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Do stress tests matter? Evidence from the 2014 and 2016 stress tests

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Abstract

Stress tests have been increasingly used in recent years by regulators to foster confidence in the banking sector by not only increasing its resilience via mandatory capital increases but also by enhancing transparency to allow investors to better discriminate between banks. In this study, using an event study approach, we explore how market participants reacted to the 2014 Comprehensive Assessment and the 2016 EBA EU-wide stress test. The results show that stress test disclosures revealed new information that was priced by the markets. We also provide evidence that the publication of stress test results enhanced price discrimination as the impact on bank CDS spreads and equity prices tended to be stronger for the weaker performing banks in the stress test. Finally, we provide some evidence that also sovereign funding costs were affected in the aftermath of the stress test publications. The results provide insights into the effects and usefulness of stress test-related disclosures.

JEL classification: G14, G18, G21.

Keywords: event study, bank stress tests, disclosure.

Non-technical summary

The purpose of this paper is to assess whether the 2014 and 2016 EU-wide stress tests achieved one of their main objectives, namely to provide new information to the market via detailed disclosures of point-in-time bank balance sheet characteristics and of the outcome of the forward-looking solvency assessment (the stress test). The assessment is centred on whether banks' cost of funding and equity prices were visibly affected by the announcement of the stress test and by the publication of the results.

Against this background, we test three hypotheses. We first conjecture that stress tests may reveal new information about the banks being stress tested and therefore could impact their market-based funding costs and stock prices. The second hypothesis is that the publication of stress test results improved price discrimination in terms of allowing markets to better discriminate between 'good' and 'bad' banks. Finally, the third hypothesis is that the stress test, in particular the 2014 Comprehensive Assessment (CA), may have affected the CDS prices of the sovereigns of banks being stress tested due to the potential fiscal implications of filling identified bank capital shortfalls.

To test these hypotheses we employ an event study approach estimating cumulative "abnormal" returns of banks' CDS spreads and stock prices and sovereign CDS spreads around the stress test events (e.g. announcements, results publication, etc.). To test the second hypothesis, we furthermore distinguish between banks according to what the stress test revealed about their relative strengths and weaknesses.

The main findings are the following:

For what concerns Hypothesis 1 the results show that both the announcement of the key features of the stress test and the publication of results revealed new information that was priced by markets, as reflected in statistically significant abnormal returns.

With respect to whether markets became better at discriminating 'strong' and 'weak' banks (Hypothesis 2) we also find that the market price impact differs across the banks when we measure banks according to how well they performed in the stress tests. In the 2014 CA, after the publication of the results we observe negative abnormal CDS returns for banks with a large CET1 impact resulting from the Asset Quality Review (AQR) and the stress test adverse scenario. This may suggest that given the 'pass-fail' nature of the exercise, creditors of the weakest performing banks may benefit from the remedial actions required as a follow up to the CA (e.g. capital raising). At the same time, stock prices of the weaker banks performed significantly worse than those of the stronger banks upon publication of

the 2014 CA results, which could reflect the likely dilution of equity holders for those weaker banks needing to raise capital as a follow-up to the CA. In the 2016 stress test, banks experiencing a large CET1 ratio decline under the adverse scenario reported significantly higher positive abnormal CDS returns (and negative abnormal stock price returns) after the publication of the stress test results compared to better performing banks. While the sign of the expectations may have been different in the two stress tests, the revision of expectations conditional on the credit quality of tested banks provide consistent evidence for the hypothesis that the two stress tests improved the ability of markets to discriminate between 'good' banks and 'bad' banks.

We also provide evidence that sovereign funding costs were somewhat affected by the publication of stress test results. In the 2014 CA, this was especially the case for sovereigns where stress tested banks had relatively large exposures to their own sovereign, which could indicate a strong bank-sovereign link. In the 2016 stress test, that feature did not seem to affect sovereign CDS spreads (potentially due to the fact that there was no new information compared to previously disclosed data on sovereign exposures) but instead sovereign funding costs displayed abnormal increases in those countries where banks' CET1 buffers were relatively low under the adverse scenario.

Overall, our study provides insights into the effects and usefulness of stress test-related disclosures. It is shown that the most recent EU-wide stress tests provided value added in terms of providing new information to the market, which by enhancing market efficiency provided support to the broader micro- and macroprudential uses of the stress tests aiming at safeguarding financial stability.

1 Introduction

Stress tests have been increasingly used in recent years by regulators to foster confidence in the banking sector by not only increasing its resilience via mandatory capital increases but also by enhancing transparency to allow investors to better discriminate between banks and thereby contributing to a more efficient market pricing of bank funding costs. Financial crises are typically characterised by heightened uncertainty about the quality and hence valuation of assets held by banks. This can have negative implications for even sound banks' access to and cost of funding, as markets may not be able to properly discriminate between 'good' and 'bad' banks.[1]

The Comprehensive Assessment (CA) conducted by the ECB in 2014 as well as the 2016 EBA EU-wide stress test should also be viewed in this tradition. The stated objectives of the CA were to: (i) strengthen banks' balance sheets by repairing the problems identified through the necessary remedial actions; (ii) enhance transparency by improving the quality of information available on the condition of the banks; and (iii) build confidence by assuring all stakeholders that, on completion of the identified remedial actions, banks will be soundly capitalised.[2] In addition, the publication of the results of the 2014 Comprehensive Assessment marked the beginning of the SSM, a core element of the Banking Union, that was expected to severe the vicious link between banks and their respective sovereign. Similarly, the 2016 stress test aimed at improving market discipline by enhancing transparency.[3]

In this paper, we focus on whether the second stated objective was met: To what extent did information about the underlying quality of banks' assets, their exposures and their resilience to an assumed adverse scenario imply new information to the market and thereby affected the pricing of banks' cost of funding and stock prices? We attempt to answer three main questions in an event study setting on bank (and sovereign) CDS returns and stock price returns around key events during the 2014 and 2016 stress tests. With respect to the 2014 CA we focus on the announcement of the stress test, the clarification of the methodology, the

[1] As asymmetric information between banks and outside investors may become particularly pronounced during a crisis, this is likely to amplify the adverse selection bias where the 'good' banks will be priced out of the market because it cannot distinguish between them and the 'lemons' (the unhealthy banks); see Akerlof (1970)

[2] See ECB (2014) "Aggregate Report on the Comprehensive Assessment", October.

[3] Thus, according to the EBA press release when publishing the 2016 stress test results, "the objective of the stress test is to provide supervisors, banks and other market participants with a common analytical framework to consistently compare and assess the resilience of large EU banks to adverse economic developments. Along with the results, the EBA is providing again substantial transparency of EU banks' balance sheets, with over 16,000 data points per bank, an essential step towards enhancing market discipline in the EU." (see EBA, "EBA publishes 2016 EU-wide stress test results", 29 July 2016)

publication of the Comprehensive Assessment Stress Test (CAST) Manual for the 2014 stress test that laid out the stress test quality assurance methodology and finally the publication of the stress test results. Similarly, for the 2016 stress test we examine the impact on market prices around the announcement of the exercise, the publication of key features and the publication of the results. In light of the significant differences in the design of the 2014 and the 2016 stress tests, the comparison of the market reaction to the two disclosure events can be of interest for regulators wishing to achieve an efficient stress test setup. A further element that we explore is the extent to which stress test related disclosures, incl. potential recapitalisation needs, had any impact on the pricing of CDS spreads on the banks' sovereigns. Stress test disclosures could have an impact on sovereign funding costs both by providing new information about banks' exposures to their sovereign and due to potential fiscal implications if the sovereign has to provide support to banks failing the stress test.[4]

Against this background, we test three hypotheses. We first conjecture that stress tests may reveal new information about the banks being stress tested and therefore impact their market-based funding costs and stock prices. The second hypothesis is that the publication of stress test results improved price discrimination in terms of allowing markets to better discriminate between 'good' banks and 'bad' banks. Finally, the third hypothesis is that the stress test, in particular the 2014 CA, may have affected the CDS prices of the sovereigns of banks being stress tested.

To test these hypotheses we employ an event study approach estimating cumulative "abnormal" returns of banks' CDS spreads and stock prices and sovereign CDS spreads around the stress test events (e.g. announcements, results publication, etc.). To test the second hypothesis, we furthermore distinguish between banks according to what the stress test revealed about their relative strengths and weaknesses.

The main findings are the following:

For what concerns Hypothesis 1 the results show that both the announcement of the key features of the stress test and the publication of results revealed new information that was priced by markets, as reflected in statistically significant abnormal returns.

With respect to whether markets became better at discriminating 'strong' and 'weak' banks (Hypothesis 2) we also find that the market price impact differs across the banks when we measure banks according to how well they perform in the stress tests. The direction of the market price impact between weak and strong banks is however different in the 2014 exercise compared to the 2016 stress test. In the 2014 CA, after the publication of the

[4]The latter feature was mainly an issue for the 2014 CA due to its "pass-fail" nature.

CA results, we observe large, negative abnormal CDS returns for banks with a large CET1 impact resulting from the AQR and the stress test adverse scenario. This may suggest that results for the weaker banks were less bad than expected for bank creditors and given the 'pass-fail' nature of the exercise that creditors of the weaker banks would benefit from the remedial actions required by the weakest performing banks. At the same time, stock prices of the weaker banks performed significantly worse than those of the stronger banks upon publication of the 2014 CA results, which could reflect the likely dilution of equity holders for those weaker banks needing to raise capital as a follow-up to the CA. The opposite pattern can be observed for the 2016 stress test. Banks with large adverse-baseline CET1 ratio gaps reported significantly higher positive abnormal CDS returns after the publication of the stress test results compared to banks with a small adverse baseline gap.[5] While the sign of the expectations may have been different in the two stress tests, the revision of expectations conditional on the credit quality of tested banks provide consistent evidence for the hypothesis that the two stress tests improved the ability of markets to discriminate between 'good' banks and 'bad' banks. We interpret these findings as a confirmation of the fact that the stress test results publication fosters transparency by confirming or adjusting prevailing bank risk perceptions, irrespective of whether the disclosed results triggered a mandatory capital issuance or not.

The comparison of the results of the CDS and stock market event study is of interest because creditors and stock holders may have different incentives with respect to the disclosure of stress test information. The negative abnormal stock returns in conjunction with the negative abnormal CDS returns observed after the publication of the 2014 stress test results point to a disconnect between the stock market and the CDS market. In addition, it seems that stock markets discriminate between 'good' and 'bad banks': Banks with a large CET1 impact resulting from the stress test adverse scenario and the AQR experienced negative abnormal returns, while banks that are well capitalised conditional on the hypothetical adverse scenario and the AQR correction report positive abnormal returns. These results provide support for the hypothesis that regulatory or voluntary capital raising needs uncovered by the stress test may be detrimental to shareholders. In contrast, creditors seem to be more focused on the solvency of the banks and may have been relieved to learn that losses incurred in the adverse scenario were lower than expected. The disconnect between CDS and stock markets cannot be observed for the 2016 stress test. The reason may be the different setup of the 2016 stress test, with creditors benefitting from remedial capital actions in the 2014 but not

[5]The capital impact of the 2014 stress test is computed relative to the end 2013 starting point, in order to account for the effect of the AQR. The capital impact of the 2016 stress test refers to the difference between the CET1 ratio in the adverse and baseline scenario.

in the 2016 stress test. Another explanation could be the different ex-ante expectations of creditors with respect to banks' performance in the stress test.

We also provide evidence that sovereign funding costs were somewhat affected by the publication of stress test results. In the 2014 CA, this was especially the case for sovereigns where stress tested banks had relatively large exposures to their own sovereign, which could indicate a strong bank-sovereign link. In the 2016 stress test, that feature did not seem to affect sovereign CDS spreads (potentially due to the fact that there was no new information compared to previously disclosed data on sovereign exposures) but instead sovereign funding costs displayed abnormal increases in those countries where banks' CET1 buffers were relatively low under the adverse scenario.

This paper is organized as follows: Section 2 and 3 give an overview of the existing literature as well as the main features of the two stress tests, Section 4 describes the data and the empirical methodology. Section 5 discusses the results. Section 6 concludes.

2 Related literature

There is a small but emerging literature on stress test disclosures and their implications.

Some theoretical papers discuss the trade-off implied by the publication of stress test results. Goldstein and Sapra (2012) show that disclosure of supervisory information and stress test results can have a detrimental effect on the ex-ante incentives of banks. In the absence of informational frictions, more information always improves market discipline. In reality, banks are opaque institutions whose reactions are endogenous to the regulatory environment. Banks maximizing equity returns will have incentives to engage in short-term risky projects in order to pass the stress tests. Moreover, as shown by Morris and Shin (2002), if the precision of the disclosed information is not sufficiently high, market participants may place too much weight on the public signal leading to market overreaction and coordination failures.

Similarly, Gick and Pausch (2012) show in a game-theoretical framework that macro stress tests can be welfare improving if the methodology as well as the results of the stress test are communicated effectively. Spargoli (2012) shows that in the case that the regulator is able to recapitalize banks, it is in the interest of the regulator to reveal a bank's capital shortfall. The difference in recapitalization capability is found to partly explain why the market's reaction to stress tests was favorable for the US SCAP and largely negligible in Europe for the 2010 and 2011 stress tests.

Hirtle (2007) shows that enhanced disclosure of bank holding companies is associated with higher risk-adjusted returns. Horvath and Vasco (2012) document various countries' degrees of transparency since the year 2000 and find that in good times increased transparency is beneficial for financial stability. A telling example for the potentially adverse consequences of low disclosure requirements is the 1982 saving and loans crisis in the US. The combination of a pronounced maturity mismatch coupled with rising interest rates led to the insolvency of many US saving banks. The build-up of risks was not apparent from the financial statements of these banks as they reported their financial statements under amortized cost, delaying the recognition of their funding vulnerability (see Elliott et al. (2013)). There is a wide literature documenting the tendency of banks to use reporting discretion in order to manage earnings (see for example Huizinga and Laeven (2012), Laux and Leuz (2009), Kolev (2009) and Song (2010)). This also applies to stress test disclosure, as banks have considerable discretion in mapping their risk parameters to the adverse scenario. As shown by Gao and Jiang (2014), the incentives for misreporting are not linear in the bank's fundamentals. Very 'good' and very 'bad' banks have less incentive for misreporting, while banks in between wish to avoid panic-based runs. This gives rise to pooling equilibria in which 'good' banks avoid panic based runs while 'bad' banks avoid fundamental based runs.

Comparing US and EU stress tests, Schuerman (2013) and Candelon and Amadou (2015) discuss governance aspects that are essential for the effectiveness of stress tests, such as the institutional framework, the scope, the methodology and scenario design, the granularity of disclosed information as well as the planned follow-up actions by the relevant authorities. Their analysis suggests that a strong institutional framework, a credible backstop and efficient communication to market participants are key elements for an effective stress test that may be more important than the technical specifications of the stress test. Frame et al. (2015) review the key features of the supervisory stress tests performed on Fannie Mae and Freddie Mac and identify two major flaws in the setup of the stress test that that rendered these stress tests uninformative. First, the supervisor failed to update the model with data on mortgages originated after 1997 or to extend the model with other relevant variables. Second, the house price adverse scenario was much too mild compared to the actual house price development in the bust. Acharya and Steffen (2014b) criticise the ECB's Comprehensive Assessment for not being stringent enough pointing out a striking divergence between their own market-based stress test estimates and the ECB's stress test results, which in their view can be explained by the reliance on static risk-weights in the regulatory assessment.[6] Homar et al. (2016) however argue that the SRISK approach of Acharya and Steffen by focusing

[6]See also Acharya and Steffen (2014a) and Acharya, Pierret and Steffen (2016).

purely on bank equity losses (and not losses on total assets) is not a well-suited benchmark for supervisory and macroprudential stress tests.

The existing empirical evidence on stress tests suggests that the mandatory disclosure of stress test results generally revealed new information to the market. Breckenfelder and Schwaab (2015) use the reaction of equity and CDS markets to the publication of 2014 stress test results to quantify the cross-border spillovers from changes in banks CDS and equity prices in stressed countries to the sovereign CDS in non-stressed countries. The paper shows that after the publication of stress test results, the debt-weighted sovereign CDS of non-stressed countries (Austria, Belgium, France, Germany and the Netherlands) increased more than the sovereign CDS of stressed countries (Greece, Ireland, Portugal, Italy and Spain), while the corresponding debt-weighted bank CDS remain relatively flat. Moreover, the paper finds that after the results publication, the average response of bank CDS to a change in stock prices is less strong for bank equity located in stressed countries compared to bank equity located in a non-stressed country. Last, sovereign CDS spreads of non-stressed countries seem to be more sensitive to changes in CDS spreads and equity prices of banks located in stressed countries compared to banks from non-stressed countries. The authors interpret these results as evidence for the fact that non-stressed countries provide a priced second line of defense to banks in stressed countries. Barucci et al (2014) analyze cross-sectional drivers of the AQR and stress test shortfall and find a negative correlation with the initial CET1 ratio, bank size, the ratio of non-performing loans and the use of the internal rating based approach (IRB) for the determination of risk-weighted assets. Steffen (2014) discusses the trade-off faced by the ECB between maintaining its reputation as an independent regulator and disclosing bank shortfalls in the absence of credible backstops. In order to emphasize the uncertainty around the results of the Comprehensive Assessment, Steffen (2014) compares several alternative capital shortfall measures that could be used as benchmarks in future exercises, such as a 7% leverage ratio, a market capital shortfall, a capital shortfall in a systemic crisis as well as a capital shortfall after write-down.

Petrella and Resti (2013) finds a significant reaction of stock markets to the publication of the 2011 EU stress test results. Peristian et al. (2010) find that stock markets reacted to the disclosure of policy-related information during the SCAP and to the announcement of the methodology publication. Along the same lines, Neretina et al. (2014) investigate the effects of the announcement, clarication, methodology and outcomes of US bank stress tests on banks' equity prices, credit risk and on systemic risk. While only weak effects on large US banks' equity returns are found, for some exercises, CDS spreads and bank systemic risk declined after the results publication. Ellahie (2012) employs a difference-in-

difference methodology in order to compare tested EU banks with propensity score matched control firms in an event study around stress test announcement and disclosure events of the 2010 CEBS and the 2011 EBA stress tests. The study finds that unlike the publication of the results, the 2010 and the 2011 stress test announcements did not have identifiable effects on information asymmetry.[7] Bischof and Daske (2013) analyze bank behavior after the publication of the 2011 stress test results and show that tested banks increased their subsequent voluntary disclosures on their sovereign exposures. Jordan et al. (2000) analyze the market reaction to the announcement of formal supervisory enforcement actions on US banks. Their results show that the supervisory actions revealed new information and that the cross-sectional variation in the disclosure policy prior to the announcement explains the magnitude of the market reaction. Finally, in a study closely related to ours (albeit for the US), Flannery et al. (2016) present evidence that the Federal Reserve stress tests produce information about both the stress-tested bank holding companies and the overall state of the banking industry. They find that stress test disclosures are associated with significantly higher absolute abnormal returns, as well as higher abnormal trading volume. In addition, they document that more levered and riskier holding companies seem to be more affected by the stress test information.

We add to these studies by comparing the market reactions to the 2014 Comprehensive Assessment with the 2016 EBA stress test. As we will discuss below, the two exercises had slightly different purposes (the first being a 'pass-fail' exercise and the other a supervisory exercise) and how markets react to their publication and disclosures may therefore offer useful insights into the importance and implications of stress test methodologies and disclosure requirements. We also examine the market pricing impact for both bank shareholders and creditors, which could be different due to the implications that stress test outcomes may entail for the two types of investors.

3 The 2014 and 2016 Stress Tests

The ECB 2014 Comprehensive Assessment included an Asset Quality Review (AQR) and a stress test. The scope of the 2014 CA was significantly larger than that of previous EBA stress tests, with more granular information disclosed and extensive quality assurance. The AQR involved the analysis of 119,000 debtors and 170,000 collateral items, while the stress test implied granular analysis of 40 million data points (around 300,000 per bank).

[7] The information asymmetry was proxied by equity and credit bid-ask spreads.

The quality assurance process involved a significant number of ECB top-down models, was automated and data driven, targeting the material deviations that were identified between the banks' own (bottom-up) estimates and those of the ECB (top-down).[8] In addition, the 2014 adverse scenario was widely considered to be more severe - and more credible - than those of past EU-wide stress test exercises. By linking the disclosed capital shortfalls with mandatory equity issuance, the CA was meant to improve the resilience of banks and increase confidence across the European banking sector. The capital plans of banks identified with a shortfall were assessed by the ECB Supervisory Board and challenged by the joint supervisory teams of the newly founded Single Supervisory Mechanism (SSM). Finally, the starting point figures used for the projections were revised figures resulting from the AQR. This feature of the 2014 stress test is essential as the magnitude of this correction in conjunction with the stress test results enables an interpretation of the market reaction to the stress tests results conditional on the bank-specific disclosure quality.

The AQR was intended to be point-in-time assessment of the accuracy of the carrying value of banks' assets as of December 2013. For the banks to be included in the Single Supervisory Mechanism (SSM), the results of the AQR were used as a starting point for the stress test. The stress test was a forward looking examination of the resilience of banks' solvency to two hypothetical scenarios. The minimum required capital under the baseline scenario was set to 8%. The minimum required capital under the adverse scenario was 5.5%.

The 2014 stress test was jointly undertaken by the 130 participating banks, National Competent Authorities, the ECB and the European Systemic Risk Board (ESRB). We also include in our sample the 10 non-euro area banks that were part of the EBA stress test but will not be part of the SSM.

The AQR revealed that bank asset values need to be adjusted by €48 billions. The publication of stress test results showed that the adverse scenario would deplete banks' capital by €263 billion, reducing the median CET1 ratio by 4 percentage points from 12.4% to 8.3%. A combined capital shortfall of €25 billion was detected for 25 participating banks. Considering the capital-rasing actions in 2014, 8 banks would have fallen below the capital threshold of 5%.

Unlike the 2014 stress test, the 2016 stress test did not stipulate a 'pass-fail' CET1 ratio threshold implying that the stress test results would not automatically result in a mandatory capital issuance. This is an important difference to the 2014 stress test. However, the results of the stress test are an important input into the supervisory review process. The

[8] See ECB (2014), "Asset Quality Review - Phase 2 Manual", March; and ECB (2014), "Comprehensive Assessment Stress Test Manual, August.

EBA clarified during the execution phase of the stress test that the results will be part of the supervisory guidance. This guidance does not constitute a legal minimum and does not impact the maximum distributable amount. ECB also clarified that for what concerns SSM significant institutions taking part in the exercise, the stress test results "...contribute in a non-mechanistic way as one of several input factors to determine Pillar 2 capital in the ECBs overall Supervisory Review and Evaluation Process (SREP)". It also clarified that the stress test results "are used by the ECB in Pillar 2 guidance, taking additionally into account consequences of the static balance sheet assumption and banks mitigating management actions among other factors."[9] The ECB did however clarify in separate communication that a benchmark for how stress test results are treated in the SREP would be the banks' adverse scenario results in relation to a CET1 ratio of 5.5% or, in the case of global systemically important banks (G-SIBs), 5.5% plus the G-SIB buffer. Markets could therefore interpret banks falling below this threshold as banks failing the stress test and thus require some form of recapitalisation (even if filling the shortfall would occur in a less mechanistic manner and subject to more supervisory discretion, compared to the 2014 exercise). Overall, the adverse scenario led to a 380 bps drop in the starting point CET1 ratio of 13.2% by the end of the three-year scenario horizon. The fully-loaded CET1 ratio fell from 12.6 to 9.2% while the aggregate leverage ratio dropped from 5.2 to 4.2% in the adverse scenario.

4 Methodology

Empirical Method

In order to gauge the impact of the stress test-related events we employ an 'event study' approach. For this purpose, we estimate cumulative returns and cumulative excess returns around the stress test events (i.e. announcements of the exercises, publication of key features such as methodologies and scenarios, publication of results). Table 7 provides an overview of the key events during the 2014 CA and the 2016 stress test exercises that we analyse.

A number of strategies for the estimation of excess returns exist.[10] Excess returns of a security are traditionally defined as the actual ex-post return over the event window minus a normal return of the same security of the event window. The normal return is the expected return without conditioning on the event taking place or taking into account external factors. Other event studies on related topics use one or two factor models to control for external

[9] See ECB Banking Supervision press release 29 July 2016.

[10] For a review of methodologies, see Brown and Warner (1985) and MacKinlay (1997).

factors. Peristian et al. (2010) regress the daily stock return on the market return only, proxied by the S&P financial index, Cardinali and Nordmark (2011) employ a univariate model and use the MSCI World Index, while Jordan et al. (2000) use two versions of a two-factor model.

For the purpose of our assessment, we also employ a standard method whereby for all banks and sovereigns we compute excess returns relative to the market; that is, we employ a "market model" approach (MacKinlay (1997)). These are computed as the residuals from a set of regression equations (one equation for each sovereign and bank) that relate the individual bank and sovereign market prices to market dynamics. Each bank (sovereign) i is regressed on the set of two common regressors: the day-on-day returns of the financial and sovereign indices.

$$R_{t,i}=\alpha_0 + \alpha_1 R_t^{fin} + \alpha_2 R_t^{sov} + \varepsilon_{t,i} \; . \tag{4.1}$$

where $R_{t,i}$ is the return on bank i (or sovereign i) in period t, R_t^{fin} is the return on the market index for banks, and R_t^{sov} is the return of the sovereign CDS index.[11] [12] Abnormal returns, i.e. the equations' residuals, are estimated using a 30 business days rolling window and a robust Iteratively Reweighted Least Squares (IRLS) method.[13] Rolling sets of residuals are computed for each window. The excess returns implied by the model are given by $\varepsilon_{t,i}$. In the second stage, excess returns over the relevant window around the event date are used to compute excess/abnormal returns (CARs). The event window considered was 2 days. The results were robust to alternative window lengths, while the 2-day window turned out to be more informative (and thus the one reported below in the results section). For the purpose of assessing the significance of the excess returns, we employ a standard t-test methodology.

[11] The sovereign CDS index return at a given point in time t is defined as the simple average of the individual sovereign CDS returns at that time t.

[12] Our method is not entirely standard with regard to the fact that we include some sovereign return measure on the right hand-side of the equations for the banks, and mirror-wise the bank market returns in the equations for the individual sovereigns. This feature owes to our presumption that non-negligible links exist between banks (in particular sizable, systemically relevant ones) and sovereigns, due to various forms of implicit and explicit guarantees that effectively tie the risk pertaining to banks and sovereigns together. Controlling for such known links is therefore warranted.

[13] IRLS finds the maximum likelihood estimates of a generalized linear model, and in the framework of robust regressions finds the M-estimator, as a way to deal with outliers and non-normally distributed data by minimizing the least absolute error rather than the least squared error.

Data

CDS and stock price data are not available for all banks stress tested in the 2014 and 2016 European exercises.

For what concerns the data on CDS spreads a sample of 62 European stress tested banks was selected on the basis of availability of CDS spread data. 62 of these banks participated in the 2014 CA and 36 banks participated in the EBA 2016 stress test.[14] In addition, for the event study on the 2016 stress test exercise we also include in one specification 26 and 14 European banks that were not tested for the CDS and stock event study, respectively, in order to gauge differences in the market impact around the stress test result publication between banks included in the exercise and those not being tested (see Table 3 below). For the 2014 CA, the number of non-stress tested banks for which CDS spreads were available was not big enough to constitute a reliable 'control' group. Table 6 provides an overview of the banks included in our sample.

For each bank and the corresponding sovereign daily 5-year maturity senior CDS, prices were collected from Datastream, and Bloomberg in those cases where the respective bank CDS prices were not available on Datastream. Even if the CDS spreads used in the estimations were observed spreads, they could be highly illiquid, as can be seen in the stale prices for some banks. The log transformation of CDS spreads in returns leads to zero returns for these observations. As an example, 5 of the 62 tested banks reported zero returns around the publication of the 2014 results. These banks were kept in the sample as it was considered that an abnormal return of zero is also informative.[15] Indices for bank CDS and sovereign CDS spreads are the ITRX Financial and the ITRX Sovx, respectively. Realized volatilities of these indices are calculated using 5-day rolling windows.

For what concerns equity prices daily stock price data for 45 European banks was obtained from Bloomberg. 31 one of those banks were stress tested in the 2014 and 2016 exercises, while 14 banks were not participating in the stress tests but were included as a non-tested

[14] Only for 62 of the 140 banks participating in the 2014 EBA stress test CDS data was available. 10 non-euro area EU banks were included in the 2014 EBA stress test but not in the CA. The 2016 stress test sample included 51 banks covering around 70% of total assets in each country in the EU. 37 out of these 51 bank are supervised by the ECB. CDS data was available for 36 banks included in the EBA sample.

[15] For 51 of the 59 banks for which CDS data was available on Datastream the veracity score was available. The veracity score indicates the type of price used in calculating the CDS spread. A score value of 1 indicates an observed market spread while a score value of 2 indicates a derived spread. For at least 70% of the 51 banks, the veracity score is lower than 1.5 on average during the estimation and event period for both the 2014 and the 2016 stress test. The average veracity score ranges from 70% for the abnormal returns estimated around the results publication for the 2014 stress test and 76% for the abnormal returns estimated around the announcement of the 2014 stress test.

'control' group (see Table 3 below).

The impact on sovereign CDS spreads following stress test publications could be particularly pronounced for countries where banks hold large sovereign exposures. The absolute exposure of each bank to all regions is weighted by the CDS spreads of the respective sovereigns and expressed relative to the total assets of each bank.

$$Sov.\ exp.\ bank_i = \sum_{j=1}^{30} \frac{\{\frac{Net\ direct\ position\ bank\ i\ to\ country\ j}{TA_i}\ x\ CDSS_j \times 100\}}{\sum_{j=1}^{30} CDSS_j}$$

where CDSS and TA refer to the CDS spread of sovereign j and bank i's total assets, respectively. For each bank, the sovereign exposures per country was obtained from the 2014 and 2016 stress test databases available on the EBA website. Accounting values gross of provisions were used.[16]

5 Results

Hypothesis 1: Did the 2014 and 2016 stress tests reveal new information?

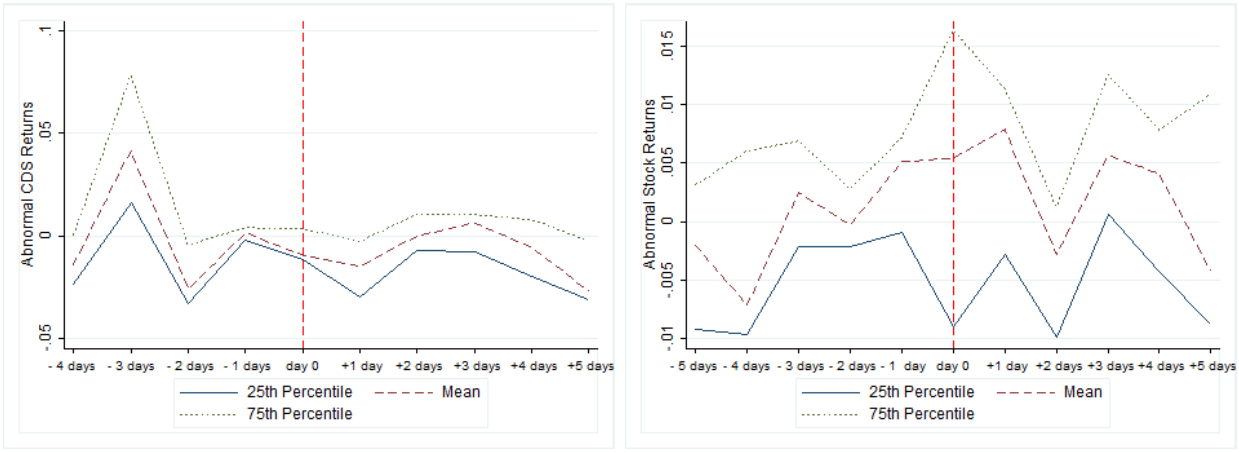
The disclosure of stress test information involves a trade-off between fostering transparency and possibly adversely affecting financial stability. On the one hand, more transparency improves market investors' ability to discriminate between banks and may enhance incentives for prompt corrective action by identifying banks with capital shortfalls. On the other hand, disclosure of bad news about banks that are already under financial strain can lead to market overreaction and hurt financial stability. This is particularly harmful when the precision of the disclosed information is low, as market participants will place too much weight on the public signal (see Morris and Shin (2002)). Moreover, more disclosure improves transparency only if it is effective in reaching market participants. Information that is not considered to be sufficiently precise, for example due to an ill-designed disclosure template or due to market perception that the quality assurance process cannot prevent banks from engaging in 'beauty contests', will not achieve this objective. It could also be that the information disclosed in the stress test was anticipated. Even though in theory supervisors have an informational advantage over market participants, it cannot be ruled out that in some cases

[16] In the EBA statistical dictionary this corresponds to gross direct exposures, item number 993301.

private information is more timely than the information disclosed by the supervisor (see Berger et al. (2000)).

If market participants had doubts about the reliability of the disclosed information or if they could anticipate the stress test results, we should observe abnormal returns that are not statistically different from zero around the stress test-related events (announcement, clarification of key features and results publication). In contrast, significant abnormal excess returns suggest that the stress test-related events revealed new information (our Hypothesis 1).

Figure 1. Bank CDS and Equity Abnormal Returns - Stress Test 2014



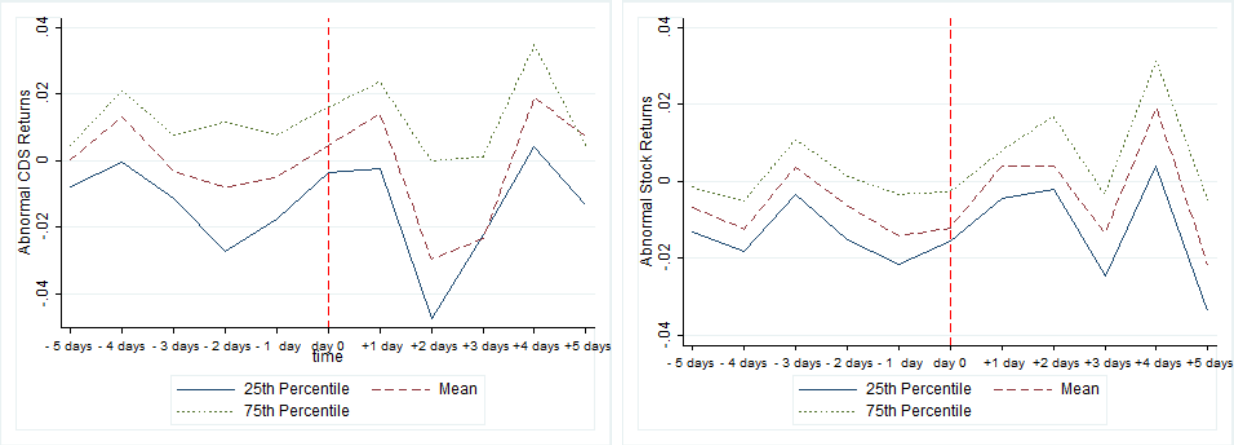
(a) CDS abnormal returns **(b)** Stock abnormal returns

Figure 1 shows the cross-sectional distribution of abnormal bank CDS and equity returns of tested banks around the publication of the 2014 stress test results. Positive abnormal bank CDS returns were reported in the days before the results publication, presumably in response to the speculation in the media regarding the magnitude of the downward revisions (left-hand panel). The negative abnormal returns around the publication date could be interpreted as a relief following these conservative expectations. Looking at abnormal stock returns (right-hand panel), there seems to be significant cross-sectional heterogeneity in the days before the publication. After the publication of results, abnormal stock returns became negative for most banks and recovered in the following days. It is also noticeable that while mean abnormal returns were overall mostly hovering around zero there were tails of the distribution where the market impact around the stress test event differed substantially from zero. The cross-distributional effects will be explored further below (Hypothesis 2).

Similarly, Figure 2 shows the cross-sectional distribution of abnormal bank CDS and equity returns around the publication of the 2016 stress test results. Negative abnormal returns

can be observed in the days before the publication of the results, with CDS returns changing sign after the publication date. The comparison of the two figures suggests that in the case of CDS markets, the different sign of the CDS abnormal returns in the 2016 exercise may be due to different ex-ante expectations compared to the 2014 stress test.

Figure 2. Bank CDS and Equity Abnormal Returns - Stress Test 2016



(a) CDS abnormal returns **(b)** Stock abnormal returns

In order to test Hypothesis 1, Tables 1 and 2 report the abnormal returns obtained from the CDS and stock event study in the 2014 and 2016 stress tests, respectively. Throughout this paper, the sign of the abnormal returns is interpreted as a revision of previous expectations conditional on the new information revealed by the various stress test events.

Table 1 (upper panel) shows that the *announcement* of the 2014 stress test in late January 2014 as well as the announcement of the key features (incl. methodology and scenarios) in April 2014 resulted in positive abnormal CDS returns for tested banks (and significant negative abnormal stock returns following the announcement of key features, as can be seen in the lower panel in table 1). This could be due to uncertainty on the financial position and resilience of tested banks and their ability to raise the amount of capital revealed by the stress test.[17] At the time of the publication of the results in October 2014, however, markets seemed to have largely priced in the results as reflected in the non-significant abnormal (negative) CDS and stock returns.

The comparison of the results of the CDS and stock market event study is of interest because

[17]Banks with shortfalls had to submit capital plans by the 10th of November 2014. These plans were to be evaluated by the Supervisory Board by December 2014, while the joint supervisory teams would be in charge of assessing the adequacy and credibility of capital plans. Banks would then have to cover the shortfalls within 6 months for shortfalls identified in the AQR or stress test baseline scenario and within 9 months for shortfalls identified in the stress test adverse scenario.

creditors and stock holders may have different incentives with respect to the disclosure of stress test information. More information can be beneficial for creditors due to lower monitoring costs, while mandatory capital actions as a result of the stress test decreases the default probability and hence the funding cost. In contrast, mandatory equity issuance can be detrimental for equity holders due to its a diluting effect on share values. From this perspective, although the results did not trigger large abnormal returns, it is nevertheless interesting to observe that the direction of returns pointed to a (slight) improvement in banks' default probability as reflected in negative CDS spreads while the value of bank stocks declined on average.

Turning to the 2016 stress test Table 2 (upper panel) shows that for the 2016 exercise CDS abnormal returns the opposite pattern can be observed. While the announcement of the key features of the scenario and stress test methodology in February 2016 led to negative abnormal CDS returns, these positive expectations were reverted upon results publication following which significantly positive abnormal CDS returns were observed. This finding is corroborated by the comparison of CDS abnormal returns between stress tested and non-stress tested banks, as illustrated in the upper panel of Table 3, which shows that tested banks experienced significantly higher CDS abnormal returns than non-tested banks. Likewise, when looking at the stock price reactions (lower panel of Table 2), excess stock returns are found to be significant and negative both in relation to the announcement of key features and following the publication of results. One reason could be that 2016 stress test results were assessed by market participants to have been worse than anticipated.[18] Another reason could be that the 2016 exercise did not foresee any fail and pass threshold or mandatory capital issuance. As a result, creditors of problematic banks would not benefit from the improved solvency following mandatory regulatory capital issuance.[19] Another potential explanation may be that the results for tested banks are driven by the banks with a poor performance in the stress test, and for which the publication of the stress test results led to a downward revision of market expectations (to be explored more in detail below). Additional generalised uncertainty may have been created by the impact of the Brexit - which was clearly not part of the macro scenario - on UK and possibly other European banks.[20]

The next section sheds more light on the drivers of this result by analyzing cross-sectional differences across the various sub-samples.

[18]The decrease in CET1 ratio is of similar magnitude in the 2014 versus 2016 stress test, with a 380 bps decline in the starting point CET1 ratio in 2016 versus 300 bps in 2014 (including the AQR correction).

[19]This notwithstanding, mainly due to substantial capital raising efforts between 2014 and 2016, only one of the 51 banks fell below the 5.5% that was relevant in the 2014 stress test.

[20]The UK referendum on EU membership took place on 23 June 2016, approximately one month prior to the release of the stress test results.

Hypothesis 2: Did the stress test improve price discrimination?

Banks are relatively opaque institutions whose assets are difficult to evaluate by external parties, for example creditors, regulators and market participants. This information asymmetry (possibly combined with the implicit government guarantee for banks) can result in a disconnect between banks funding costs and their risk profile. As a consequence, the ability of creditors to distinguish between 'good banks' and 'bad banks' can be impaired, especially during periods of heightened uncertainty. This may result in inefficient resource allocations at the expense of depositors and taxpayers. In this context, mandatory disclosure via stress tests can overcome the above mentioned inefficiency and improve price discrimination as stipulated by Hypothesis 2.

The upper panel in Table 4 shows that after the publication of the 2014 stress test results, banks with a large CET1 impact resulting from the AQR report significantly higher negative CDS abnormal returns than banks with a low impact. We interpret the negative abnormal returns as evidence for the revision of previous conservative estimates on the magnitude of the capital shortfall and/or the AQR corrections. This result suggests that the disclosure of the CA results enhanced price discrimination. This finding is confirmed when looking at the excess stock returns in the lower panel in Table 4 which displays significant, more negative abnormal returns for banks performing worse in the stress test (in terms of CET1 ratio impact). Thus, looking at the different sub-samples in the lower panel in Table 4, it seems that stock markets do discriminate between 'good' and 'bad banks': Banks with a large CET1 impact resulting from the AQR and the stress test adverse scenario report negative abnormal returns, while banks that are well capitalised after the adverse scenario and the AQR correction report positive abnormal returns. The difference between the two groups is statistically significant. This could reflect that regulatory actions implied by the stress test are seen as detrimental to shareholders.

In contrast, for the 2016 stress test, Table 5 shows that capital-constrained banks - as measured by the adverse baseline gap - reported significantly higher positive excess returns after the publication of stress test results compared to better capitalized banks. A similar reaction can be observed for stock markets in the lower panel in Table 5. Poorly capitalized banks under the adverse scenario reported higher negative returns compared to banks with a high capital buffer. Thus, it seems that the publication of the stress test results improved the price discrimination between 'good' and 'bad' banks.

The above disconnect between CDS and stock markets cannot be observed for the 2016 stress test. The reason may be the different setup of the 2016 stress test, with the creditors

benefitting from compulsory remedial capital actions in the 2014 but not in the 2016 stress test. Another explanation could be the different ex-ante expectations of creditors with respect to bank performance.

Taken together, the results of both the 2014 and 2016 stress test suggest that that price discrimination was enhanced to the extent that previous expectations on well versus poorly capitalized banks were revised. Even if the pricing before the stress test results publication was already reflecting these risk characteristics of tested banks, the new information revealed by the stress test is reflected in the lower/higher than expected downward correction.

Hypothesis 3: Bank-sovereign risk spillover

The size of banks' sovereign exposure can be seen as a measure of the strength of the link between the bank and the sovereign. Sovereign distress can directly affect banks through their holdings of sovereign bonds, while a fragile banking sector increases the contingent liabilities of the sovereign, further deteriorating the financial position of banks with a large sovereign exposure.[21]

Looking at the 2014 stress test, Table 1 (mid panel) shows that sovereign CDS spreads reacted in similar ways as those of the tested banks. For example, at the time of the *clarification of the methodology* sovereign CDS excess returns were significantly positive while they were followed by significantly negative abnormal returns upon the publication of the stress test results. The latter result could reflect that capital shortfalls identified in the 2014 CA were deemed small enough (and perhaps smaller than a priori expected) for banks to be able to address them via private solutions without having to rely on the sovereign.

At the same time, the middle panel in Table 4 provides evidence for the risk transfer from the bank to the sovereign after the *publication* of the CA results in October 2014, with the sovereign CDS spreads of banks with a large CET1 impact resulting from the Comprehensive Assessment reporting significantly larger negative abnormal returns than the sovereign of banks with a low CA CET1 impact. The same pattern can be observed for the reaction of the sovereign of banks with large (small) sovereign exposure; that is, for sovereigns which exhibit a stronger link to domestic banks.[22]

[21] See e.g. Acharya, Drechsler and Schnabl (2014), Gennaioli et al. (2014) and Faia (2016).

[22] This is not in line with Breckenfelder and Schwaab (2015) who find no significant relation between the reaction of bank CDS spreads and their respective sovereign. The authors interpret the stronger reaction of sovereign CDS in non-stressed countries to changes in bank CDS spreads and equity in stressed countries compared to non-stressed countries as evidence of a risk transfer from the last to the former group of countries. Differences in results could be attributed to differences in the econometric setting, as Breckenfelder

In contrast, for the 2016 stress test the link between the bank and the respective sovereign is less pronounced. The middle panel in Table 3 shows that the sovereign of stress tested banks reported significantly higher negative abnormal CDS returns compared to non-tested banks after the publication of key features of the stress test. These expectations were reverted upon results publication. The middle panel in Table 5 suggest that the results are driven mostly by the sovereign of banks experiencing a low CET1 buffer under the adverse scenario.

Overall, the results of the 2014 stress test provide evidence that the bank-sovereign link is priced by the markets, thus confirming Hypothesis 3. The large negative sovereign abnormal CDS returns observed after the publication of the 2014 results suggest that creditors were relieved to learn the lower than expected capitalization needs weighing on the fiscal position of the sovereign. The comparison with the 2016 results suggests that in the context of the stress test, this relation depends on particular features of the exercise. In particular, it seems intuitive that this relation is stronger when the stress test features a 'fail and pass' threshold, followed by mandatory capital issuance, implying a potential need for the sovereign to recapitalize 'bad banks' after the stress test. A further explanation could be that at the time of the 2016 stress test markets were already well informed about the extent of banks' sovereign exposures following the EBA's 'transparency exercises' of previous years as well as the ECB's Comprehensive Assessment in 2014. The news content of the 2016 stress test disclosures related to sovereign exposures may therefore have been limited.

6 Conclusions

The aim of the analysis presented in this paper was to gauge whether the 2014 and 2016 European stress tests, and their related individual bank disclosures, provided new information to the market, affecting the pricing of banks' cost of funding and stock prices as well as the funding costs of their sovereigns.

For this purpose, we tested three hypotheses. We first conjectured that stress tests may reveal new information about the banks being stress tested and therefore impact their market-based funding costs and stock prices. The second hypothesis is that the publication of stress test results improved price discrimination in terms of allowing markets to better discriminate

and Schwaab (2015) are using a difference-in-difference estimator compared to an event study setting in this paper, while the time horizon is considerably longer, 14 days versus 2-5 days for the event window in this paper. More importantly, the authors seem to interpret a negative correlation between the change in banks and sovereign CDS spreads as evidence of a weak bank-sovereign link. However, a strong negative correlation can also be interpreted as evidence of a risk transfer from the bank to the respective sovereign.

between 'good' banks and 'bad' banks. The third hypothesis is that the stress test, in particular the 2014 CA, may have affected the CDS prices of the sovereigns of banks being stress tested. For what concerns Hypothesis 1, the results show that both the announcement of the key features of the stress test and the publication of results revealed new information that was priced by markets, as reflected in statistically significant abnormal returns. With respect to whether markets became better at discriminating 'strong' and 'weak' banks (Hypothesis 2) we also find that the market price impact differs across the banks when we measure banks according to how well they perform in the stress tests. As regards the third hypothesis we provide evidence that sovereign funding costs were somewhat affected by the publication of stress test results.

Moreover, especially in the context of the 2014 Comprehensive Assessment we find that stock market and debt market price reactions went in opposite directions. This may reflect that creditors and stock holders have different incentives with respect to the disclosure of stress test information. For instance, regulatory or voluntary capital raising needs uncovered by the stress test may be detrimental to shareholders as their shares would be diluted. In contrast, creditors seem to be more focused on the solvency of the banks which should be improved by capital raising following the stress test. The disconnect between CDS and stock prices cannot be observed for the 2016 stress test. The reason may be the different setup of the 2016 stress test, with the creditor benefitting form remedial capital actions in the 2014 but not in the 2016 stress test. Another explanation could be the different ex-ante expectation of creditors with respect to bank performance.

Overall, our study provides insights into the effects and usefulness of stress test-related disclosures. It is shown that the most recent EU-wide stress tests provided value added in terms of providing new information to the market, which by enhancing market efficiency provided support to the broader micro- and macroprudential uses of the stress tests aiming at safeguarding financial stability.

7 Appendix

Table 1: Cumulative Excess CDS and Stock Returns (2014 Stress Test)

Event\Sample	N Obs	Mean	Std Dev	Min	Max
Bank CDS CAR					
Announcement	61	0.07*	0.03	-0.15	0.09
Key Features	61	0.029***	0.04	-0.03	0.19
CAST Manual	61	-0.009	0.05	-0.12	0.27
Results	61	-0.001	0.03	-0.13	0.08
Sovereign CDS CAR					
Announcement	61	-0.001	0.01	-0.02	0.03
Key Features	61	0.011***	0.02	-0.03	0.03
CAST Manual	61	0.010***	0.03	-0.06	0.08
Results	61	-0.026***	0.04	-0.12	0.03
Stock CAR					
Announcement	33	0.008	0.04	-0.07	0.12
Key Features	33	-0.018***	0.02	-0.08	0.02
CAST Manual	33	-0.001	0.08	-0.11	0.37
Results	33	-0.014	0.07	-0.11	0.28

The table reports the summary statistics of the cumulative abnormal CDS and stock returns of tested banks and the corresponding sovereigns around the 2014 stress test related events. The announcement event refers to 31/01/2014, the date when the 2016 stress test was announced. The key features of the stress test were clarified on the 29/04/2014. The Comprehensive Assessment and Stress Test (CAST) was published on the 08/08/2016. The stress test results were published on the 26/10/2014. ***, **, * indicate p-values below 0.01, 0.05 and 0.1 respectively.

Table 2: Cumulative Excess CDS and Stock Returns (2016 Stress Test)

Event\Sample	N Obs	Mean	Std Dev	Min	Max
Bank CDS CAR					
Announcement	36	0.005	0.023	-0.028	0.108
Key Features	36	-0.016**	0.044	-0.120	0.096
Results	36	0.028***	0.042	-0.021	0.227
Sovereign CDS CAR					
Announcement	36	0.022**	0.06	-0.04	0.19
Key Features	36	-0.037***	0.02	-0.08	0.00
Results	36	0.006***	0.01	-0.01	0.02
Stock CAR					
Announcement	31	-0.002	0.012	-0.039	0.029
Key Features	31	-0.062***	0.024	-0.123	-0.022
Results	31	-0.008**	0.017	-0.064	0.034

The table reports the summary statistics of the cumulative abnormal CDS and stock returns of tested banks and the corresponding sovereigns around the 2016 stress test related events. The announcement event refers to 5/11/2016, the date when the 2016 stress test was announced. The key features of the stress test were clarified on the 24/02/2016. The stress test results were published on the 29/07/2016. ***, **, * indicate p-values below 0.01, 0.05 and 0.1 respectively.

Table 3: Cumulative Excess CDS and Stock Returns (2016 Stress Test)

Event/Sample	Tested	Not Tested	t test
Banks CDS CAR			
Announcement	0.005	0.008	0.69
Key Features	-0.016	-0.012	-0.27
Results	0.028	0.005	2.61**
Sovereign CDS CAR			
Announcement	0.022	0.000	1.65*
Key Features	-0.036	-0.045	1.61*
Results	0.006	0.003	0.98
Stock CAR			
Announcement	-0.002	0.027	-2.12**
Key Features	-0.062	-0.063	0.11
Results	-0.008	-0.001	-1.09

The table reports the average excess CDS and stock returns of banks and the corresponding sovereigns CDS abnormal returns around the 2016 stress test events. The CDS event study includes 36 tested banks and 26 non-tested banks. The stock return event study includes 31 tested and 14 non-tested banks. The announcement event refers to 5/11/2016, the date when the 2016 stress test was announced. The key features of the stress test were clarified on the 24/02/2016. The stress test results were announced on the 29/07/2016. ***, **, * indicate p-values below 0.01, 0.05 and 0.1 respectively.

Table 4: Cumulative Excess Returns (2014 Stress Test)

Sample	Sub-sample 1	Sub-sample 2	t test
Bank CDS CAR			
Large vs small CA CET1 impact	-0.006	0.006	-1.16
Large vs small sovereign exposure	0.001	-0.005	0.67
Large vs small AQR CET1 buffer	-0.008	0.009	-1.99**
Small vs large CET1 buffer	0.001	-0.001	0.35
Sovereign CDS CAR			
Large vs small CA CET1 impact	-0.033	-0.031	-1.41*
Large vs small sovereign exposure	-0.051	-0.003	-5.1***
Large vs small AQR CET1 buffer	-0.034	-0.029	-0.4
Small vs large CET1 buffer	-0.037	-0.03	-1.1
Stocks CAR			
Large vs small CA CET1 impact	-0.038	0.008	-2.1**
Large vs small sovereign exposure	-0.047	0.017	-3.1***
Large vs small AQR CET1 buffer	-0.043	0.016	-2.77***
Small vs large CET1 buffer	-0.024	-0.005	-0.77

The first two columns report the average excess returns after the publication of the stress test results on the 26/10/2014. The last column reports the values of the t statistic comparing the respective sub-samples. The large/small sub-samples refer to average returns of banks for which the CET1 impact after the Comprehensive Assessment (CA) or alternatively capital buffers/sovereign exposures are above (below) the median. The first two panels report the excess CDS returns of the 62 tested banks and the respective sovereign. The lower panel reports the stock excess returns of 33 tested banks. The CET1 impact after the CA refers to the decrease in CET1 capital ratio due to the stress test adverse scenario and the AQR. The CET1 impact resulting from the AQR refers to credit exposure corrections before any offsetting effects. The capital buffer refers to the CET1 capital ratio above 7% in the adverse scenario. For each bank, the sovereign exposures per country was obtained from the 2014 stress test database available on the EBA website. ***, **, * indicate (one-sided) p-values below 0.01, 0.05 and 0.1 respectively.

Table 5: Cumulative Excess Returns (2016 Stress Test)

Sample	Sub-sample 1	Sub-sample 2	t test
Bank CDS CAR			
Large vs small adverse baseline gap	0.043	0.013	2.26**
Large vs small sovereign exposure	0.036	0.021	1.07
Small vs large CET1 buffer	0.023	0.034	-0.82
Sovereign CDS CAR			
Large vs small adverse baseline gap	0.004	0.007	-0.86
Large vs small sovereign exposure	0.005	0.006	-0.53
Small vs large CET1 buffer	0.009	0.003	1.79*
Stocks CAR			
Large vs small adverse baseline gap	-0.008	-0.008	-0.05
Large vs small sovereign exposure	-0.006	-0.010	0.7
Small vs large CET1 buffer	-0.012	-0.004	-1.51*

The first two columns report the average excess returns after the publication of the stress test results on the 29/07/2016. The last column reports the values of the t statistic comparing the respective sub-samples. The large/small sub-samples refer to average returns of banks for which the gap between the baseline and adverse CET1 ratios in the stress test or alternatively capital buffers/sovereign exposures are above (below) the median. The first two panels report the excess CDS returns of the 36 tested banks and the respective sovereign. The lower panel reports the stock excess returns of 31 tested banks. The capital buffer refers to the CET1 capital ratio above 7% in the adverse scenario. For each bank, the sovereign exposures per country was obtained from the 2016 stress test database available on the EBA website. ***, **, * indicate (one-sided) p-values below 0.01, 0.05 and 0.1 respectively.

Table 6: Sample of Banks (2014 and 2016 Stress Test)

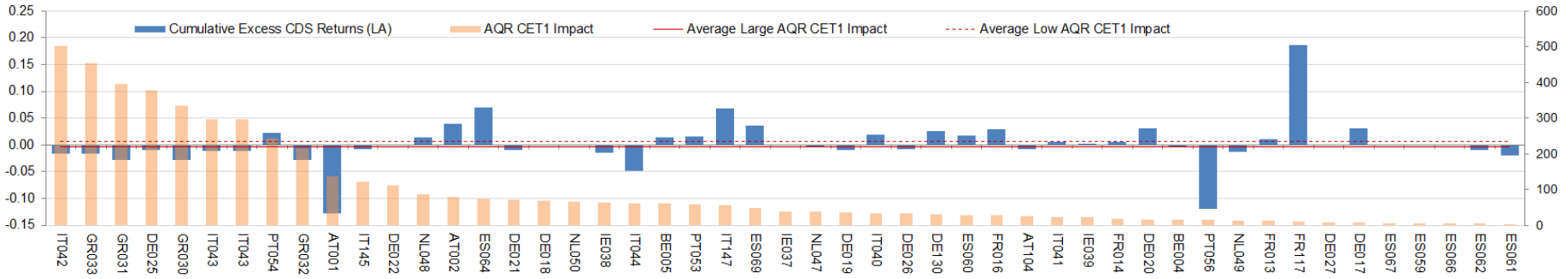
EBA Identifier	Bankname	Tested 2016	Tested 2014
AT001	Erste Group Bank AG	Yes	Yes
AT002	Raiffeisen Zentralbank sterreich AG	Yes	Yes
BE005	KBC Group NV	Yes	Yes
DE017	Deutsche Bank AG	Yes	Yes
DE018	Commerzbank AG	Yes	Yes
DE019	LB.Baden-Wuertemberg	Yes	Yes
DE021	Bayerische Landesbank.	Yes	Yes
DE026	LB.Hessen-Thuringen	Yes	Yes
DK008	Dankse bank	Yes	Yes
ES059	Banco Santander, S.A.	Yes	Yes
ES060	Banco Bilbao Vizcaya Argentaria, S.A.	Yes	Yes
ES064	BANCO POPOLAR ESPN. SA	Yes	Yes
ES065	BANCO SABADELL SA	Yes	Yes
FR013	BNP Paribas	Yes	Yes
FR014	Groupe Crdit Agricole	Yes	Yes
FR016	Socit Gnrale	Yes	Yes
FR117	Banque Fedv	Yes	Yes
GB088	Royal Bank of Scotland Group	Yes	Yes
GB089	HSBC Holdings Plc	Yes	Yes
GB090	Barclays Bank Plc	Yes	Yes
GB091	Lloyds Bank Plc	Yes	Yes
IE037	Allied Irish Banks plc	Yes	Yes
IE038	Bank of Ireland	Yes	Yes
IT040	Intesa Sanpaolo S.p.A.	Yes	Yes
IT041	UniCredit S.p.A.	Yes	Yes
IT042	Banca Monte dei Paschi di Siena S.p.A.	Yes	Yes
IT043	Banco Popolare - Societ Cooperativa	Yes	Yes
IT044	UBI Banca	Yes	Yes
NL047	ING Bank NV	Yes	Yes
NL048	Rabobank	Yes	Yes
NL049	ABN Amro Bank N.V.	Yes	Yes
NO051	DnB NOR Bank ASA	Yes	Yes
SE084	Nordea Bank AB (publ)	Yes	Yes
SE085	Skand Enskilda Banken AB	Yes	Yes
SE086	Svenska Handelsbanken AB (publ)	Yes	Yes
SE087	Swedbank AB (publ)	Yes	Yes
AT104	BAWAG P.S.K	No	Yes
BE004	Dexia NV	No	Yes
DE020	DZ BANK AG	No	Yes
DE025	HSH Nordbank AG	No	Yes
DE130	IKB Deutsche Industriebank AG	No	Yes
ES061	Bankia SA	No	Yes
ES062	La Caja des Ahorros y Pensiones	No	Yes
ES069	Bankinter, S.A.	No	Yes
GR030	Eurobank Ergasias, S.A.	No	Yes
GR031	National Bank of Greece, S.A.	No	Yes
GR032	Alpha Bank, S.A.	No	Yes
GR033	Piraeus Bank, S.A.	No	Yes
IE039	Permanent LTD	No	Yes
IT145	Mediobanca - Banca di Credito Finanziario S.p.A.	No	Yes
IT147	Banca Popolare Di Milano	No	Yes
PT053	Caixa Geral des Deposits	No	Yes
PT054	Banco Comercial Portugues, SA	No	Yes
PT056	Banco BPI, SA	No	Yes
CH001	Credit Suisse	No	No
CH002	UBS AG	No	No
DE024	WESTLB AG	No	No
ES083	Caja del Ahorros del Med	No	No
FR113	Natixis	No	No
GB192	Nationwide Building Society.	No	No
GB193	Standard Chartered	No	No
PT055	Banco Espirito Santo	No	No

Table 7: Stress Test Events

2014 Stress Test	
Announcement	31/01/2014
Key Features	29/04/2014
CAST Manual	08/08/2018
Publication	26/10/2014
2016 Stress Test	
Announcement	05/11/2015
Key Features	24/02/2016
Publication	29/07/2016

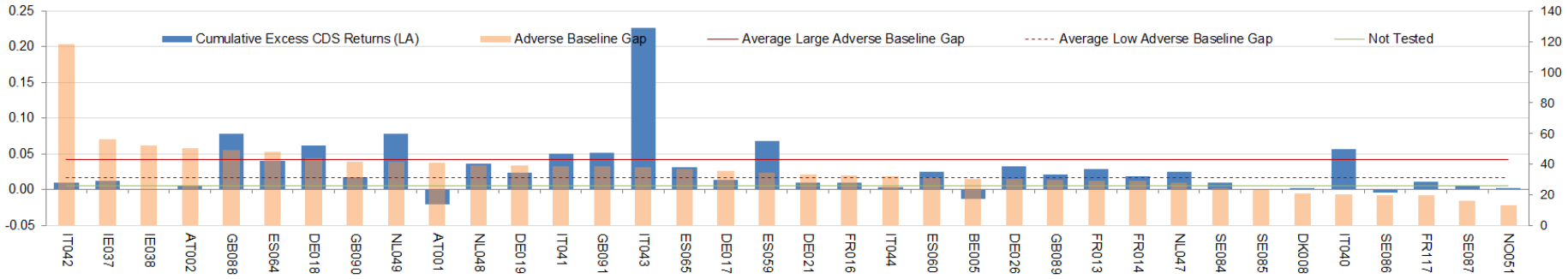
The table reports the dates of each of the events considered in the 2014 and 2016 event study. The 'Announcement' event refers to the date when the EBA announced a new stress test. 'Key Features' refers to the date when clarifications on the stress test methodology and the scenario were published. 'CAST Manual' refers to the publication of the Comprehensive Assessment manual by the ECB, containing further details on the quality assurance process. The 'Results' event refer to the date when the stress test results were published.

Figure 3. 2014 EBA Stress Test Cumulative 2-day (post event) excess returns - AQR CET1 Impact (bps)



Note: The left axis shows the cumulative 2-day post event excess CDS returns after the stress test results publication on the 26/10/2014. The right axis shows the CET1 impact resulting from AQR credit exposure corrections before any offsetting effects expressed in percent. Average large (small) CET1 impact refers to the average cumulative excess returns for the banks with the CET1 impact higher (lower) than the median.

Figure 4. 2016 EBA Stress Test Cumulative 2-day (post event) excess returns (Publication) - Adverse Baseline Gap (pp)



Note: The left axis shows the cumulative 2-day post event excess CDS returns after the stress test results publication on the 29/07/2016. The right axis shows the relative adverse baseline gap. Average large (small) gap refers to the average cumulative returns for the with the adverse baseline gap above (below) the median.

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