	-	-0.126*	-0.149*	-0.223***	-0.215**	-0.037	-0.057
		[0.066]	[0.079]	[0.083]	[0.086]	[0.085]	[0.067]
Dirb	-	-	-0.196*	-0.157*	0.078	-0.223**	-0.216
			[0.099]	[0.083]	[0.202]	[0.107]	[0.152]
rwa	-	-	-	0.007*	0.009*	-	-
				[0.004]	[0.005]		
rwa×Dirb	-	-	-	-	-0.005	-	-
					[0.004]		
lr	-	-	-	-	-	-0.123***	-0.194***
						[0.044]	[0.057]
constant	-0.010	-0.197	0.135	-0.119	-0.240	0.855	-0.047
	[0.481]	[0.534]	[0.546]	[0.470]	[0.514]	[0.587]	[1.077]
sigma	0.227***	0.213***	0.206***	0.197***	0.197***	0.190***	0.357***
	[0.033]	[0.027]	[0.029]	[0.031]	[0.032]	[0.027]	[0.053]
$\left.\frac{\partial SF\_aqr}{\partial Dirb}\right\|_{rwa}$	-	-	-	-	-0.166*	-	-
F statistic (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Uncens. obs	16	16	16	16	16	16	16
Obs	129	129	129	129	129	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.
The derivate of SF_aqr with respect to Dirb is evaluated at the median value of rwa.

Table 5. Regression results – reference model for capital shortfall in the ST adverse

In the table are reported the estimation results of eq. (1) using Tobit estimator.
Dependent variable: SF_stad

	Model						
	I	II	III	IV	V	VI	VII
cet1	-0.053	-0.090	-0.114*	0.007	-	-	-
	[0.042]	[0.061]	[0.067]	[0.022]			
lasset	2.057**	2.676***	2.690***	1.613**	1.844**	2.907***	2.885***
	[0.823]	[0.915]	[1.001]	[0.804]	[0.900]	[0.891]	[0.907]
lasset2	-0.234**	-0.329***	-0.333**	-0.201*	-0.240**	-0.352***	-0.351***
	[0.101]	[0.119]	[0.128]	[0.102]	[0.116]	[0.121]	[0.124]
npe	0.095***	0.119***	0.133***	0.139***	0.146***	0.128***	0.139***
	[0.036]	[0.034]	[0.039]	[0.033]	[0.032]	[0.035]	[0.039]
cr	-0.012	0.004	0.020	0.009	0.011	-0.006	0.003
	[0.009]	[0.010]	[0.015]	[0.010]	[0.011]	[0.011]	[0.014]
sys	-0.018	-0.023**	-0.027***	-0.018*	-0.019**	-0.024**	-0.027**
	[0.011]	[0.010]	[0.010]	[0.010]	[0.009]	[0.010]	[0.011]
marketcap	-0.045***	-0.057***	-0.057***	-0.053***	-0.055***	-0.057***	-0.057***
	[0.017]	[0.017]	[0.018]	[0.014]	[0.014]	[0.017]	[0.018]
Drestruct	1.093*	1.316**	1.441**	1.187**	1.192**	1.262**	1.242**
	[0.645]	[0.562]	[0.612]	[0.518]	[0.525]	[0.579]	[0.622]
level3	-	0.095	0.113	-	0.120	0.067	0.078
		[0.121]	[0.151]		[0.146]	[0.118]	[0.133]
Dirb	-	0.241	3.861**	-	0.334	-	3.089**
		[0.445]	[1.486]		[0.400]		[1.240]
rwa	-	-0.036**	-0.005	-	-	-0.032**	-0.003
		[0.016]	[0.019]			[0.015]	[0.016]
rwa×Dirb	-	-	-0.072**	-	-	-	-0.061**
			[0.028]				[0.024]
lr	-	-	-	-0.557***	-0.574***	-	-
				[0.150]	[0.149]		
constant	-3.391*	-2.554	-5.052**	-0.783	-1.204	-3.903***	-6.132***
	[1.928]	[1.871]	[2.493]	[1.511]	[1.609]	[1.460]	[1.947]
sigma	1.339***	1.217***	1.229***	1.067***	1.068***	1.253***	1.274***
	[0.237]	[0.178]	[0.186]	[0.131]	[0.137]	[0.191]	[0.203]
$\left.\frac{\partial SF\_stad}{\partial Dirb}\right\|_{rwa}$	-	-	0.615	-	-	-	0.349
F statistic (p-value)	0.005	0.001	0.000	0.000	0.000	0.001	0.000
Uncens. obs	23	23	23	23	23	23	23
Obs	129	129	129	129	129	129	129

Notes: Cluster-robust standard errors appear in parentheses.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.
The derivate of *SF_stad* with respect to *Dirb* is evaluated at the median value of *rwa*.

Table 6. Regression results – Risk composition effect on capital shortfall in the AQR

In the table are reported the estimation results of eq. (1) using Tobit estimator.

Dependent variable: SF_aqr

	Model				
	I	II	III	IV	V
lasset	1.537***	0.937	0.672	0.845	-1.638
	[0.533]	[0.686]	[0.758]	[0.590]	[1.152]
lasset2	-0.229***	-0.145	-0.102	-0.130	0.185
	[0.086]	[0.103]	[0.115]	[0.089]	[0.122]
cr	-0.028***	-0.031***	-0.033***	-0.031***	-0.029**
	[0.008]	[0.009]	[0.009]	[0.009]	[0.011]
sys	-0.018***	-0.017***	-0.016***	-0.016***	-0.026***
	[0.005]	[0.006]	[0.006]	[0.005]	[0.009]
marketcap	-0.023***	-0.016*	-0.015*	-0.015*	-0.018**
	[0.008]	[0.009]	[0.008]	[0.009]	[0.009]
Drestruct	0.721**	0.573	0.553*	0.497	0.531**
	[0.331]	[0.345]	[0.314]	[0.354]	[0.257]
Dirb	-0.176	-0.075	-0.145	-0.109	-0.434*
	[0.168]	[0.250]	[0.203]	[0.193]	[0.255]
npe	0.064***	0.060***	0.058***	0.059***	0.063***
	[0.017]	[0.019]	[0.018]	[0.017]	[0.020]
rwacr	-0.009	-	-	-	-
	[0.007]				
rwa	-	0.001	0.001	0.001	-0.004
		[0.009]	[0.007]	[0.007]	[0.009]
corpexpsh	-	0.000	-	-	-
		[0.008]			
retexpsh	-	-	0.006	-	-
			[0.005]		
gov	-	-	-	0.006	-
				[0.010]	
bankbook	-	-	-	-	-0.002
					[0.002]
constant	-1.106	-0.653	-0.371	-0.641	4.990*
	[0.741]	[1.203]	[1.278]	[1.115]	[2.926]
sigma	0.411***	0.415***	0.400***	0.410***	0.356***
	[0.067]	[0.072]	[0.068]	[0.072]	[0.053]
F statistic (p-value)	0.001	0.016	0.007	0.008	0.001
Uncens. obs	16	16	16	16	12
Obs	129	103	103	103	84

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 7. Regression results – Risk composition effect on capital shortfall in the ST adverse

In the table are reported the estimation results of eq. (1) using Tobit estimator.

Dependent variable: SF_stad

	Model				
	I	II	III	IV	V
lasset	3.013***	3.039***	2.100***	2.816***	-2.319
	[0.959]	[0.951]	[0.710]	[0.986]	[1.815]
lasset2	-0.369***	-0.373***	-0.251***	-0.367***	0.129
	[0.134]	[0.129]	[0.086]	[0.137]	[0.172]
cr	-0.006	0.004	-0.001	0.002	-0.003
	[0.010]	[0.011]	[0.011]	[0.011]	[0.018]
sys	-0.023**	-0.023**	-0.022**	-0.022*	0.002
	[0.011]	[0.010]	[0.011]	[0.011]	[0.016]
marketcap	-0.057***	-0.078***	-0.067***	-0.061***	-0.083***
	[0.016]	[0.021]	[0.019]	[0.019]	[0.025]
Drestruct	1.252**	1.334**	1.285**	1.262**	1.479**
	[0.547]	[0.530]	[0.491]	[0.563]	[0.649]
Dirb	0.095	1.177**	0.482	0.733	0.291
	[0.382]	[0.537]	[0.505]	[0.519]	[0.594]
npe	0.130***	0.099***	0.101***	0.115***	0.124***
	[0.037]	[0.036]	[0.036]	[0.039]	[0.045]
rwacr	-0.037**	-	-	-	-
	[0.017]				
rwa	-	0.003	-0.023	-0.022	-0.050*
		[0.014]	[0.017]	[0.018]	[0.027]
corpexpsh	-	-0.044***	-	-	-
		[0.017]			
retexpsh	-	-	0.023*	-	-
			[0.013]		
gov	-	-	-	-0.006	-
				[0.018]	
bankbook	-	-	-	-	-0.010
					[0.007]
constant	-4.034***	-4.274***	-3.133**	-3.923**	11.692**
	[1.504]	[1.587]	[1.505]	[1.687]	[5.627]
sigma	1.223***	1.202***	1.201***	1.254***	1.278***
	[0.182]	[0.196]	[0.191]	[0.198]	[0.250]
F statistic (p-value)	0.000	0.000	0.000	0.001	0.000
Uncens. obs	23	23	23	23	17
Obs	129	103	103	103	84

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 8 - Regression results – Size effect on capital shortfall in the AQR

In the table are reported the estimation results of eq. (1) using Tobit estimator.
Dependent variable: SF_aqr

	Model				
	I	II	III	IV	V
cet1	-0.095***	-0.100***	-0.090***	-0.081***	-0.090***
	[0.020]	[0.023]	[0.020]	[0.017]	[0.020]
lasset	0.918***	0.654**	1.137***	1.077***	1.070**
	[0.339]	[0.268]	[0.365]	[0.296]	[0.486]
lasset2	-0.103**	-0.064	-0.145**	-0.138***	-0.128
	[0.050]	[0.042]	[0.056]	[0.043]	[0.078]
cr	-0.020***	-0.015**	-0.019***	-0.014***	-0.020***
	[0.006]	[0.007]	[0.006]	[0.004]	[0.006]
sys	-0.012***	-0.011***	-0.012***	-0.008***	-0.011***
	[0.004]	[0.004]	[0.004]	[0.003]	[0.004]
marketcap	-0.018***	-0.014***	-0.014***	-0.012***	-0.015***
	[0.005]	[0.004]	[0.003]	[0.003]	[0.004]
Drestruct	0.673***	0.540**	0.524***	0.344**	0.572***
	[0.218]	[0.221]	[0.193]	[0.155]	[0.187]
Dirb	-0.192**	-0.112	-0.127	-0.136*	-0.148*
	[0.091]	[0.119]	[0.094]	[0.073]	[0.080]
npe	0.032***	0.033***	0.037***	-	0.033***
	[0.011]	[0.010]	[0.011]		[0.012]
level3×Dlarge	0.252***	-	-	-	-
	[0.079]				
level3×(1-Dlarge)	-0.144*	-	-	-	-
	[0.074]				
noderexp	-	-0.214	-	-	-
		[0.189]			
noderexp×Dlarge	-	-	1.405***	-	-
			[0.428]		
npeL	-	-	-	7.467***	-
				[1.203]	
npe×(1-Dlarge)	-	-	-	2.545***	-
				[0.687]	
level3	-	-	-	-0.062	-0.123
				[0.062]	[0.090]
rwacr×Dlarge	-	-	-	-	0.012
					[0.008]
rwacr×(1-Dlarge)	-	-	-	-	0.002
					[0.005]
constant	-0.090	0.040	-0.669	-0.632	-0.516
	[0.527]	[0.410]	[0.517]	[0.444]	[0.667]
sigma	0.198***	0.218***	0.194***	0.161***	0.196***
	[0.026]	[0.034]	[0.026]	[0.025]	[0.027]

$\beta_{Dlarge} = \beta_{(1-Dlarge)}$ (p-value)	0.001	-	-	0.000	0.224
F statistic (p-value)	0.000	0.000	0.000	0.000	0.000
Uncens. obs	16	16	16	16	16
Obs	129	129	129	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 9 - Regression results – Size effect on capital shortfall in the ST adverse

In the table are reported the estimation results of eq. (1) using Tobit estimator.
Dependent variable: SF_stad

	Model				
	I	II	III	IV	V
cet1	-0.063	-0.066	-0.053	-0.045	-0.067
	[0.061]	[0.049]	[0.056]	[0.042]	[0.057]
lasset	3.405***	2.271**	3.974***	2.874***	3.578***
	[1.163]	[0.906]	[1.387]	[1.029]	[1.234]
lasset2	-0.448***	-0.271**	-0.548***	-0.376***	-0.480***
	[0.150]	[0.114]	[0.191]	[0.139]	[0.178]
cr	-0.011	-0.010	-0.015	-0.015*	-0.003
	[0.012]	[0.010]	[0.012]	[0.009]	[0.009]
sys	-0.029**	-0.019*	-0.028**	-0.015*	-0.025***
	[0.011]	[0.011]	[0.011]	[0.008]	[0.009]
marketcap	-0.058***	-0.047***	-0.055***	-0.040***	-0.056***
	[0.020]	[0.017]	[0.018]	[0.014]	[0.014]
Drestruct	1.224*	1.145*	1.091*	0.713	1.215***
	[0.714]	[0.628]	[0.652]	[0.440]	[0.460]
Dirb	0.459	0.479	0.464	0.362	0.267
	[0.559]	[0.500]	[0.543]	[0.420]	[0.419]
npe	0.117***	0.098***	0.122***	-	0.135***
	[0.039]	[0.037]	[0.041]		[0.035]
level3×Dlarge	0.918***	-	-	-	-
	[0.203]				
level3×(1-Dlarge)	-0.132	-	-	-	-
	[0.132]				
noderexp	-	0.050	-	-	-
		[0.078]			
noderexp×Dlarge	-	-	4.286***	-	-
			[1.156]		
npeL	-	-	-	24.080***	-
				[6.742]	
npe×(1-Dlarge)	-	-	-	9.388***	-
				[3.355]	
level3	-	-	-	0.083	0.130
				[0.115]	[0.119]
rwacr×Dlarge	-	-	-	-	-0.012
					[0.026]
rwacr×(1-Dlarge)	-	-	-	-	-0.044**
					[0.017]
constant	-4.967*	-3.696*	-5.918**	-4.627**	-3.828*
	[2.609]	[2.047]	[2.845]	[2.109]	[2.123]
sigma	1.280***	1.334***	1.283***	1.245***	1.170***
	[0.231]	[0.238]	[0.238]	[0.252]	[0.173]

$\beta_{Dlarge} = \beta_{(1-Dlarge)}$ (p-value)	0.000	-	-	0.023	0.153
F statistic (p-value)	0.003	0.008	0.007	0.000	0.002
Uncens. obs	23	23	23	23	23
Obs	129	129	129	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 10 - Regression results – Home bias effect on capital shortfall in the AQR
In the table are reported the estimation results of eq. (1) using Tobit estimator.
Dependent variable: SF_aqr

	Model					
	I	II	III	IV	V	VI
lr	-0.188***	-0.154***	-0.166***	-0.157***	-0.191***	-0.154***
	[0.059]	[0.046]	[0.044]	[0.049]	[0.058]	[0.045]
lasset	1.022	2.267***	0.563	2.402***	1.038*	2.249***
	[0.636]	[0.508]	[0.520]	[0.568]	[0.606]	[0.505]
lasset2	-0.157*	-0.350***	-0.086	-0.371***	-0.160*	-0.347***
	[0.093]	[0.081]	[0.081]	[0.091]	[0.088]	[0.080]
npe	0.062***	0.064***	0.060***	0.067***	0.062***	0.064***
	[0.019]	[0.014]	[0.017]	[0.015]	[0.019]	[0.014]
cr	-0.020**	-0.020***	-0.025***	-0.019***	-0.019**	-0.020***
	[0.009]	[0.006]	[0.009]	[0.006]	[0.008]	[0.006]
sys	-0.014***	-0.012***	-0.011**	-0.013***	-0.014***	-0.012***
	[0.004]	[0.003]	[0.005]	[0.003]	[0.004]	[0.003]
marketcap	-0.022***	-0.014***	-0.020***	-0.016***	-0.022***	-0.015***
	[0.006]	[0.004]	[0.006]	[0.005]	[0.005]	[0.003]
Drestruct	0.701***	0.264	0.634**	0.336**	0.719**	0.281*
	[0.266]	[0.160]	[0.310]	[0.152]	[0.276]	[0.161]
level3	-0.059	0.026	-0.028	0.026	-0.057	0.024
	[0.066]	[0.044]	[0.109]	[0.045]	[0.065]	[0.044]
Dirb	-0.227	-0.155	-0.222	-0.085	-0.218	-0.147
	[0.155]	[0.114]	[0.279]	[0.156]	[0.157]	[0.111]
homebias	0.001	-	-	-	-	-
	[0.004]					
homebiasL	-	0.014***	-	-	-	-
		[0.003]				
gov_homebias	-	-	0.024***	-	-	-
			[0.008]			
gov_homebiasL	-	-	-	0.016***	-	-
				[0.004]		
cred_homebias	-	-	-	-	0.002	-
					[0.004]	
cred_homebiasL	-	-	-	-	-	0.017***
						[0.003]
constant	-0.094	-2.312***	-1.441	-2.514***	-0.187	-2.253***
	[1.096]	[0.792]	[1.226]	[0.918]	[1.047]	[0.787]
sigma	0.355***	0.259***	0.292***	0.273***	0.352***	0.258***
	[0.049]	[0.037]	[0.035]	[0.039]	[0.047]	[0.037]
F statistic (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Uncens. obs	16	16	15	15	16	16
Obs	103	103	100	100	103	103

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 11 - Regression results – Home bias effect on capital shortfall in the ST adverse
In the table are reported the estimation results of eq. (1) using Tobit estimator.
Dependent variable: SF_stad

	Model					
	I	II	III	IV	V	VI
lr	-0.530***	-0.522***	-0.563***	-0.542***	-0.517***	-0.522***
	[0.159]	[0.160]	[0.156]	[0.161]	[0.154]	[0.159]
lasset	2.312**	2.131*	2.338**	1.928*	2.226**	2.155*
	[0.930]	[1.088]	[0.903]	[1.024]	[0.877]	[1.115]
lasset2	-0.316**	-0.296*	-0.308**	-0.258*	-0.302***	-0.299*
	[0.121]	[0.162]	[0.117]	[0.151]	[0.115]	[0.167]
npe	0.143***	0.137***	0.151***	0.131***	0.139***	0.137***
	[0.034]	[0.034]	[0.035]	[0.035]	[0.033]	[0.034]
cr	0.015	0.015	0.014	0.014	0.014	0.015
	[0.013]	[0.012]	[0.012]	[0.013]	[0.014]	[0.012]
sys	-0.023**	-0.018**	-0.025***	-0.018**	-0.021**	-0.018**
	[0.009]	[0.009]	[0.008]	[0.009]	[0.009]	[0.009]
marketcap	-0.066***	-0.057***	-0.064***	-0.063***	-0.064***	-0.057***
	[0.018]	[0.014]	[0.017]	[0.016]	[0.018]	[0.014]
Drestruct	1.237**	1.113**	1.381**	1.268***	1.159**	1.108**
	[0.546]	[0.430]	[0.535]	[0.477]	[0.562]	[0.427]
level3	0.045	0.110	0.023	0.108	0.048	0.112
	[0.171]	[0.173]	[0.151]	[0.168]	[0.174]	[0.173]
Dirb	0.700	0.610	0.338	0.426	0.673	0.611
	[0.485]	[0.450]	[0.490]	[0.544]	[0.477]	[0.448]
homebias	-0.011	-	-	-	-	-
	[0.008]					
homebiasL	-	0.003	-	-	-	-
		[0.010]				
gov_homebias	-	-	-0.017**	-	-	-
			[0.008]			
gov_homebiasL	-	-	-	0.001	-	-
				[0.011]		
cred_homebias	-	-	-	-	-0.010	-
					[0.009]	
cred_homebiasL	-	-	-	-	-	0.004
						[0.013]
constant	-0.759	-1.748	-0.388	-1.160	-0.919	-1.783
	[1.829]	[1.900]	[1.716]	[1.849]	[1.763]	[1.926]
sigma	1.056***	1.073***	1.020***	1.087***	1.060***	1.072***
	[0.133]	[0.141]	[0.121]	[0.143]	[0.132]	[0.142]
F statistic (p-value)	0.000	0.000	0.000	0.000	0.001	0.000
Uncens. obs	23	23	22	22	23	23
Obs	103	103	100	100	103	103

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 12 - Regression results – Core vs non-core country effect on capital shortfall in the AQR
In the table are reported the estimation results of eq. (1) using Tobit estimator.
Dependent variable: SF_aqr

	Model					
	I	II	III	IV	V	VI
cet1	-0.092***	-	-	-0.105***	-0.103***	-0.100***
	[0.018]			[0.017]	[0.014]	[0.016]
lasset	0.773**	0.759**	1.166**	0.754**	0.908***	0.613**
	[0.328]	[0.323]	[0.509]	[0.290]	[0.332]	[0.284]
lasset2	-0.080	-0.078	-0.181**	-0.078*	-0.103**	-0.051
	[0.050]	[0.050]	[0.077]	[0.044]	[0.052]	[0.043]
sys	-0.011***	-0.012***	-0.014***	-0.011***	-0.012***	-
	[0.004]	[0.003]	[0.005]	[0.003]	[0.003]	
marketcap	-0.019***	-0.027***	-0.025**	-0.024***	-0.027***	-0.022***
	[0.004]	[0.003]	[0.010]	[0.003]	[0.004]	[0.003]
Drestruct	0.804***	1.039***	0.806**	0.909***	1.017***	0.929***
	[0.223]	[0.155]	[0.406]	[0.157]	[0.185]	[0.141]
Dirb	-0.201	-0.254***	-0.093	-0.196*	-0.163	-0.328***
	[0.126]	[0.081]	[0.193]	[0.103]	[0.105]	[0.092]
1-Dcore	0.410***	-2.397***	-0.092	-0.447*	-0.830*	-0.197
	[0.147]	[0.809]	[0.960]	[0.248]	[0.433]	[0.165]
npe	0.025**	0.018**	0.054***	-	0.019**	0.021***
	[0.010]	[0.008]	[0.016]		[0.008]	[0.008]
cr	-0.028***	-0.006	-0.027	-0.008	-	-0.020***
	[0.009]	[0.008]	[0.019]	[0.006]		[0.006]
level3	-0.232**	-0.170**	-0.114	-0.165**	-0.154**	-0.221***
	[0.090]	[0.075]	[0.188]	[0.071]	[0.076]	[0.079]
cet1×Dcore	-	-0.398***	-	-	-	-
		[0.089]				
cet1×(1-Dcore)	-	-0.103***	-	-	-	-
		[0.014]				
lr×Dcore	-	-	-0.419**	-	-	-
			[0.203]			
lr×(1-Dcore)	-	-	-0.157***	-	-	-
			[0.050]			
npe×Dcore	-	-	-	-27.057***	-	-
				[7.951]		
npe×(1-Dcore)	-	-	-	1.849**	-	-
				[0.736]		
cr×Dcore	-	-	-	-	-4.618***	-
					[0.819]	
cr×(1-Dcore)	-	-	-	-	-0.359	-
					[0.898]	
sys×Dcore	-	-	-	-	-	-0.135***
						[0.029]
sys×(1-Dcore)	-	-	-	-	-	-0.011***

						[0.003]
constant	0.205	2.548***	0.311	0.639	0.672*	0.904*
	[0.468]	[0.565]	[1.021]	[0.404]	[0.401]	[0.469]
sigma	0.183***	0.160***	0.337***	0.165***	0.164***	0.162***
	[0.025]	[0.026]	[0.048]	[0.024]	[0.025]	[0.027]
$\beta_{Dcore} = \beta_{(1-Dcore)}$ (p-value)	-	0.001	0.172	0.000	0.002	0.000
$\left.\frac{\partial SF\_aqr}{\partial Z_{Dcore}}\right\|_{Z}$	-	-5.518***	-1.773**	-58.026***	-189.6***	-3.523***
$\left.\frac{\partial SF\_aqr}{\partial Z_{(1-Dcore)}}\right\|_{Z}$	-	-3.542***	-1.054	18.775**	-16.382	-0.552***
F statistic (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Uncens. obs	16	16	16	16	16	16
Obs	129	129	129	129	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.
Derivates evaluated at the median value of the Z control variable interacted with *Dcore* and *(1-Dcore)*.

Table 13 - Regression results – Core vs non-core country effect on capital shortfall in the ST adverse

In the table are reported the estimation results of eq. (1) using Tobit estimator.

Dependent variable: SF_stad

	Model					
	I	II	III	IV	V	VI
lr	-0.574***	-	-	-0.568***	-0.569***	-0.605***
	[0.149]			[0.147]	[0.150]	[0.158]
lasset	1.843**	2.261**	2.733**	1.998**	1.675*	2.397*
	[0.897]	[0.928]	[1.253]	[0.948]	[0.893]	[1.229]
lasset2	-0.239**	-0.270**	-0.373**	-0.260**	-0.222*	-0.345**
	[0.116]	[0.114]	[0.175]	[0.125]	[0.114]	[0.170]
sys	-0.019**	-0.020*	-0.029***	-0.023**	-0.020**	-
	[0.009]	[0.010]	[0.009]	[0.009]	[0.009]	
marketcap	-0.055***	-0.048***	-0.071***	-0.058***	-0.053***	-0.061***
	[0.014]	[0.016]	[0.017]	[0.015]	[0.015]	[0.014]
Drestruct	1.187**	1.118*	1.722**	1.349**	1.184**	1.438**
	[0.526]	[0.613]	[0.739]	[0.564]	[0.525]	[0.554]
Dirb	0.339	0.533	0.331	0.357	0.365	0.470
	[0.404]	[0.513]	[0.450]	[0.404]	[0.418]	[0.428]
1-Dcore	0.031	1.081	-1.319	-0.517	0.564	0.489
	[0.436]	[1.301]	[1.282]	[0.555]	[1.037]	[0.457]
npe	0.145***	0.098**	0.163***	-	0.149***	0.169***
	[0.033]	[0.038]	[0.031]		[0.034]	[0.034]
cr	0.011	-0.006	0.019	0.013	-	0.002
	[0.011]	[0.013]	[0.012]	[0.011]		[0.012]
level3	0.119	0.061	-0.039	0.152	0.125	0.053
	[0.146]	[0.121]	[0.128]	[0.143]	[0.142]	[0.129]
cet1×Dcore	-	-0.010	-	-	-	-
		[0.061]				
cet1×(1-Dcore)	-	-0.096	-	-	-	-
		[0.068]				
lr×Dcore	-	-	-0.907***	-	-	-
			[0.253]			
lr×(1-Dcore)	-	-	-0.596***	-	-	-
			[0.156]			
npe×Dcore	-	-	-	5.989	-	-
				[6.910]		
npe×(1-Dcore)	-	-	-	15.744***	-	-
				[3.365]		
cr×Dcore	-	-	-	-	1.654	-
					[1.393]	
cr×(1-Dcore)	-	-	-	-	0.281	-
					[1.815]	

sys×Dcore	-	-	-	-	-	0.019*
						[0.010]
sys×(1-Dcore)	-	-	-	-	-	-0.029***
						[0.008]
constant	-1.225	-4.606*	-1.007	-1.137	-1.187	-1.646
	[1.630]	[2.393]	[2.127]	[1.696]	[1.658]	[2.176]
sigma	1.068***	1.327***	0.985***	1.048***	1.070***	1.034***
	[0.137]	[0.235]	[0.128]	[0.129]	[0.139]	[0.137]
$\beta_{Dcore} = \beta_{(1-Dcore)}$ (p-value)	-	0.391	0.243	0.189	0.557	0.001
$\left.\frac{\partial SF\_stad}{\partial Z_{Dcore}}\right\|_{Z}$	-	-0.143	-3.840***	12.844	67.887	0.503*
$\left.\frac{\partial SF\_stad}{\partial Z_{(1-Dcore)}}\right\|_{Z}$	-	0.020	-4.977***	163.150***	12.734	-0.428
F statistic (p-value)	0.000	0.010	0.000	0.001	0.000	0.000
Uncens. obs	23	23	23	23	23	23
Obs	129	129	129	129	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.
Derivates evaluated at the median value of the Z control variable interacted with *Dcore* and *(1-Dcore)*.

Table 14. Regression results – State aids effect on capital shortfall in the AQR

In the table are reported the estimation results of eq. (1) using Tobit estimator.

Dependent variable: SF_aqr

	Model					
	I	II	III	IV	V	VI
cet1	-0.099***	-0.099***	-0.088***	-0.100***	-0.088***	-0.091***
	[0.020]	[0.019]	[0.020]	[0.021]	[0.014]	[0.017]
lasset	0.767**	1.822***	0.656**	1.944***	1.048**	2.323***
	[0.357]	[0.568]	[0.300]	[0.569]	[0.432]	[0.591]
lasset2	-0.080	-0.209***	-0.064	-0.222***	-0.126*	-0.275***
	[0.052]	[0.074]	[0.047]	[0.074]	[0.067]	[0.079]
cr	-0.020***	-0.031***	-0.019***	-0.029***	-0.025***	-0.035***
	[0.006]	[0.007]	[0.006]	[0.008]	[0.006]	[0.007]
sys	-0.011***	-0.015***	-0.011***	-0.015***	-0.015***	-0.017***
	[0.004]	[0.004]	[0.003]	[0.004]	[0.004]	[0.004]
marketcap	-0.018***	-0.021***	-0.015***	-0.020***	-0.017***	-0.018***
	[0.005]	[0.004]	[0.004]	[0.004]	[0.003]	[0.005]
Drestruct	0.694***	1.095***	0.618***	1.084***	1.063***	1.303***
	[0.235]	[0.235]	[0.216]	[0.238]	[0.268]	[0.227]
level3	-0.148*	-0.210***	-0.143*	-0.209***	-0.012	-0.108
	[0.079]	[0.067]	[0.074]	[0.072]	[0.051]	[0.107]
Dirb	-0.197*	-0.081	-0.201	-0.053	-0.225**	0.059
	[0.103]	[0.138]	[0.145]	[0.136]	[0.106]	[0.146]
npe	0.030**	-	0.036***	-	0.041***	-
	[0.012]		[0.012]		[0.012]	
Dbailout	0.013	0.089	-	-	-	-
	[0.130]	[0.105]				
gdp	-	-0.337***	-	-0.353***	-	-0.438***
		[0.099]		[0.104]		[0.094]
bailout	-	-	-0.012	0.000	-	-
			[0.009]	[0.006]		
cet1_gov	-	-	-	-	-1.091***	-0.575**
					[0.295]	[0.262]
constant	0.178	-1.687*	0.181	-2.015**	-0.296	-2.814***
	[0.604]	[0.950]	[0.478]	[0.910]	[0.627]	[0.898]
sigma	0.206***	0.176***	0.199***	0.180***	0.172***	0.164***
	[0.029]	[0.028]	[0.026]	[0.028]	[0.029]	[0.033]
F statistic (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Uncens. obs	16	16	16	16	16	16
Obs	129	129	126	126	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 15. Regression results – State aids effect on capital shortfall in the ST adverse

In the table are reported the estimation results of eq. (1) using Tobit estimator.

Dependent variable: SF_stad

	Model					
	I	II	III	IV	V	VI
lr	-0.577***	-0.355*	-0.575***	-0.338*	-0.606***	-0.451***
	[0.148]	[0.186]	[0.147]	[0.190]	[0.152]	[0.158]
lasset	1.260	2.237	2.030**	3.400**	2.312***	4.448***
	[0.859]	[1.490]	[0.888]	[1.530]	[0.684]	[1.452]
lasset2	-0.201*	-0.341*	-0.268**	-0.445**	-0.277***	-0.530***
	[0.107]	[0.175]	[0.120]	[0.187]	[0.096]	[0.173]
cr	0.008	0.014	0.012	0.020	0.004	0.016
	[0.010]	[0.016]	[0.012]	[0.015]	[0.013]	[0.016]
sys	-0.015*	-0.004	-0.020**	-0.016*	-0.018**	-0.009
	[0.008]	[0.008]	[0.009]	[0.009]	[0.008]	[0.008]
marketcap	-0.047***	-0.051***	-0.063***	-0.078***	-0.061***	-0.071***
	[0.014]	[0.017]	[0.017]	[0.023]	[0.015]	[0.020]
Drestruct	1.040**	1.046	1.340**	1.547**	1.164**	1.232*
	[0.499]	[0.666]	[0.544]	[0.680]	[0.510]	[0.648]
level3	0.106	0.082	0.109	0.125	0.040	-0.038
	[0.106]	[0.125]	[0.148]	[0.147]	[0.191]	[0.169]
Dirb	0.332	0.778	0.399	1.022	0.114	0.677
	[0.385]	[0.556]	[0.468]	[0.619]	[0.458]	[0.618]
npe	0.130***	-	0.132***	-	0.138***	-
	[0.029]		[0.031]		[0.032]	
Dbailout	1.048***	1.417***	-	-	-	-
	[0.349]	[0.430]				
gdp	-	-0.510**	-	-0.534**	-	-0.683***
		[0.203]		[0.206]		[0.244]
bailout	-	-	0.021	0.060*	-	-
			[0.031]	[0.036]		
cet1_gov	-	-	-	-	0.171**	0.295***
					[0.070]	[0.085]
constant	0.054	-2.595	-1.247	-4.712	-1.712	-6.688**
	[1.538]	[3.248]	[1.527]	[3.328]	[1.198]	[3.156]
sigma	0.995***	1.256***	1.053***	1.249***	1.047***	1.217***
	[0.130]	[0.210]	[0.131]	[0.197]	[0.138]	[0.193]
F statistic (p-value)	0.000	0.001	0.000	0.001	0.000	0.002
Uncens. obs	23	23	23	23	23	23
Obs	129	129	126	126	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 16 - Regression results – Bank regulations effect on capital shortfall in the AQR

In the table are reported the estimation results of eq. (1) using Tobit estimator.

Dependent variable: SF_aqr

	Model			
	I	II	III	IV
cet1	-0.104***	-0.091***	-0.098***	-0.096***
	[0.020]	[0.017]	[0.018]	[0.016]
lasset	0.277	0.880**	1.237***	0.335
	[0.390]	[0.339]	[0.418]	[0.300]
lasset2	-0.024	-0.071	-0.144**	-0.030
	[0.052]	[0.046]	[0.062]	[0.044]
npe	0.036***	0.024***	0.034***	0.043***
	[0.012]	[0.008]	[0.012]	[0.012]
cr	-0.022***	-0.025***	-0.024***	-0.023***
	[0.007]	[0.006]	[0.007]	[0.007]
sys	-0.010***	-0.014***	-0.015***	-0.011***
	[0.003]	[0.003]	[0.004]	[0.003]
marketcap	-0.024***	-0.018***	-0.025***	-0.009***
	[0.006]	[0.003]	[0.005]	[0.003]
Drestruct	0.716***	0.918***	1.009***	0.786***
	[0.225]	[0.154]	[0.235]	[0.207]
level3	-0.114	-0.242***	-0.035	-0.092*
	[0.073]	[0.084]	[0.055]	[0.053]
Dirb	-0.231***	-0.450***	-0.237**	-0.336***
	[0.087]	[0.158]	[0.093]	[0.111]
foreign	-0.035*	-	-	-
	[0.020]			
restrict	-	0.216**	-	-
		[0.095]		
capstring	-	-	0.174***	-
			[0.051]	
supind	-	-	-	-0.233***
				[0.078]
constant	2.035*	-1.537	-1.299*	1.068*
	[1.213]	[1.128]	[0.675]	[0.597]
sigma	0.199***	0.176***	0.182***	0.183***
	[0.028]	[0.031]	[0.029]	[0.030]
F statistic (p-value)	0.000	0.000	0.000	0.000
Uncens. obs	16	15	16	16
Obs	122	104	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively

Table 17 - Regression results – Bank regulations effect on capital shortfall in the ST adverse

In the table are reported the estimation results of eq. (1) using Tobit estimator.

Dependent variable: SF_stad

	Model			
	I	II	III	IV
lr	-0.604***	-0.590***	-0.614***	-0.568***
	[0.149]	[0.149]	[0.156]	[0.155]
lasset	1.932*	1.525*	1.372	1.828**
	[1.042]	[0.780]	[0.909]	[0.915]
lasset2	-0.222*	-0.183*	-0.183	-0.241**
	[0.129]	[0.102]	[0.112]	[0.114]
npe	0.158***	0.153***	0.160***	0.147***
	[0.031]	[0.031]	[0.035]	[0.032]
cr	0.002	0.004	0.010	0.011
	[0.010]	[0.013]	[0.011]	[0.011]
sys	-0.027***	-0.019***	-0.019**	-0.019*
	[0.008]	[0.007]	[0.008]	[0.010]
marketcap	-0.056***	-0.063***	-0.046***	-0.054***
	[0.013]	[0.013]	[0.015]	[0.016]
Drestruct	1.395***	1.130**	0.937*	1.229**
	[0.528]	[0.473]	[0.524]	[0.567]
level3	0.099	0.066	0.084	0.119
	[0.125]	[0.153]	[0.163]	[0.147]
Dirb	-0.253	0.362	0.368	0.339
	[0.523]	[0.437]	[0.407]	[0.403]
foreign	0.024*	-	-	-
	[0.014]			
restrict	-	-0.399**	-	-
		[0.182]		
capstring	-	-	-0.217	-
			[0.151]	
supind	-	-	-	-0.067
				[0.269]
constant	-1.699	2.534	0.699	-1.120
	[1.972]	[2.543]	[2.170]	[1.718]
sigma	1.011***	0.975***	1.061***	1.071***
	[0.123]	[0.133]	[0.143]	[0.138]
F statistic (p-value)	0.000	0.000	0.000	0.000
Uncens. obs	23	22	23	23
Obs	122	104	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively

Table 18. Regression results – National discretion effects

In the table are reported the estimation results of eq. (1) using Tobit estimator.

	Model					
	I	II	III	IV	V	VI
Dipendent var.	SF_aqr	SF_aqr	SF_aqr	SF_stad	SF_stad	SF_stad
lr	-0.214***	-0.195***	-0.097***	-0.517***	-0.510***	-0.353***
	[0.049]	[0.040]	[0.037]	[0.125]	[0.130]	[0.135]
lasset	1.193**	1.413***	1.074**	1.467*	1.450*	2.072**
	[0.523]	[0.500]	[0.502]	[0.865]	[0.861]	[0.929]
lasset2	-0.159**	-0.194**	-0.149*	-0.214*	-0.213*	-0.277**
	[0.079]	[0.076]	[0.075]	[0.118]	[0.116]	[0.123]
cr	-0.019**	-0.020**	-0.046***	0.004	0.004	0.003
	[0.009]	[0.008]	[0.017]	[0.010]	[0.009]	[0.010]
sys	-0.017***	-0.016***	-0.004	-0.017**	-0.016**	0.000
	[0.005]	[0.005]	[0.003]	[0.008]	[0.008]	[0.006]
marketcap	-0.022***	-0.020***	-0.026***	-0.052***	-0.051***	-0.066***
	[0.006]	[0.004]	[0.008]	[0.013]	[0.015]	[0.018]
Drestruct	0.699**	0.595***	0.657*	1.237**	1.250***	1.239**
	[0.289]	[0.210]	[0.346]	[0.474]	[0.477]	[0.610]
level3	-0.074	-0.084	-0.365*	0.125	0.122	0.012
	[0.060]	[0.062]	[0.205]	[0.111]	[0.104]	[0.099]
Dirb	-0.372	-0.554**	-0.183	0.327	0.443	-0.149
	[0.229]	[0.279]	[0.195]	[0.350]	[0.359]	[0.386]
npe	0.081***	0.078***	-	0.114***	0.113***	-
	[0.021]	[0.020]		[0.026]	[0.028]	
natdiscr	-0.080**	-0.079**	-	0.181***	0.202***	-
	[0.035]	[0.031]		[0.059]	[0.066]	
natdiscr×Dirb	-	0.196**	-	-	-0.070	-
		[0.075]			[0.136]	
1-Dcore	-	-	1.343**	-	-	0.041
			[0.518]			[0.474]
natdiscr×Dcore	-	-	-0.806***	-	-	-0.285
			[0.291]			[0.279]
natdiscr×(1-Dcore)	-	-	0.046	-	-	0.314***
			[0.029]			[0.064]
constant	-0.535	-0.911	-0.101	-0.127	-0.158	-0.690
	[0.942]	[0.821]	[0.948]	[1.504]	[1.496]	[1.892]
sigma	0.326***	0.296***	0.399***	0.928***	0.918***	1.075***
	[0.044]	[0.036]	[0.076]	[0.120]	[0.124]	[0.172]
$\beta_{Dcore} = \beta_{(1-Dcore)}$ **(p-value)**	-	-	0.006	-	-	0.033
F statistic (p-value)	0.000	0.000	0.002	0.000	0.000	0.000
Uncens. obs	16	16	16	23	23	23
Obs	129	129	129	129	129	129

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.

*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 19. Regression results – CET1 ratio effect on stock return volatility
In the table are reported the estimation results of eq. (2) using OLS estimator.

Dependent variable: vol

	Model						
	I	II	III	IV	V	VI	VII
volatility period	Jan-Oct 2014	Jan-Oct 2014	Apr-Oct 2014	Jan-Oct 2014	Apr-Oct 2014	Jan-Oct 2014	Apr-Oct 2014
lasset	-4.976	-5.004	-3.187	-5.025	-3.214	-6.069*	-2.779
	[3.094]	[3.090]	[1.925]	[3.094]	[1.927]	[3.501]	[2.064]
npe	0.561	0.543	1.010***	0.544	1.018***	-0.125	0.996**
	[0.465]	[0.458]	[0.310]	[0.465]	[0.313]	[0.825]	[0.407]
ptbv	2.713	2.818	1.620	2.828	1.605	0.448	1.948
	[6.168]	[6.071]	[2.593]	[6.116]	[2.596]	[7.298]	[2.747]
cet1	0.128	-	-	-	-	-	-
	[0.222]						
Dbailout	-	-	-	-	-	-46.271	16.264
						[56.197]	[24.520]
cet1_sep14	-	0.096	0.203**	-	-	-	-
		[0.192]	[0.081]				
cet1_nov14	-	-	-	0.066	0.174*	-	-
				[0.195]	[0.101]		
cet1_nov14×Dbailout	-	-	-	-	-	5.665	-0.583
						[5.372]	[2.154]
cet1_nov14×(1-Dbailout)	-	-	-	-	-	-0.007	0.272**
						[0.213]	[0.122]
constant	59.100***	59.657***	39.470***	60.215***	40.078***	63.783**	31.722*
	[20.849]	[20.904]	[12.686]	[21.082]	[12.719]	[28.116]	[16.038]
Adj R-squared	0.036	0.035	0.346	0.034	0.342	0.123	0.335
F statistic (p-value)	0.009	0.007	0.000	0.007	0.000	0.000	0.000
Obs	41	41	41	41	41	41	41

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.

Table 20. Regression results – Leverage ratio effect on stock return volatility
In the table are reported the estimation results of eq. (2) using OLS estimator.

Dependent variable: vol

	Model						
	I	II	III	IV	V	VI	VII
volatility period	Jan-Oct 2014	Jan-Oct 2014	Apr-Oct 2014	Jan-Oct 2014	Apr-Oct 2014	Jan-Oct 2014	Apr-Oct 2014
lasset	-6.549**	-5.839**	-4.018**	-5.861**	-4.047**	-5.806**	-4.007**
	[3.193]	[2.631]	[1.734]	[2.718]	[1.756]	[2.495]	[1.514]
npe	0.961**	1.239**	1.502***	1.149***	1.408***	0.997**	1.285***
	[0.470]	[0.556]	[0.373]	[0.420]	[0.331]	[0.472]	[0.349]
ptbv	5.459	6.375	2.894	7.013	3.591	7.239	3.764*
	[5.114]	[5.714]	[2.230]	[5.604]	[2.154]	[5.761]	[2.012]
lr	-5.131	-	-	-	-	-	-
	[4.528]						
Dbailout	-	-	-	-	-	0.431	-0.327
						[18.218]	[16.722]
lr_sep14	-	-3.449	-3.719**	-	-	-	-
		[2.493]	[1.544]				
lr_nov14	-	-	-	-4.363**	-4.740***	-	-
				[1.914]	[1.638]		
lr_nov14×Dbailout	-	-	-	-	-	-4.959*	-5.161*
						[2.833]	[2.767]
lr_nov14×(1-Dbailout)	-	-	-	-	-	-7.704**	-7.465***
						[2.955]	[1.750]
constant	87.719**	70.398***	59.803***	74.038***	63.897***	81.211***	69.994***
	[32.769]	[16.114]	[11.454]	[15.935]	[11.670]	[18.585]	[10.289]
Adj R-squared	0.108	0.245	0.422	0.261	0.456	0.267	0.476
F statistic (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Obs	41	40	40	40	40	40	40

Notes: Cluster-robust standard errors appear in parentheses. We use Stata10 for all calculations.
*, **, *** indicate statistical significance of the parameters at 10%, 5% and 1% significance level, respectively.