Asymmetric Information in the European Banking Sector?

- Abnormal stock returns in connection to information disclosure

Jacob Bernland and Jennifer Zilling
Master's Thesis in Finance Supervised by Martin Strieborny
Lund University Department of Economics 2019-05-29

"…we devote our intelligences to anticipating what average opinion expects the average opinion to be."

(Keynes, 1936, p. 156)

Abstract

This thesis investigates the overall market reaction in connection to the stress test and transparency exercise conducted by the European Banking Authority in 2018. For this we apply an event study that adjusts for event clustering, something that is widely neglected in previous literature. This approach has a big impact on decreasing the statistical significance of the results. The results show an existence of stock anomalies in connection to both the stress test and the transparency exercise disclosures, indicating that they provided the market with new information. However, the results are sensitive to the choice of event window. When investigating driving factors to explain the results only weak indications of a higher transparency for larger banks are found.

Keywords; abnormal returns, event study, information disclosure, stress test, transparency exercise.

List of contents

1 Introduction **1**

2 Theoretical Framework and Earlier Findings **4**

2.1 Efficient Markets and Beauty Contests *4*

2.2 Earlier Findings in Stress Tests' Disclosure Effects on Asymmetric Information *5*

3 The European Banking Authority **8**

3.1 The Stress Test *8*

3.2 The Transparency Exercise *9*

4 Empirical Specification **10**

4.1 Data *10*

4.2 Methodology *11*

4.2.1 Event Study 11

4.2.2 Regression Models 17

5 Results **19**

5.1 The Stress Test *19*

5.2 The Transparency Exercise *21*

5.3 Regression Results *22*

5.4 Validity Analysis *23*

6 Conclusion **25**

References **27**

Appendix **29**

1 Introduction

In connection to the latest financial crisis starting in 2007, concerns regarding information asymmetries in US banks arose (Quijano, 2014). The fear of a severely unhealthy banking sector led to an unprecedented bank run, resulting in the shutdown of capital markets (Morgan, Peristiani & Savino, 2014). In order to restore the information gap, the Federal Reserve conducted a program known as the 2009 stress test to measure banks' vulnerabilities to unexpected recessions (Quijano, 2014). As financial crises increase uncertainty regarding the quality of banks' assets, a larger extent of transparency in the sector should make healthy banks less affected (Georgescu et al., 2017; Goldstein & Yang, 2017). Thus, stress tests have become a common occurrence in recent years, aiming at achieving an efficient market for bank asset pricing and funding costs (Georgescu et al., 2017).

By a broad definition, a stress test is an analysis of a bank's capacity to withstand unfavorable scenarios based on characteristics such as credit risk, market risk and liquidity risk (Ahnert et al., 2018). The disclosure of stress tests is thus an important tool to maintain market efficiency and decrease capital costs (Goldstein & Yang, 2017). However, although stress tests are believed to reduce information gaps between banks and outside stakeholders, the question regarding how much information provided by such tests should be disclosed remains. There are concerns that the disclosure will reduce private incentives to produce information (Fernandes, Igan & Pinheiro, 2017). Further, as agents do not solely act upon beliefs about the true worth of assets, but also consider expectations about what other agents believe the average opinion to be, stress tests might lead to speculative price changes as the disclosure provides agents with information about what other agents know (Goldstein & Yang, 2017).

Another concern is that the stress tests will make banks aim to deliver upon supervisors' satisfaction, making price information misleading and thus create an even more unsafe environment (Fernandes, Igan & Pinheiro, 2017). The routine of conducting stress tests has led to the creation of a consultancy industry, specializing in helping banks taking the right actions to pass the tests (Dowd, 2015). Bank managing with the aim to pass certain tests will thus position the banking system into an increased systemic risk that is not visible in the stress test (Dowd, 2015).

It is not evident that the implementation of stress tests should have made the financial system any safer (Fernandes, Igan & Pinheiro, 2017). On the contrary, stress tests may create a feeling of security that is not legitimately founded (Fernandes, Igan & Pinheiro, 2017; Dowd, 2015). Arguably stress tests might just be an expensive innovation with an ambiguous contribution, making its presence illegitimate. For example, three national banking systems collapsed without warning not long after having been considered as safe by regulatory stress tests (Dowd, 2015). In October 2008 the Icelandic banking system collapsed, within two months after being rated as healthy by several stress tests (Dowd, 2015). Later the Irish banking system collapsed four months after all the Irish banks that were included in the European 2010 stress test had passed the test, and in 2013 Cyprus followed the same fate (Dowd, 2015).

Although stress tests are controversial and their effects ambiguous, previous studies have pointed out the occurrence of abnormal returns at the time of press releases regarding stress tests as well as around the disclosure date of the results (e.g. see Petrella & Resti, 2013; Quijano, 2014; Gerhardt & Vander Vennet, 2017; Georgescu et al., 2017; Ahnert et al., 2018; Morgan, Peristiani & Savino, 2014). These studies look at different US and European stress tests, spanning over the years from 2009 to 2017 and report inconsistent support for the occurrence of abnormal asset returns. However, in general there seems to be some presence of asymmetric information in the market that is revealed in close connection to stress test press releases and results disclosure.

This study contributes to the existing literature by looking for excess stock returns in connection to the public information disclosure of the European Banking Authority's (EBA) 2018 stress test results. The aim is to investigate how the revealed information impacted the overall stock prices of the banks involved. This is done by conducting an event study, testing the hypothesis about the existence of stock return anomalies around the date of the results release. In a second step the potential difference in market reactions between banks that were more affected to those that were less affected in the hypothetical adverse scenario is tested. This is done by drawing regressions on abnormal returns with respect to the difference in solvency, being defined as the Common Equity Tier 1 (CET1) ratio, in the adverse scenario. Also if bank size and country-specific differences in default risk play a significant role in explaining stock anomalies is tested.

Beyond this, we study the disclosure of the 2018 EU-wide transparency exercise, also conducted by the EBA. While stress tests try to measure banks' immunity to an adverse scenario, the transparency exercises solely operate to provide the market with more information. This information concerns capital positions, risk exposure amounts, asset quality as well as actual information about the banks' balance sheets (European Banking Authority, 2018a). Including the transparency exercise makes it possible to distinguish the potential occurrence of stock anomalies around pure information releases that, in contrast to stress tests, are not based upon hypothetical scenarios. Hence, the transparency exercise could arguably be a better tool for investigating information asymmetries between banks and shareholders. For the transparency exercise, regressions are drawn to test if banks' stock reactions can be explained by country-specific differences in default risk. Further, if market reactions depend on bank size is investigated.

To the best of our knowledge there is no existing literature using 2018 data for abnormal returns as a response to stress tests, nor for any of the EBA's transparency exercises. Thus, besides studying the effect of information from the transparency exercise, this study also contains the most recent data in existing literature concerning abnormal returns around stress test information releases.

This thesis also focuses on different methodologies used in studies performed on a single event where the abnormal returns are all collected from the same date in calendar time. In these cases, assumptions of a non-existent covariance between individual assets' abnormal returns may cause biased results. A few previous studies have used methodologies dealing with this issue. However, in many cases this problem is neglected, causing dubious results. This study uses a methodology that adjusts for possible biases caused by cross-correlation between banks' abnormal returns. By comparing the results using our chosen methodology to results yielded by simpler methods, we also investigate the impact on results that this possible issue causes.

The results show a presence of stock anomalies in connection to both the stress test and the transparency exercise disclosures, indicating that these provided the market with new information. However, the results are sensitive to the choice of event window and thus the assumption of to what degree the market absorbs new information. When investigating driving factors to explain the results only weak indications of a higher transparency for larger banks are found in connection to the transparency exercise. Further, the applied methodology shows the significance of taking cross-correlation from event clustering into consideration, as this has a big impact on decreasing the statistical significance of the results.

The thesis proceeds as follows; next section presents a theoretical foundation for the occurrence of abnormal stock returns in connection to information releases, and previous studies that touch upon asset return anomalies around stress test events. Section three describes the EBA and its stress tests and transparency exercises, around which the studied events occur. Section four describes the data and methodology that is being used for the study. In section five the results are presented. The last section concludes.

2 Theoretical Framework and Earlier Findings

It is common knowledge that insider and outsider agents of a firm share different amounts of information. However, although Flannery, Kwan and Nimalendran (2004) find no support that banks would be less transparent than other firms, both Morgan (2002) as well as Haggard and Howe (2012) argue that so is the case. Assuming a higher extent of opaqueness in the banking sector gives rise to the dilemma of increased asymmetric information.

Asymmetric information in the banking sector might lead to adverse bank runs in times of severity as depositors cannot distinguish between healthy and unhealthy banks, leaving also good banks in despair (Morgan, 2002). One of the purposes of stress tests is to decrease potential asymmetric information in the banking sector, as it works as remedy for healthy banks when agents' information uncertainty decreases (Georgescu et al., 2017; Goldstein & Yang, 2017). In accordance with the efficient market hypothesis, stress test disclosure decreases asymmetric information as all new information is incorporated in the asset prices. Several studies investigating anomalies in banking asset returns find support for information asymmetries (e.g. see Petrella & Resti, 2013; Quijano, 2014; Gerhardt & Vander Vennet, 2017; Georgescu et al., 2017; Ahnert et al., 2018; Morgan, Peristiani & Savino, 2014). However, abnormal asset returns around information releases could also be due to the prevalence of agents' expectations about the common opinion in accordance with Keynes' (1936) beauty contest hypothesis.

2.1 Efficient Markets and Beauty Contests

An efficient market is characterized by the ability of asset prices to fully reflect all available information at all times (Fama, 1970). In a frictionless world, an efficient trading market would be determined by nonexistent transaction costs, all agents having free access to all available information and these agents all agreeing on the asset price reflecting the true value given the information at hand (Fama, 1970). Although the utopia of a frictionless world does not hold in practice, Fama argues an efficient market can still be existent, although detecting the degree of efficiency is left to be an empirical matter. Thus, official information releases, such as stress test publications, should immediately be absorbed by the market and reflected in the asset prices.

However, the asset market is not as clear cut as truly reflecting the assets intrinsic value, at least not in the short run. Keynes (1936) likens professional investment to the phenomenon of newspaper beauty contests, where the competitor who best guesses the average opinion of beauty is awarded a price. This game-theoretical approach is an important element in asset pricing. A rational investor who values an asset higher than its market price would not hold such asset if he simultaneously expects the average opinion of the asset's true value to be lower than its current market price (Keynes, 1936). Assuming all investors are rational, actions should not be based on guessing average expectations, but rather on the average expectations of average expectations, leading to a third or even higher degree of game-theoretical approach of asset price speculation (Keynes, 1936). As agents do not solely act upon beliefs about the true worth of assets, but also consider expectations about what other agents believe about the average opinion, stress tests might lead to speculative price changes and overreactions as the disclosure provides agents with information about what other agents know (Goldstein & Yang, 2017).

Incorporating Keynes' (1936) beauty contest theory with Fama's (1970) efficient market hypothesis theory, it becomes ambiguous to what extent asset return anomalies around the disclosure of stress test events depend on the reduction of information asymmetry or agents' expectations of the average opinion. What becomes clear however, is the possible presence of asset return anomalies in close connection to events of information disclosure.

2.2 Earlier Findings in Stress Tests' Disclosure Effects on Asymmetric Information

The phenomenon of stress tests has become a common occurrence after the latest global financial crisis (Fernandes, Igan & Pinheiro, 2017; Morgan, Peristiani and Savino, 2014). In its presence, the literature on banking stress tests has emerged in the last decade. Among these, several look for the occurrence of abnormal returns in connection to different events associated with these tests.

Quijano (2014) like Morgan, Peristiani and Savino (2014) study market effects of the stress test implemented in the surges of the financial crisis by the Federal Reserve in 2009. These studies conduct event studies which is commonly used for measuring abnormal returns. Quijano (2014) finds that bonds of banks passing the test reacted positively on the results release. Analyzing credit default swap (CDS) prices confirms the positive effect further. Thus Quijano (2014) argues the stress test provided the market with new information. In the paper by Morgan, Peristiani and Savino (2014) abnormal returns are studied for stress tested banks' stock prices in close connection to events related to the test. The authors find that while the announcement of the stress test had little effect on equity returns, the event of clarification as well as the results release had a strong positive impact on banks with insufficient capital. The results suggest that although the market was aware of which banks had capital deficiencies, the stress test provided information regarding the extent of the capital gaps. This information thus helped reevaluate the banks' market prices (Morgan, Peristiani & Savino, 2014).

Flannery, Hirtle and Kovner (2017) as well as Neretina, Sahin and de Haan (2015) look at stress tests' effect on US bank performance over the years 2009-2015. Apart from commonly studied effects on equity returns and CDS spreads, Neretina, Sahin and de Haan's (2015) event study also includes stress tests' impact on bank betas to capture systematic risk. They find that stress test results decrease systematic risk as the betas tend to decline. Further they find no effect on equity returns from the 2009 stress test, in contrast to the earlier findings by Morgan Peristiani and Savino (2014). The results differ between the studies due to the different methodologies, in which Neretina, Sahin and de Haan (2015) adjust for event clustering, something Morgan Peristiani and Savino (2014) do not.

Flannery, Hirtle and Kovner (2017) argue that standard event studies are flawed in the sense that this methodology relies on the assumption that the treated firms react in the same direction. A standard event study will hence show the same effect regardless if the abnormal return is small for all firms or if there are two stronger effects working in opposite directions. Thus, a zero mean abnormal return could be due to a naive assumption, leading to incorrect results. To circumvent this problem, the authors check for the average absolute cumulative abnormal return. Also the abnormal trading volume is investigated to, together with the price changes, measure the information provided by the stress tests. The findings suggest that the release of stress test results significantly increases market information.

Petrella and Resti (2013) study the effect of stress tests on European bank stock prices in 2011 and find that the test results are not anticipated by the market. Market reactions are also present in times of announcing information about the test (Petrella & Resti, 2013). Adding one more date of official press release, Gerhardt and Vander Vennet (2017) investigate the impact of the same stress test further. Both studies report a positive abnormal return at the announcement date for banks reported to be tested and a negative return for the time of revealing a clarification of the test design. However, for the remaining announcement dates the results between the two studies differ. While Petrella and Resti (2013) find that the announcement of the test's methodology had a negative impact on tested banks' stock returns and explain this with the 2011 test being more detailed than the previous year's, Gerhardt and Vander Vennet (2017) find no significant effect and argue these announcements were largely anticipated and did not provide any information. Most different are the estimates from the results release. Gerhardt and Vander Vennet (2017) find a negative equity return for stress tested banks, and an even greater negative return one week prior the results release when the scope of the disclosure was announced. On the contrary Petrella and Resti (2013) find the equity return to be positive for tested banks at the time of releasing the test scores.

Georgescu et al. (2017) study asset returns around key dates related to the EBA stress tests conducted in 2014 and 2016. These events show significant abnormal asset returns, implying these events were associated with new information being absorbed by the market. Distinguishing between banks' stress test performance, the market impact differs between well performing banks and less well performing banks, indicating that the market gained information to better recognize, and thus discriminate between the two. Thus, the authors argue that the implementation of the stress tests enhanced market efficiency.

Ahnert et al. (2018) contribute further by using a sample including both US and European conducted stress tests spanning over the years 2010-2017 to get a relatively large number of observations. They find that banks passing a stress test have a positive abnormal equity return and tighter CDS spreads. Banks not passing a stress test experience the opposite outcome with falling prices and widening CDS spreads. Analyzing the asset returns for the dates associated with the announcement of a coming stress test, there is a negative impact on equities for banks' who are declared to be tested. Ahnert et al. (2018) argue that the positive effect from passing a stress test is the compensation from the negative effect on the day of announcement as the addition of the two effects are close to zero. Further, higher abnormal equity returns at the release of the results score is associated with banks holding a higher capital buffer and asset quality, lower leverage and a less risky business model (Ahnert et al., 2018).

In summary, previous findings report an inconsistent impact on asset returns around events related to stress tests. The results differ both regarding what stress test related event is considered as well as the magnitude of such possible effect. However, the clustering problematics that occur when studying stock returns from the same event date is widely disregarded in previous research. Among the above-mentioned studies only Petrella and Resti (2013) and Neretina, Sahin and de Haan (2015) adjust for event clustering. In this thesis we highlight the impact of decreasing statistical significance by adjusting for event clustering. Further, no previous study has considered the 2018 EBA stress test nor any of the same agency's transparency exercises. Thus, this study extends the existing literature regarding the presence of asset price anomalies around bank information disclosures.

3 The European Banking Authority

The EBA is an independent authority in collaboration with the European Central Bank, with the main objective to maintain financial stability in the European banking sector (European Banking Authority, n.d.). The EBA took over the Committee of European Banking Supervisors' (CEBS) responsibilities of EU-wide stress testing for the test carried out in 2011. Since then, the EBA has been in charge of the 2014, 2016 and 2018 EU-wide stress tests as well as several transparency exercises. This to estimate weaknesses in the banking sector and to promote supervisory practices to prevent existing vulnerabilities from harming the sector (European Banking Authority, n.d.).

3.1 The Stress Test

The EU-wide stress test conducted by the EBA is carried out to measure banks' resistance to severe shocks (European Banking Authority, 2018b). The test is based upon the scenario of a macroeconomic recession. The EBA provides the methodology that is, under supervision, practiced by the included banks. The stress tests aim to assess the banks' creditworthiness when exposed to increased risk by making up a potential adverse economic scenario (European Banking Authority, 2016). Apart from providing supervisory decisionmakers with substance for appropriate policy actions, the stress tests also work to strengthen market discipline by making bank-by-bank level data official (European Banking Authority, 2018b).

In the 2011 stress test, 90 banks were included (Petrella & Resti, 2013). In this test the adverse scenario meant the equity market dropping 15 percent over two years, and a decrease of the gross domestic product by 0.4 percent in 2011, while remaining unchanged in the following year (Petrella & Resti, 2013). In the 2014 test the number of banks increased to cover 123 European banks (European Banking Authority, 2014), to decrease in 2016 to only include 51 banks (European Banking Authority, 2016) and then decrease further in 2018 to 48 banks (European Banking Authority, 2018b). This because of the desirability to hold a more homogenous sample in order to make more adequate comparisons between the banks (European Banking Authority, 2016). Even though the number of banks has declined in recent years, the included banks in the 2018 test represent about 70 percent of total assets among European banks (European Banking Authority, 2018b), an increase by 5 percent compared to the 2011 stress test (Petrella & Resti, 2013).

The most recent stress test in 2018 consisting of an adverse scenario spanning over three years considers the most ominous scenario so far. This test depicts an adverse scenario in which cumulative gross domestic product falls by 2.7 percent, a cumulative inflation of 1.7 percent, cumulative fall in real estate prices reaching about 20 percent, and an unemployment rate of 9.7 percent in the year of 2020 (European Banking Authority, 2018b).

Although the methodology for the stress tests carried out by the EBA differs over time, the main differential characteristic is likely to be the pass or fail criteria which was abandoned after the 2014 test. In the two first tests, identifying capital shortfalls was of interest (European Banking Authority, 2016), and banks not meeting the standards to pass the requirements were supposed to come up with a plan for how to strengthen present vulnerabilities (European Banking Authority, 2014). In the 2016 and 2018 stress tests, no threshold for passing the test is set. Instead agents who use the test results are encouraged to make their own assessment (European Banking Authority, 2016).

Important to remember is the incomparability between stress tests over time since they, although conducted by the same authority, differ from one another (European Banking Authority, 2018b). What should be highlighted further is the flaws of stress tests as the adverse scenarios are just theoretical speculations and does not reflect every possible side-effect the occurrence of such scenario would entail (European Banking Authority, 2018b). The results of a stress test should thus be interpreted with caution.

3.2 The Transparency Exercise

Just like the case with the stress tests, the purpose of the transparency exercises is to increase confidence in European banks as well as improving market discipline by revealing bank-by-bank information. The transparency exercises provide detailed information regarding banks' capital positions, risk exposure and asset quality. The transparency exercises are carried out on an annual basis and are extended to contain a larger sample of banks. The 2018 transparency exercise included a set of 130 European banks (European Banking Authority, 2018b). When publishing the 2018 transparency exercise the EBA released over 900 000 data points on the included banks (European Banking Authority, n.d.), making the transparency exercise considerably more extensive, data wise, compared to the stress test.

While stress tests try to measure banks' immunity to an imaginary adverse scenario, the EU-wide transparency exercises solely operate to provide the market with more information. The transparency exercise makes it possible to distinguish the potential occurrence of stock anomalies around pure information releases that, in contrast to stress tests, are not based upon hypothetical scenarios. With its extensive data, the transparency exercise could arguably be a better tool for investigating information asymmetries as this data might bring new information to outside stakeholders.

4 Empirical Specification

4.1 Data

The data of the stock returns and market capitalization of the included banks as well as the European MSCI index were collected from Datastream. The first and most obvious criterion for the banks to be included in the data sample is the stock to be publicly traded. Here the biggest loss of observations occurred for both the banks included in the stress test and the banks included in the transparency exercise. The stress test sample size was therefore reduced from the 48 participating banks to the final 33 banks used in our stress test sample. Further, Greek banks were not included in our sample due to the fact that their results were published in May, to ensure the results were ready before the end of the third European Stability Mechanism (ESM) Program for Greece (European Banking Authority, 2018b). Including the results from these banks would not suit the methodology of this thesis.

The second criterion was the sufficient provisioning of data to cover the whole estimation period of the events. This criterion did not affect the stress test sample group but reduced the sample size of the transparency exercise to 56 banks. Table 1 reports the number of banks included in the different information disclosure events as well as the final number of banks included in our samples. The table also reports the dates of the studied information releases. A full description of which banks that are included in our samples can be found in table A1 in the appendix.

TABLE 1: STUDIED EVENTS

	Information Disclosure	
	Transparency Exercise	*Stress Test*
Date	14/12 2018	2/11 2018
#of banks	130	48
(of which in sample)	(56)	(33)

The table reports the dates of official publication of the studied information disclosures and the number of banks these reports included. For reports published after open market hours the studied event dates are moved to the next coming trading day.

Further, data on the banks' different solvency ratio in terms of CET1, were collected from the interactive tools provided by the EBA at the release of the 2018 stress test results. These tools were downloaded from the EBA's website.

4.2 Methodology

To empirically test how the stress test and transparency exercise impacted the stock prices of the included banks, an event study is conducted. The event study tests the hypothesis regarding the existence of abnormal stock returns in connection to the studied information disclosures. To further investigate if abnormal returns are explained by certain bank characteristics, regressions are modelled to shed light on potential correlation. For the transparency exercise abnormal returns are tested to be explained by bank size and country exposure to higher default risk. For the stress test the studied explanatory variables are extended to also include the banks' performance in the adverse scenario in terms of solvency.

4.2.1 Event Study

The event study is based on the methodology described by Campbell, Lo and MacKinlay (1997). The structure of an event study consists of several steps; event definition, selection criteria, normal and abnormal returns, estimation procedure and testing procedure (Campbell, Lo & MacKinlay, 1997).

Event Definition

When performing an event study, the first thing to be determined is the event window of interest. The event window contains all the returns, before and after the specific event that is to be examined. The aim of this thesis is to examine the reaction to the release of the EBA's 2018 stress test and transparency exercise. Since there is no consensus regarding the length of the event window when conducting an event study, we have decided to examine three different event lengths reflecting different assumptions regarding the degree of market efficiency.

The first event window consists of the event day itself, assuming all available information is immediately priced by the market. Following Georgescu et al. (2017) who examine stress tests performed by the EBA in 2014 and 2016, we also report the results from defining the cumulative effect of the event including a two-day event window, being the day of the information disclosure and the following day. A third event window is defined as a seven-day period starting one day prior the official release. This event window assumes that it takes several days for the market to adjust prices to adequately reflect the new information. The reason for examining the day prior to the event is to capture a potential reaction of leaked information about the results to the market (Campbell, Lo & MacKinlay, 1997). This day could also reflect possible market expectations, why stock anomalies prior the information releases might exist. For reports published after open market hours the studied event date has been moved to the next coming trading day.

Selection Criteria

The selection criteria for the different events are described in the data section.

Determination of Normal and Abnormal Returns

The measurement of effect in event studies is determined as the abnormal return in the event window. In order to obtain the abnormal return, a measure for the normal return must be estimated. The normal return is defined as the return that could be expected if the specific event did not take place (Campbell, Lo & MacKinlay, 1997). The model we have used to procure the normal return is the market model. This approach puts the returns of the chosen banks against the returns of the market in an ordinary least squares regression to derive a linear relation between the two;

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

Where R_{it} is the return of the banks included, R_{mt} is the return of the market and ε_{it} is the zero mean disturbance term. To mimic the unobservable market portfolio, we follow Gerhardt and Vander Vennet (2017) and Ahnert et al. (2018) by choosing a European wide market index. For this we use the MSCI Europe Index which is an index that covers the performance of large and mid-cap equities across 15 developed countries in Europe (MSCI, 2019). In contrast Petrella and Resti (2013) use country-specific indices, arguing that large abnormal returns depend on national shocks. However, since many of the banks are active in several countries and some can be considered large enough to affect the home-market index, this broader index was chosen over smaller home-market indices.

Estimation Procedure

The coefficients α and β are estimated in the estimation window which covers a one-year period of trading days ending ten days before the event in question. The reason for the gap between the event and the estimation window is to avoid that the coefficients are influenced by the studied event (Campbell, Lo & MacKinlay, 1997). The abnormal return is then calculated by simply subtracting the normal return from the observed return in the event window;

$$AR_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i \cdot R_{mt}\right) \quad (2)$$

In our case the banks' abnormal returns are all procured for the same dates since the information disclosure for all banks are published simultaneously. We therefore focus on the average effect of the event on the included banks. The average abnormal return is defined in the equation below;

$$AAR = \frac{1}{N} \cdot \sum AR_i \quad (3)$$

To study the total effect of the events we also focus on the cumulative abnormal returns. We then get a cumulative effect on each individual bank over all the days included in the event window (equation 4). Just like for the AAR the average of these observations, the cumulative average abnormal return (CAAR), is calculated (equation 5) to see the general effect over the full event window;

$$CAR_i = \sum AR_{it} \quad (4)$$

$$CAAR = \frac{1}{N} \cdot \sum CAR_i \quad (5)$$

Testing Procedure

After estimating the abnormal returns, a framework for statistically testing the results must be defined. General principles of inference testing state that the null hypothesis in event studies states the absence of abnormal returns in the event window, while the alternative hypothesis states the opposite, being the presence of abnormal returns in the event window;

$$H_0: (C)AR = 0 \tag{6}$$

$$H_1: (C)AR \neq 0 \tag{7}$$

The same applies when testing for the cross-sectional events and cumulative effect of the event;

$$H_0: (C)AAR = 0 \tag{8}$$

$$H_1: (C)AAR \neq 0 \tag{9}$$

There are different ways to obtain statistical inference for the results of the estimations regarding the banks abnormal returns surrounding the stress test- and transparency exercise releases. One way to obtain statistical inference is by an ordinary t-test where the test statistic is derived using the equations below[1];

$$t_{AAR_t} = \sqrt{N}\frac{AAR_t}{S_{AAR_t}} \tag{10}$$

$$t_{CAAR} = \sqrt{N}\frac{CAAR}{S_{CAAR}} \tag{11}$$

This method comes with the assumption that abnormal returns are independent and identically distributed (IID). This assumption might be reasonable if the event windows for different banks do not overlap. As in our case when the abnormal returns of the included banks are all estimated from the same event date in calendar time with the same estimation period, this assumption does no longer hold.

[1] The following formulas (10-20) are collected from eventstudytools.com

Clustering of event-dates may cause serious biases in inference in stock-return based studies if not accounted for (Bernard, 1987). This is due to the fact that covariances between the abnormal returns may differ from zero (Campbell, Lo & MacKinlay, 1997). The clustering problem is often neglected in previous studies (e.g. see Fernandes, Igan & Pinheiro, 2017; Gerhardt & Vander Vennet, 2017; Georgescu et al. 2017; Flannery, Hirtle & Kovner, 2017; Ahnert et al., 2018). However, Petrella and Resti (2013) as well as Neretina, Sahin and de Haan (2015) adjust for event clustering, arguing this is the appropriate approach to reduce biases.

There are different ways of dealing with the clustering problem. The first way used in this thesis is an approach developed by Patell (1976) and later Kolari and Pynnönen (2010). This method adjusts the obtained Z-value by the average cross-correlation between the abnormal returns of the included banks in the estimation window. By standardizing the abnormal returns with the forecasted daily standard errors, this method also accounts for possible distortions from event induced volatility changes, i.e. an increase of variance of stock returns for the days immediately around events (Brown & Warner, 1984).

The second way to deal with the event clustering problem used in this thesis is to aggregate the abnormal returns into a portfolio. With this approach an equally weighted portfolio including all the stress tested banks is created and the abnormal return is derived for this single asset. This approach allows for cross-correlation of the abnormal returns among individual banks (Campbell, Lo & MacKinlay, 1997). A simple t-test is then used to draw inference on the abnormal returns of the event window. In this study the latter method is not described in detail, but the results are used for robustness check for the results obtained by the prior method.

To account for event clustering the abnormal returns are first standardized using the following formula;

$$SAR_{it} = \frac{AR_{it}}{S_{AR_{it}}} \tag{12}$$

In which the standard deviation of the abnormal return is derived from the equation below. The standard error is adjusted by the forecast error;

$$S^2_{AR_{it}} = S^2_{AR_t}\left(1 + \frac{1}{M_i} + \frac{(R_{mt}-\bar{R}_m)^2}{\sum_{t=T_0}^{T_1}(R_{mt}-\bar{R}_m)^2}\right) \quad (13)$$

R_m is the market return, $\bar{R}_m$ is the average market return in the estimation period and M_i is the number of non-missing returns in the estimation period. The test statistic for the null hypothesis about average abnormal returns being equal to zero is then achieved by the following formula and is assumed to follow a t-distribution with M-2 degrees of freedom;

$$Z_{Patell,t} = \frac{ASAR_t}{S_{ASAR_t}} \quad (14)$$

Where;

$$ASAR_t = \sum_{i=1}^{N} SAR_{it} \quad (15)$$

With expectation zero and variance equal to;

$$S^2_{ASAR_t} = \sum_{i=1}^{N} \frac{M_i-2}{M_i-4} \quad (16)$$

For testing the null hypothesis of the cumulative abnormal returns being equal to zero, we use a similar approach to receive the test statistic;

$$Z_{Patell} = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} \frac{CSAR_i}{S_{CSAR_t}} \quad (17$$

Where;

$$CSAR_i = \sum_{t=T_1+1}^{T_2} SAR_{it} \quad (18)$$

With expectation zero and variance equal to;

$$S^2_{CSAR_t} = L_2 \frac{M_i-2}{M_i-4} \quad (19)$$

In which L_2 is the number of observations in the event-window and $T_2 - T_1$ is the length of the event window. To account for cross-correlation the test statistic is adjusted using the average cross-correlation of the abnormal returns in the estimation period ($\bar{r}$);

$$Z_{Patell}Adj. = Z_{Patell}\sqrt{\frac{1}{1+(N-1)\bar{r}}} \tag{20}$$

With this approach the risk of over-rejecting the null hypothesis of zero average abnormal returns due to event clustering cross-correlation is reduced.

4.2.2 Regression Models

The Stress Test

To test the hypothesis if the stress test performance has an impact on the market reaction, the relation between the two is investigated through ordinary least squares regressions. In many previous studies when comparing this relation, a distinct definition has been to compare market reactions of failing and passing results for the banks (e.g. see Ahnert et al., 2018; Fernandes, Igan & Pinheiro, 2017; Quijano, 2014). As previously mentioned, the 2018 EBA stress test does not provide the market with a pass/fail threshold. We have therefore decided to define performance through the banks' change in solvency. We focus on the most highlighted ratio in the results report which is the CET1. This ratio refers to a bank's assets, such as capital instruments, retained earnings and other reserves that are unrestricted and immediately available to cover losses, in relation to its risk-weighted assets (Regulation EU No 575/2013).

To test if the stress test performance drives the market reaction the following regression model is composed;

$$CAR = \alpha + \beta_1 \Delta CET1 + \beta_2 MarketCap + \beta_3 PIIGS + \varepsilon \tag{21}$$

Where *CAR* is the cumulative abnormal returns of the banks, *ΔCET1* is the difference in the CET1-ratio between the hypothetical ratio in the adverse scenario in December 2020 and the actual ratio in December 2017. Note that since the CET1 ratio decreases for all the banks in the adverse scenario, *ΔCET1* yields negative values for all banks. *MarketCap* is the market capitalization of the banks expressed in billion US dollars. *PIIGS* is a dummy variable taking the value of one for banks originating from Portugal, Italy, Ireland, Greece and Spain.

The null hypothesis of this regression is that the explanatory variables do not have any significant impact on the abnormal returns of the banks. On the contrary, the alternative hypothesis states that the performance in terms of CET1 ratio do affect the abnormal returns of the event. For example, a significant negative coefficient for CET1 indicates that the abnormal returns increase the bigger the CET1 decrease in the adverse scenario. This might be intuitive since a revelation that a bank's solvency is relatively sensitive to the adverse scenario, one can expect a more negative reaction to the stock price if the information is not already captured by the market. Georgescu et al. (2017) find that banks with worse CET1 ratio in the EBA's 2014 and 2016 stress tests' adverse scenarios experience more negative abnormal returns.

Barucci, Baviera and Milani (2014) state that larger banks are more likely to be supervised by market participants. Intuitively, larger banks should thus be more transparent, experiencing lower abnormal returns compared to smaller banks. The null hypothesis in the regression states that there is no correlation between bank market cap size and the cumulative effect on the stock price. The rejection of this hypothesis might suggest that transparency differs between small and large banks in terms of market capitalization.

Gerhardt and Vander Vennet (2017) find that banks with sovereign debt exposure to PIIGS countries experience more negative abnormal returns when exposed to stress test releases. This finding is confirmed by Petrella and Resti (2013) in a univariate analysis but does not hold when tested in a multivariate setting. In our study we therefore investigate a potential difference in the abnormal returns between banks originating from PIIGS countries and those who do not. The null hypothesis states that there is no significant difference in the extent that banks originating from the PIIGS countries react to the information revealed in the transparency exercise compared to banks originating from non-PIIGS countries.

The Transparency Exercise

For the transparency exercise the regression drawn to explain stock anomalies were formulated as follows;

$$|CAR| = \alpha + \beta_1 MarketCap + \beta_2 PIIGS + \varepsilon \tag{22}$$

Where $|CAR|$ is the absolute cumulative abnormal returns of the banks, *MarketCap* is the market capitalization of the banks expressed in billion US dollars. *PIIGS* is a dummy variable taking the value of one for banks originating from Portugal, Italy, Ireland, Greece and Spain.

The reason for using the absolute value for cumulative abnormal returns is the more informative property to use the magnitude of the effect when investigating the transparency of banks. This since just using the regular cumulative abnormal returns assumes that the revelation of new information to the market will make the rated firms react in the same direction, when in reality new information might lead to either positive or negative reactions.

5 Results

5.1 The Stress Test

Table 2 shows the excess stock returns in connection to the public disclosure of the stress test results. Average abnormal returns are shown for each separate trading day from one day prior the information release up to five trading days post event. The table reports both the statistical significance obtained by the Patell Z-score as well as the significance when adjusted for event clustering cross-correlation. The highest average abnormal return is traced to the first trading day in which the information about the stress test results were publicly available. For this day, the excess return of 1.34 percent is statistically significant also when considering the adjusted Patell Z-score, indicating an anomaly of higher validity. This suggests that the stress test results revealed new information that was immediately absorbed by the market. However, since the two following days after the information release display negative results, the positive abnormal return might to some extent reflect an overreaction caused by stock price speculations that was later neutralized.

TABLE 2: EXCESS STOCK RETURNS FOR THE STRESS TEST

Event Day	AAR (%)	Z_{Patell}	Z_{Patell} Adj.
T-1	0.30	1.19	0.43
T	1.34	5.81***	2.10**
T+1	-0.35	-1.59	-0.58
T+2	-0.20	-0.98	-0.36
T+3	0.36	1.20	0.43
T+4	0.83	4.22***	1.52
T+5	0.13	0.78	0.28

Note: The table reports the average abnormal stock returns in connection to the 2018 stress test's results release where T is the first day in which the disclosed information is publicly available during open market hours. *, **, *** show statistical significance of 10, 5 and 1 percent.

Table 3 shows the cumulative excess stock returns for the one-day, two-day, and seven-day event windows for the stress test results. The two-day cumulative excess return, considering the event day and one day post event, shows strong statistical significance that is lost when adjusting for event clustering cross-correlation. The same conclusion is drawn for the seven-day event window, spanning from one day pre event to five days post event.

TABLE 3: CUMULATIVE EXCESS STOCK RETURNS FOR THE STRESS TEST

Event Window	CAAR (%)	Z_{Patell}	Z_{Patell} Adj.
[T]	1.34	5.81***	2.10**
[0, +1]	0.98	2.98***	1.08
[-1, +5]	2.41	4.01***	1.45

Note: The table reports the average cumulative abnormal returns in connection to the 2018 stress test's results release. [T] is a one-day event window, [0, +1] are the first two days in which the information is publicly available during open market hours. [-1, +5] denotes the seven-day time period spanning from one day prior the information release to five days post event. *, **, *** show statistical significance of 10, 5 and 1 percent.

Interpreting the results focusing on the one-day event window, the stress test caused an overall positive reaction on the banks' stock prices. Whether the positive reaction depends on new information pointing on an overall better security of the included banks or is reflecting expectations of the market reaction is unclear. Observing the results from longer event windows, the result is no longer significant. This might depend on a faulty assumption of the market needing more time to price new information, making the null harder to reject since they include irrelevant days.

The presented results for abnormal returns might be modest in the sense of evaluating the amount of new information disclosed. As argued by Flannery, Hirtle and Kovner (2016), a zero mean effect can be due to different signs, suppressing also abnormal returns that are large in absolute values. Hence the effect of the disclosed information could be even stronger than the results suggest.

What becomes evident from the results is the more frequent rejection of the null hypothesis for tests not considering cross-correlation from event clustering. The adjusted Z-score has thus a big impact on decreasing the statistical significance, why results from previous studies neglecting the cross-correlation problematics should be interpreted with care.

5.2 The Transparency Exercise

Table 4 shows the excess stock returns in connection to the public information disclosure of the transparency exercise. Average abnormal returns are shown for seven separate trading days from one day prior the information release up to five trading days post event. Just like for the stress test, statistical significance is rare when adjusting for event clustering cross-correlation.

TABLE 4: EXCESS STOCK RETURNS FOR THE TRANSPARENCY EXERCISE

Event Day	AAR (%)	Z_{Patell}	Z_{Patell} Adj.
T-1	0.07	0.72	0.23
T	-0.79	-4.22***	-1.37
T+1	0.08	1.01	0.33
T+2	-0.78	-4.34***	-1.41
T+3	-1.15	-6.33***	-2.06**
T+4	-0.65	-3.71***	-1.21
T+5	0.15	0.30	0.10

Note: The table reports the average abnormal stock returns in connection to the 2018 transparency exercise's information disclosure. T is the first day in which the disclosed information is publicly available during open market hours. *, **, *** show statistical significance of 10, 5 and 1 percent.

Table 5 shows the cumulative excess stock returns for the one-day, two-day, and seven-day event windows for the transparency exercise. After adjusting for event clustering, only the seven-day event window retain its statistical significance. This result suggests that the market interpreted the studied bank stocks to be over-valued after accessing the disclosed information, resulting in predominately negative abnormal returns.

TABLE 5: CUMULATIVE EXCESS RETURNS FOR THE TRANSPARENCY EXERCISE

Event Window	CAAR (%)	Z_{Patell}	Z_{Patell} Adj.
[T]	-0.79	-4.22***	-1.37
[0, +1]	-0.70	-2.27**	-0.74
[-1, +5]	-3.06	-6.26***	-2.04**

Note: The table reports the average cumulative abnormal stock returns in connection to the 2018 transparency exercise's information disclosure. [T] is a one-day event window, [0, +1] are the first two days in which the information is publicly available during open market hours. [-1, +5] denotes the seven-day time period spanning from one day prior the information release to five days post event. *, **, *** show statistical significance of 10, 5 and 1 percent.

The results suggest that while the information from the stress test was immediately absorbed, the market needed a longer period of time to digest the information provided by the transparency exercise. This might be explained by the information releases' different properties. The stress test reports projections on individual banks' capacities to withstand a hypothetical recession. Assuming an efficient market, incorporating such information might be questionable as the made-up adverse scenario is likely to never occur. Arguably the abnormal returns at the day of the results disclosure is the presence of Keynes' (1936) beauty contest phenomenon, in which agents speculate about how the market will price the released information.

5.3 Regression Results

Table 6 shows the results from equation 21 in which abnormal returns are being explained by the change in CET1 ratio in the stress test adverse scenario, bank size and PIIGS countries. The dependent variable refers to the one-day event window, as this event window shows significant abnormal returns of a higher validity in table 3. For change in CET1 ratio the sign of the coefficient indicates that the abnormal returns increase the bigger the decrease of ratio in the adverse scenario. The sign of the coefficient is thus in line with the findings by Georgescu et al. (2017) about a higher decrease in CET1 ratio being associated with more negative abnormal returns. However, the impact is small and statistically insignificant. We can thus not prove any relation between the adverse scenario's effect on CET1 ratio and abnormal returns.

Banks originating from the PIIGS countries do not show any significant difference from the banks originating from other European countries. Assuming that the findings made by Gerhardt and Vander Vennet (2017) were correct, this might indicate that the transparency of the banks originating from the PIIGS countries have improved their transparency over the seven years between the two stress tests. The result also rejects a relationship between bank size and abnormal returns.

TABLE 6: STRESS TEST REGRESSION ABNORMAL RETURNS

	Event Window
Variable	**[T]**
ΔCET1	-0.0010 (0.0014)
MarketCap	-0.0001 (0.0001)
PIIGS	0.0010 (0.0050)
Constant	0.0109* (0.0063)
Observations	33
Adjusted R^2	-0.0638

Note: The dependent variable is the abnormal stock returns for the event day. Standard errors in parenthesis. *, **, *** show statistical significance of 10, 5 and 1 percent.

Table 7 shows the results from running a regression on the absolute abnormal stock returns in connection to the transparency exercise release. The abnormal return refers to the seven-day event window as this window shows statistically significant abnormal returns of higher validity in table 5. Looking at the regression drawn, one can see that the result shows that banks originating from the PIIGS countries, just like in the stress test, do not show any significant difference from the banks originating from other European countries.

In contrast to the stress test the transparency exercise shows a weak significance in the relationship between the absolute cumulative abnormal return and the market cap values of the banks. Although the coefficient might be small, what it says is that the higher the market cap of the bank, the lower absolute value on the cumulative abnormal return in connection to the event. Assuming that the abnormal returns reflect information asymmetry between the bank and its shareholders, this is an indication of a potential difference between the transparency of big and small banks. This result falls in line with the assumption about larger banks being more supervised by market participants made by Barucci, Baviera and Milani (2014).

TABLE 7: TRANSPARENCY EXERCISE REGRESSION ABSOLUTE ABNORMAL RETURNS

	Event Window
Variable	**[-1, +5]**
Market Cap	-0.0003* (0.0002)
PIIGS	-0.0120 (0.0094)
Constant	0.0504*** (0.0070)
Observations	52
Adjusted R^2	0.0366

Note: The dependent variable is the absolute cumulative abnormal stock returns for the seven-day event window. Standard errors in parenthesis. *, **, *** show statistical significance of 10, 5 and 1 percent.

The results from the regressions must obviously be viewed with scepticism due to the sample size and above-mentioned assumptions. We further stress the need for interpreting the results with caution since the individual cumulative abnormal returns of the banks are unadjusted and still exposed to the covariance of the abnormal returns between banks.

5.4 Validity Analysis

To check for robustness in our results regarding the event study we compare the given results from the adjusted Patell method with the ones made using the portfolio method previously mentioned in the testing procedure. Table 8 shows the cumulative abnormal returns for the studied events when applying the portfolio method.

TABLE 8: CUMULATIVE EXCESS RETURNS

	Information Disclosure			
	Stress Test		*Transparency Exercise*	
Event Window	**CAAR (%)**	**Z**	**CAAR (%)**	**Z**
[T]	1.28	2.09**	-0.68	-1.16
[0, +1]	0.88	1.01	-0.72	-0.87
[-1, +5]	2.04	1.26	-3.04	-1.97**

Note: The table reports the average cumulative abnormal stock returns calculated using the portfolio approach. [T] is a one-day event window, [0, +1] are the first two days in which the information is publicly available during open market hours. [-1, +5] denotes the seven-day time period spanning from one day prior the information release to five days post event. *, **, *** show statistical significance of 10, 5 and 1 percent.

Comparing the results in table 8 derived from a simple t-test on the cumulative abnormal returns of the portfolio with the results in table 3 and table 5, the two different methodologies show almost identical results in terms of cumulative abnormal returns as well as in inference. This further supports the validity of our results.

Since the stress tests performed by the EBA differ, the results of this study are incomparable with previously performed tests. The event study method chosen in this study also differs when it comes to interpretation and inference of the results. To test whether our results are in line with previous findings, tests on previous EBA stress tests have been issued using the same methodology. We compare the results from the EBA's 2014 and 2016 stress tests obtained by our applied methodology to the results from the same events provided by Georgescu et al. (2017). Their study shows significant, negative, cumulative abnormal returns at the release of the 2016 stress test. However, for the 2014 stress test Georgescu et al.'s negative abnormal returns are insignificant. Table 9 shows the results from these events when obtained by our methodology. For comparison, the results by Georgescu et al. can be found in table A2 in the appendix

TABLE 9: CUMULATIVE EXCESS STOCK RETURNS

	Information Disclosure					
	Stress Test 2014			*Stress Test 2016*		
Event Window	**CAAR (%)**	$\mathbf{Z_{Patell}}$	$\mathbf{Z_{Patell}}$ **Adj.**	**CAAR (%)**	$\mathbf{Z_{Patell}}$	$\mathbf{Z_{Patell}}$ **Adj.**
[0, +1]	-1.46	-3.37***	-1.14	-1.15	-2.10**	-0.64

Note: The table reports the average cumulative abnormal returns in connection to the 2014 and 2016 stress test results release. [0, +1] denotes the first two days in which the information is publicly available during open market hours. *, **, *** show statistical significance of 10, 5 and 1 percent.

Looking at the 2014 result, one can see that the result from the adjusted Patell methodology yields almost identical abnormal returns as the simple t-test used by Georgescu et al. (2017) while the result from the 2016 stress test differs. Although the simple t-test shows a negative result statistically significant at the five percent level for the 2016 stress test, the adjusted Patell is unable to reject the null hypothesis. This shows the impact of including the covariance of abnormal returns and standardization when drawing inferences and supports the findings of Kolari and Pynnönen (2010) that ignoring cross-correlation due to event clustering in event studies will tend to over reject the null hypothesis.

6 Conclusion

This thesis investigates the overall impact on stock prices from the 2018 stress test and transparency exercise conducted by the EBA. Also driving factors of abnormal returns are studied. The results show that the stress test evoked a significant, positive cumulative average abnormal return among the included banks. This indicates that the stress test provided the market with new information not previously reflected in the stock prices. However, the result is sensitive to the choice of event window and the time given to absorb the information. A similar conclusion can be drawn for the transparency exercise. However, the market needed a longer time horizon in order to absorb the information from the transparency exercise, resulting in overall negative stock returns.

When trying to explain what drives the abnormal returns this thesis fails to find any substantial support for any of the explanatory factors investigated. Only weak indications for a higher transparency among larger banks are found in connection to the transparency exercise.

Further findings of the thesis are the importance of methodology when conducting an event study of simultaneous information releases. What becomes evident from the results from the events examined in this thesis and results from earlier studies is the statistical difference between methodologies. We find that ignoring correlation between abnormal returns in the estimation window leads to an over rejection of the null hypothesis. Adjusting for event clustering has a big impact on decreasing the statistical significance, why results from previous studies neglecting the cross-correlation problematics should be interpreted with care.

Further research in the area could include the examination of the effect of the 2018 stress test and transparency exercise on the included banks' CDS spreads. This is done in many of the previous mentioned studies to examine information disclosure between the banks and their creditors, but this is outside the aim of this thesis.

References

Ahnert, L., Vogt, P., Vonhoff, V. & Weigert, F. (2018). The Impact of Regulatory Stress Testing on Bank's Equity and CDS Performance. *University of St. Gallen, School of Finance Research Paper NO. 2018/15.*

Barucci, E., Baviera, R. & Milani, C. (2014). Is the Comprehensive Assessment really comprehensive? *SSRN 2541043.*

Bernard, V.L. (1987). Cross-Sectional Dependence and Problems in Inference in Market-Based Accounting. *Journal of Accounting Research*, Vol. 25, No. 1, pp. 1-48.

Brown, S.J. & Warner, J.B. (1986). Using daily stock returns: The Case of Event Studies. *Journal of Financial Economics*, Vol. 14 No.1, pp. 3-31.

Campbell, J.Y., Lo, A.W. & MacKinlay, A.C. (1997). *The econometrics of financial markets*. pressNew Jersey: Princeton University.

Dowd, K. (2015). Central bank stress tests: mad, bad, and dangerous. *Cato Journal*, Vol. *35*, No. 3, pp.507-524.

European Banking Authority (n.d.). Available Online: https://eba.europa.eu/about-us (Accessed April 9, 2019).

European Banking Authority (2018a). 2018 EU-wide transparency exercise: Frequently Asked Questions. Available Online: https://eba.europa.eu/documents/10180/2518651/EU-wide_transparency_exercise-Public_FAQ.pdf (Accessed April 9, 2019).

European Banking Authority (2018b). 2018 EU-wide stress test: Frequently Asked Questions. Available Online: https://eba.europa.eu/documents/10180/2419200/2018-EU-wide-stress-test-FAQ.pdf (Accessed April 9, 2019).

European Banking Authority (2016). 2016 EU-wide stress test: Frequently Asked Questions. Available Online: https://eba.europa.eu/documents/10180/1532819/2016-EU-wide-stress-test-FAQ.pdf (Accessed April 9, 2019).

European Banking Authority (2014). 2014 EU-wide stress test: Frequently Asked Questions. Available Online: https://eba.europa.eu/documents/10180/851779/FAQs%20on%20EU-wide%20stress%20test.pdf (Accessed April 9, 2019).

Eventstudytools.com. Available Online: https://www.eventstudytools.com/significance-tests?fbclid=IwAR3tkpxeJcYh0eTkIDyM2mJ4wIus73LXpK2D8NPvgSmeny_irQP1FilfYgw#adjPatell (Accessed April 14, 2019).

Fama, E.F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, Vol. 25 No. 2, pp. 383-417.

Fernandes, M., Igan, D. & Pinheiro, M. (2017). March madness in Wall Street: (What) Does the Market Learn from Stress Tests? *Journal of Banking & Finance*, Vol. 14 No. 6, pp. 1-20.

Flannery, M.J., Hirtle, B. & Kovner, A. (2017). Evaluating the information in the federal reserve stress tests. *Journal of Financial Intermediation*, Vol. 29, pp.1-18.

Flannery, M.J., Kwan, S.H. & Nimalendran, M. (2004). Market evidence on the opaqueness of banking firms' assets. *Journal of Financial Economics*, Vol. 71 No. 3, pp.419-460.

Gerhardt, M. & Vander Vennet, R. (2017). European bank stress test and sovereign exposures. *Applied Economics Letters*, Vol. 24 No. 14, pp.972-976.

Georgescu, O.M., Gross, M., Kapp, D. & Kok, C. (2017). Do stress tests matter? Evidence from the 2014 and 2016 stress tests. *European Central Bank Working Paper Series.* No 2054.

Goldstein, I. & Yang, L. (2017). Information disclosure in financial markets. *Annual Review of Financial Economics*, Vol. 9, pp.101-125.

Haggard, K.S. & Howe, J.S. (2012). Are banks opaque? *International Review of Accounting, Banking and Finance*. Vol. 4 No.1, pp. 51-72.

Keynes, J.M. (1936). *The General Theory of Employment, Interest, and Money*. London: Macmillan.

Kolari, J.W. & Pynnönen, S., (2010). Event study testing with cross-sectional correlation of abnormal returns. *The Review of financial studies*, Vol. 23 No. 11, pp.3996–4025.

MSCI (2019). MSCI Europe Index. Available Online: www.msci.com/europe (Accessed April 12, 2019).

Morgan, D.P., Peristiani, S. & Savino, V. (2014). The information value of the stress test. *Journal of Money, Credit and Banking*, Vol. 46 No. 7, pp.1479-1500.

Morgan, D.P. (2002). Rating banks: Risk and uncertainty in an opaque industry. *American Economic Review*, Vol. 92 No. 4, pp.874-888.

Neretina, E., Sahin, C. & De Haan, J. (2015). Banking stress test effects on returns and risks. *De Nederlandsche Bank Working Paper* No. 419, pp 1-26.

Patell, J. (1976). Corporate Forecasts of Earnings Per Share and Stock Price Behavior: Empirical Tests. *Journal of Accounting Research,* Vol.14 No. 2, pp. 246–276.

Petrella, G. & Resti, A., (2013). Supervisors as information producers: do stress tests reduce bank opaqueness? *Journal of Banking & Finance*, Vol. 37 No. 12, pp.5406-5420.

Quijano, M. (2014). Information asymmetry in US banks and the 2009 bank stress test. *Economics Letters*, Vol. 123 No. 2, pp.203-205.

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

Appendix

TABLE A1: SAMPLE OF BANKS

Country	**Bank**	***Transparency Exercise***	***Stress Test***
Austria	ERSTE GROUP BANK	√	√
	RAIFFEISEN BANK INTL.	√	√
	BAWAG GROUP	√	
Belgium	KBC GROUP	√	√
Bulgaria	CB FIRST INVESTMENT BANK	√	
Cyprus	BANK OF CYPRUS HOLDING	√	
Denmark	DANSKE BANK	√	√
	JYSKE BANK	√	√
	SYDBANK	√	
France	BNP PARIBAS	√	√
	CREDIT AGRICOLE	√	√
	SOCIETE GENERALE	√	√
Germany	DEUTSCHE BANK	√	√
	AAREAL BANK	√	
	COMMERZ BANK	√	√
Greece	ALPHA BANK	√	
	BANK OF PIRAEUS	√	
	NATIONAL BANK OF GREECE	√	
	EUROBANK ERGASIAS	√	
Hungary	OTP BANK	√	√
Ireland	BANK OF IRELAND GROUP	√	√
	AIB GROUP	√	√
Italy	BANCO BPM	√	√
	INTESA SANPAOLO	√	√
	UNICREDIT	√	√
	UNIONE DI BANCHE ITALIAN	√	√
	BPER BANCA	√	
	BANCA MONTE DEI PASCHI	√	
	BANCA PPO.DI SONDRIO	√	
	CREDITO EMILIANO	√	
	MEDIOBANCA BC.FIN	√	
Netherlands	ABN AMRO GROUP	√	√
	ING GROEP	√	√
Norway	DNB	√	√
	SPAREBANK 1 SR-BANK	√	
	SPAREBANK 1 SMN ORDS	√	
Poland	BANK POLSKA KASA OPIEKI	√	√
	PKO BANK	√	√
Portugal	BANCO COMR.PORTUGUES	√	
Romania	BANCA TRANSILVANIA CLUJ	√	

Spain	BANCO DE SABADELL	√	√
	BANCO SANTANDER	√	√
	CAIXABANK	√	√
	LIBERBANK	√	
	UNICAJA BANCO	√	
	BANKINTER	√	
	BBV.ARGENTARIA	√	
Sweden	SWEDBANK A	√	√
	SVENSKA HANDELSBANKEN	√	√
	NORDEA BANK	√	√
	SKANDINAVISKA ENSKILDA BANKEN	√	√
United Kingdom	ROYAL BANK OF SCTL.GP.	√	√
	LLOYDS BANKING GROUP	√	√
	BARCLAYS	√	√
	HSBC HOLDINGS	√	√
	STANDARD CHARTERED	√	

TABLE A2: GEORGESCU ET AL.'S (2017) CUMULATIVE EXCESS STOCK RETURNS

	Information Disclosure	
	Stress Test 2014	*Stress Test 2016*
Event Window	**CAAR**	**CAAR**
[0, +1]	-1.4 %	-0.8 % **

Note: The table reports the average cumulative abnormal returns in connection to the 2014 and 2016 stress test results release. [0, +1] denotes the first two days in which the information is publicly available during open market hours. *, **, *** show statistical significance of 10, 5 and 1 percent. Figures retrieved from Georgescu et al. (2017).