Credit and Capital Markets, Volume 54, Issue 2, pp. 223 – 263
Scientific Papers

The ECB's 2019 Liquidity Stress Test: An Event Study Evaluating the Impact on Owners and Creditors

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Abstract

The liquidity stress test (LiST) 2019 by the European Central Bank (ECB) examines the liquidity situation of banks, which is novel at the European level. Therefore, a well-founded empirical analysis is necessary to derive implications for the capital market. This paper investigates the impact on stock returns and credit default swap (CDS) spread changes of the participating banks using an event study methodology. This approach allows for conclusions about the entire capital market. A major problem with the sample, event clustering, is addressed with appropriate test statistics. The paper provides evidence of the absence of a capital market reaction, which could be the goal of supervisors, namely, being able to assess the banking sector and providing general information without triggering panic.

Keywords: Liquidity Stress Test 2019, Liquidity Risk, Event Study, ECB Stress Testing, European Banking Sector

JEL Classification: G01, G14, G28

I. Introduction

Since the financial crisis in 2008, banking stress tests have gained importance globally. Supervisors have discovered and increasingly used this instrument to reduce bank opacity to gain detailed knowledge of actual financial conditions. The release of stress test results is often expected by the press and the public with a great deal of tension, which was also the case for the liquidity stress test

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The authors are grateful for comments and input on the earlier version of the paper from the reviewer.

(LiST). Although the European Central Bank (ECB) certifies that the tested banks have adequate liquidity reserves, the news releases evaluate the liquidity situation ambivalently (ECB 2019c). For instance, the *Frankfurter Allgemeine Zeitung*, *Thomson Reuters* and the *Irish Independent* interpreted the results as a bad market signal, whereas the most high-circulation German tabloid newspaper even headlined that half of the banks failed the stress test (*Mussler* 2019; *Thomson Reuters* 2019; *O'Donovan* 2019; *Bild* 2019). In contrast, the *Handelsblatt* and *Focus* argued that banks' liquidity situation was adequate (*Handelsblatt* 2019; *Focus* 2019).

The liquidity risk was addressed by regulators only in the aftermath of the crisis, as evidenced by the successive introduction of relevant regulations. Therefore, the LiST in 2019 was the first stress test to explicitly analyze the liquidity situation of institutions. Hence, this new regulatory instrument needs to be evaluated with respect to two dimensions. First, the impact of the stress test on the capital market has to be examined to derive the implications of the revealed information, particularly because news releases are contradictory. Second, the objective of the ECB and its potential achievements can be discussed.

The present paper uses the event study methodology to determine the effects on equity and debt of the participating banks. The event to be investigated is the publication of the stress test results on October 7, 2019. Under the efficient market hypothesis (EMH), new and relevant information should be priced into securities immediately after they are revealed. Therefore, the value-based effects of the news can be quantified. If credit default swap (CDS) spread changes as well as stock returns of banks react significantly to the publication, then these responses could be interpreted as event-induced and attributed to the ability of the LiST to uncover significant information. The relevance of this paper is reflected in the topicality of the issue, which, to the authors' knowledge, has not been scientifically addressed so far. In addition, the focus is not unilateral on stock price returns because the inclusion of CDS spread changes allows statements to be made about the entire capital market, and potential differences can be identified. Thus, the paper contributes to closing the existing research gap, and a starting point for further research is given.

The remainder of this paper is structured as follows: Chapter II starts with LiST, its test methodology and the results. Based on this background, a literature review is given, and hypotheses are derived. Chapter III explains in detail the research approach of the event study, the database used and the models for calculating abnormal returns and CDS spread changes. Since the event period is the same for all banks, special test statistics are explained to address this problem. Chapter IV summarizes the empirical and statistical results descriptively and discusses the robustness. Chapter V analyzes the implications for the capital market as well as the potential objective of the regulator and discusses probable limitations of the study. Moreover, the need and possibilities for further research are given alongside concrete proposals. Chapter VI concludes.

II. Theoretical Background

1. Liquidity Stress Test

a) Background and Test Methodology

The liquidity stress test conducted by the ECB in 2019 is part of the Supervisory Review and Evaluation Process (SREP) and serves to assess the liquidity situation of banks that are under the direct supervision of the ECB. The legal basis is Art. 100 CRD IV, which obliges the relevant authorities to conduct annual stress tests to simplify the interpretation of the SREP. The supervisor attests that the majority of the banking sector has a fundamentally comfortable liquidity position through compliance with the Liquidity Coverage Ratio (LCR) and the Internal Liquidity Adequacy Assessment Process (ILAAP) (ECB 2019a). It is also argued that there have been liquidity bottlenecks at individual financial intermediaries, which can spread instantly through contagion effects in the financial system, which is why a review of this risk in the Single Supervisory Mechanism (SSM) is appropriate (ECB 2019a). On October 7, 2019, the results of the LiST were published at an aggregated level by the ECB. The results were integrated into the SREP and thus serve to determine the liquidity risk of the bank, thereby directly influencing qualitative and quantitative supervisory measures (ECB 2019c). A total of 103 credit institutions participated, and it should be emphasized that banks could not "fail" the test (ECB 2019c). This means that there is no threshold for failing or passing the test.

Liquidity risks and consequently liquidity crises can be conditioned idiosyncratically as well as systemically. The LiST examines the former component of a hypothetical idiosyncratic shock that lasts for six months (ECB 2019a). Banks report the consolidated opening balance of all positions as of December 31, 2018, and their contractual changes according to the maturity ladder for six months until June 28, 2019 (ECB 2019b). In addition, the analysis is supplemented by a special consideration of significant foreign currency positions, intragroup relationships and the ability to mobilize collateral (ECB 2019c). This allows the results of the LiST to be better assessed and reveals information that would not be disclosed only with the scenarios. The main components of the LiST comprise the net cash outflows and the counterbalancing capacity, assuming that there are no refinancing possibilities via liabilities. The LiST thus makes it possible to determine the extent to which the assets are sufficient to compensate for the net cash outflows through liquidation or lending transactions. Management measures that could mitigate the shock are explicitly not considered to focus the analysis on the counterbalancing capacity, which corresponds to the static balance sheet assumption. Based on this, the net liquidity position (NLP) on each day is calculated as the difference between the counterbalancing capacity and the net cash outflows to determine the institution's survival period, expressed in days (ECB 2019c). This methodological framework is used to analyze four scenarios. The baseline scenario projects contractual cash flows without assuming new business, whereas the adverse and extreme scenarios assume a shock. The fourth simulation includes the business view of the institution, whereby this serves the purpose of information aggregation and is not considered in the SREP (ECB 2019c). The parameters that stress the NLP increase in intensity according to the severity of the scenario. Within this methodological framework, assumptions are made about banks' on-balance sheet and off-balance sheet positions.

For the following, an overview of the scenarios is sufficient. In the baseline scenario, the extent to which the banks' counterbalancing capacity as of December 31, 2018, is sufficient to cover the contractual cash outflows until June 28, 2019, is examined. For each relevant day, the NLP and thus the survival period of an institution are calculated. Relevant days are all calendar days of the period on which TARGET2 is not closed (ECB 2019b). With the exception of constant volumes for time deposits and loans with private and commercial customers, receivables and liabilities with contractual residual maturity flow in and out fully at maturity (ECB 2019a). In the case of positions with open maturity, sight deposits with private and commercial customers remain constant, whereas securities financing transactions flow in and out completely (ECB 2019a). The interbank market already freezes in the baseline scenario. Accordingly, 100 % of the demand deposits of financial counterparties run off, and the maturing time deposits and loans granted to them are not rolled over, so they flow back completely when they mature during this period (ECB 2019c). Contingencies are not considered in this scenario (ECB 2019c). This scenario serves as a reference for the shocks. When assessing them, it should be taken into account that even in the baseline scenario, considerable stress is assumed with regard to the interbank market.

Based on this, in the adverse and extreme scenario, the demand and maturing time deposits of private and commercial customers run off. In the adverse scenario, outflow rates amount to 12 %–58 % and 18 %–52 %, whereas in the extreme scenario, demand deposits run off between 18 % and 74 %, and maturing time deposits run off between 27 % and 76 % (ECB 2019c). Furthermore, the rating of the bank is downgraded, and outflows from credit and liquidity facilities occur.

Basically, it can be stated that the focus of the supervisor was on a bank run of commercial and private customers. This circumstance is already exacerbated in the baseline scenario to the extent that the interbank market collapses completely. The liquidity situation of the banks is further impaired by drawn facilities and a rating downgrade. The assumptions made by the supervisor are based on historical experience and include a constant level of loans with private and commercial counterparties. This implies the inability of banks to deleverage their balance sheets, which is gradually reflected in a lower NLP and ultimately leads to insolvency (ECB 2019a). After the main mechanics of the stress test are discussed, the results are presented in the next chapter. In the discussion and evaluation, an understanding of how the test works is important since not only the banks' positions but also the assumptions of the test have a causal effect on the results and must be considered accordingly.

b) Results

The results of the LiST were published in aggregated form by the ECB on October 7, 2019. The majority of the participating banks had adequate liquid funds to compensate for the net cash outflows, although the liquidity situation in foreign currencies and of subsidiaries outside the euro zone was more problematic (ECB 2019c). The total outflows are obviously determined not only by the assumed outflow rates but also at the individual bank level, especially by the maturity structure and composition of liabilities. In particular, the classification of deposits is decisive for the outflows for demand and time deposits. With regard to time deposits and securities issued, it is crucial whether the positions fall due within the six months during the LiST. It is assumed that all maturing securities will not be rolled over, and therefore, outflows occur. Hence, banks with short-term financing via the capital market or with certain types of deposits are subject to more serious stress.

On average, banks had an initial counterbalancing capacity of 23 % of total assets (ECB 2019c). After six months, the counterbalancing capacity was 18.1 % in the baseline scenario, 1.5 % in the adverse scenario and −3.7 % in the extreme scenario on average (ECB 2019c), which indicate extreme stress illiquidity on average. Similar to NLP, the survival period of institutions decreases with the severity of the shock. Even in the baseline scenario, four banks do not survive but become insolvent between 120 and 160 days (ECB 2019c). One potential cause is short-term capital market financing and a focus on financial customers. It is also possible that the counterbalancing capacity may be lower than average.

A total of 52 banks do not survive adverse stress, and 77 do so in the extreme scenario. Expressed as medians, these figures indicate a survival time of more than six months in the baseline scenario, 176 in the adverse scenario, and

122 days under extreme stress (ECB 2019c). As already described, the counterbalancing capacity and the financing structure have a considerable influence on which outflows occur and how they can be compensated. Since such positions also depend on the business model of the credit institution, it is evident that different types of banks have significantly different survival periods. It can be seen that universal banks as well as globally systemically important institutions are most severely affected in principle since their financing structure is based primarily on less stable deposits and the interbank market (ECB 2019c). At the median, they are insolvent after 126 days in the adverse scenario and after 80 days in the extreme scenario. Less susceptible are retail banks as well as smaller and local credit institutions due to a higher share of stable deposits (ECB 2019c). At the median, they are illiquid in the extreme scenario after 140 days and survive during the adverse simulation. In addition to the analysis on the consolidated level for all currencies, it was also examined whether banks are exposed to liquidity shortages in significant currencies. Significant currencies are those that account for at least 5 % of total liabilities excluding regulatory capital and off-balance-sheet items (ECB 2019b). The comparison shows that the median survival time for the US dollar and GBP currencies is significantly lower than that of the Euro. Additionally, the ECB evaluated the liquidity situation within group structures. In this context, the analysis reveals that the group subsidiaries within the eurozone have a longer survival period than those outside it (ECB 2019c). The significantly lower survival time of 25 days is attributed by the supervisor to primarily two factors. First, the counterbalancing capacity of subsidiaries outside the EU is lower, and second, they tend to finance themselves more via the interbank market and within the group (ECB 2019c).

In addition, reporting the LCR on a consolidated level for all currencies is mandatory under the LiST. In this context, the analysis by the ECB shows cliff effects due to optimization strategies (ECB 2019c). This means a significant decrease in the level of the LCR after 30 days since positions for the period beyond are no longer reflected in the ratio. Measures taken by the bank include, for example, collateral swaps that increase the HQLA in the time horizon of the LCR, as well as securities or time deposits that mature after 30 days (ECB 2019c). It can be stated that the majority of audited banks have, from a supervisory perspective, sufficient counterbalancing capacity to compensate for the simulated net cash outflows. The main criteria for evaluating the liquidity position of institutions are the NLP and the associated survival period. In this context, it should be emphasized that this ratio is inherent in the consideration of both the asset and liability sides. This means that a bank with a comparatively low counterbalancing capacity can nevertheless remain liquid for an above-average period of time, given that net cash outflows are also low. Correspondingly, the survival period can be comparatively long even if the net cash outflows and the counterbalancing capacity are high. Consequently, both the amount and quality of the counterbalancing capacity and the stability of the refinancing have an equal impact on the result.

2. *Literature Review and Hypotheses Building*

As no comparable liquidity stress test had been carried out before, the scarce general bank stress testing literature must be used to describe the possible effects of the LiST.

In an event study of the EBA stress tests in 2014 and 2016, *Georgescu* et al. (2017) state that stress tests provide new information and thus increase market efficiency, whereby they evaluate the effects in terms of CDS spreads and stock returns. For the US banking market, *Fernandes* et al. (2015) conduct an event study for various stress tests between 2009 and 2015, evaluating stock prices and CDS spreads after publication. They conclude that the publication of stress test results provides new information, especially when markets are under stress anyway.

Candelon/Sy (2015) assess the impact of stress tests in the US and Europe in the years 2009 to 2013 on stock prices. They analyze three US and four EU-wide stress tests and their market implications and find that the announcement of stress tests does not have a significant impact on stock prices in the US, whereas the opposite is true for European banks. However, the publication of the results generally has a statistically significant impact on the stock price returns of the banks tested. The authors also include banks in the study that did not participate in stress tests. For the EU-wide stress test 2011, they also show significant effects for banks that were not stressed, although the effects are more pronounced for participating institutions. This finding is relevant to this paper because the results of the LiST are available only in aggregated form, which entails certain limitations in the formulation of the hypotheses. Hence, the hypotheses were chosen in such a way that they allow statements to be made about the banking sector rather than the individual level. Consequently, the fact that the stock prices of nonstressed banks change significantly supports the plausibility of the hypotheses made at the banking sector level. *Neretina* et al. (2014) examine the effects of the publication of stress test results in the US in the years 2009 to 2015 on stock prices and CDS spreads, also using the classic event study methodology. In doing so, they generally state that stress tests can in principle provide information for the capital market, as the empirical results are not fully consistent. *Alves* et al. (2015) conduct a similar event study in which they evaluate stock prices and CDS spreads in relation to the two EBA stress tests of 2010 and 2011. The empirical analysis reveals a statistically significant and positive abnormal effect on stock prices and CDS spreads. However, this cannot be shown for banks that pass the test because their control group reports similar

CDS spreads. This finding implies an asymmetric effect in that the market gives greater weight to negative news. On the other hand, the results of the second stress test are not clear, since the negative results were wrongly anticipated by the stock market, whereas the CDS market partially correctly assessed this development. The authors attribute this result to the fact that market participants in the CDS market are better informed, since no retail investors are active there. The study by *Morgan* et al. (2014) examines various hypotheses in the context of the 2009 stress test in the US. The stress test during the financial market crisis was intended to reduce information asymmetries and help in the fair valuation of equity and debt, whereby the authors conclude that the test contained useful information for the market. They also find that investors were already informed about the capital gaps but not about their size, and as a result, such banks experienced particularly negative abnormal returns.

Although both the aforementioned studies and this paper examine capital market reactions to stress tests, the differences are substantial. First of all, it should be noted that the majority of the studies presented here focus on stress tests during or after the financial market and sovereign debt crises. During this economically turbulent period, stress tests served to reduce information asymmetries and to calm markets, among other purposes. It turns out that the majority of authors attribute the publication of stress test results to the ability to provide new information for the market. In this context, it is conceivable that positive test results are more weighty in an economically tense situation than they were during the LiST. Furthermore, the focus of the LiST is completely different than of the stress tests carried out before. While the previous stress tests examined banks' capitalization, the LiST analyzes the liquidity adequacy for the first time. Another distinction can be made regarding the type of result publication. Previously, results were published primarily at the level of individual institutions, whereas the results of the LiST are available only in aggregated form. Since information at the individual level can be used directly to evaluate equity or debt positions, it is assumed that it is also more likely to lead to reactions from investors and creditors. This may indicate that the market reactions are less pronounced for LiST than for publication on an individual institution basis. Moreover, institutions may fail within the majority of presented stress tests, which has a signal effect. In this respect, a blanket transferability to possible market implications of LiST does not seem appropriate. Rather, the findings of these studies can be used to interpret the results of this paper.

The event study conducted here tries to capture the capital market reaction to the stress test results holistically. As discussed in Chapter III later on, CDS spreads are included in the event study to capture possibly different reactions of equity and debt. This circumstance could be explained by a higher responsiveness in the CDS market compared to the stock market, because the former market is primarily characterized by better informed professional investors (*Alves* et al. 2015).

Based on the literature review, the hypotheses to be tested and the corresponding mechanism are discussed.

Hypothesis 1: LiST leads to higher stock price returns and lower CDS spread changes because it represents a positive market signal.

It is assumed that owners and creditors could not anticipate the comfortable liquidity situation ex ante, and moreover, they perceived the signal in such a way that the banking sector as a whole is in good shape. This leads to a lower illiquidity risk to positive abnormal returns and negative abnormal CDS spread changes because the spreads positively depend on the default risk, which in turn positively correlates with the liquidity risk.

Hypothesis 2: LiST leads to uncertainty and thus to negative abnormal returns and positive abnormal CDS spread changes.

It is supposed that the uncertainty regarding the results is significant both before publication and afterwards. The uncertainty may be increased if information is "leaked" before the official release. This is justified by the risk aversion of market participants. It is also possible that the publication of only aggregated results could lead to or increase uncertainty in the banking sector. The news releases as of October 7, 2019, indicate an inconclusive evaluation of the stress test results.

Hypothesis 3: LiST does not lead to abnormal returns or abnormal CDS spread changes because it does not contain any new information.

Relevant information will be priced instantly when it is revealed unless it can be anticipated in advance. In this respect, it is assumed that the test results do not contain new or essential information. This means that the returns or CDS spread changes either reflect the implications of the test even before disclosure or that the information is irrelevant from the perspective of shareholders and creditors. One reason for the irrelevance could be the fact that the results of the stress test were not published on an individual level. It is therefore difficult for economic entities to derive concrete actions because there is no direct reference to the test results at the individual institution level. Accordingly, it is supposed that the test result does not lead to a concrete market reaction and thus to abnormal effects.

Hypothesis 4: Southern European banks are affected differently by the event than northern European financial institutions.

In the recent past, southern European banks have increasingly faced difficulty due to increased risk potential, especially during the financial and sovereign debt crisis. It is possible that their creditors and shareholders will react more sensitively to new information and uncertainty, which will cause different capital market reactions.

III. Methodology

1. Research Approach

The previous chapter provides the foundation for the empirical analysis. Based on this, the methodology that is used to quantify the capital market reaction is discussed. In this context, the event study serves as a tool to analyze whether and how the information provided by the LiST influences the stock prices and CDS spreads of the banks investigated.

In the first step, the quantitative method of the event study is outlined. The procedure is suitable for testing the null hypothesis that the market processes information efficiently and for clarifying the question of whether certain events have an influence on security prices (*Binder* 1998). The paper also uses the approach to analyze whether the publication of the results of the LiST on October 7, 2019, leads to so-called abnormal returns or abnormal spread changes. A temporary distinction can be made between the estimation and event window. The estimation window of this event study ranges from t_{-210} to t_{-11} and covers 200 days, whereas the event window ranges from t_{-10} to t_{+10} and includes 21 days, including October 7, 2019 (t_0). The temporary structure is shown graphically in Figure 1 for better understanding.

The estimation window is used to theoretically model ex ante the parameters that are subsequently used to determine the expected and thus the abnormal returns and spread changes in the event window. In this respect, it is assumed that the model parameters are identical in the estimation and event period (*Röder* 1999). To prevent the distorting influence of the event on the estimators, the event window is not part of the estimation window (*MacKinlay* 1997). The expected returns and CDS spread changes therefore do not include the effect of

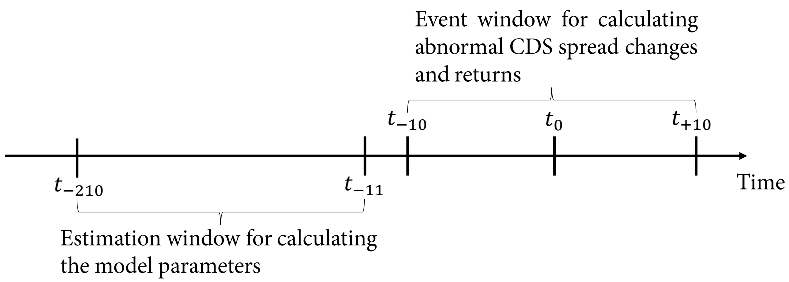


Figure 1: Temporal Structure of the Event Study

the event. CDSs can be interpreted as over-the-counter (OTC) default insurance for debt, whose compensation is paid out after the occurrence of a predefined event. The periodic premium corresponds to the spread and is applied to the nominal amount and expressed in basis points (BP) (1 % = 100 BP) and a measure of credit risk. When choosing a suitable estimation window, there is a trade-off because the longer the time period is, the higher the accuracy in the statistical estimation of the model parameters, and the higher the probability that these parameters have changed over time and overlapping events occur (*Strong* 1992; *Röder* 1999). Overlapping events are a major problem in both the estimation and event periods. In the estimation period, events influence the estimation of the expected model parameters. Events that occur in the event period have a direct influence on the abnormal returns and CDS spread changes, as well as the simultaneous announcement of several facts on the event day itself (*Röder* 1999). These and possible further limitations in the estimation and interpretation of the results are treated in the discussion. The estimation of expected returns and CDS spread changes can be based on various models, which are discussed later. The abnormal return $AR_{i,t}$ of bank i at time t in the event window is the difference between the actual return $R_{i,t}$ and the expected return $E(r_{i,t})$:

$$AR_{i,t} = R_{i,t} - E(r_{i,t}). \tag{1}$$

The average abnormal return $\overline{AR}_t$ is the average of $AR_{i,t}$ at time t. The basic methodology was first used by *Fama* et al. (1969). It can be applied analogously to debt without significant modification and thus to changes in CDS spreads (*MacKinlay* 1997). In the event window, the expected spread changes $\Delta\hat{S}_{i,t}$ are subtracted from the actual spread changes $\Delta S_{i,t}$ to obtain the abnormal spread changes $\Delta AS_{i,t}$:

$$\Delta AS_{i,t} = \Delta S_{i,t} - \Delta\hat{S}_{i,t}. \tag{2}$$

By analogy, the average abnormal spread change $\overline{\Delta AS}_t$ per event day is calculated. The averaging allows the question to be answered regarding whether the event leads to a significant reaction across all institutions. Subsequently, the average cumulative abnormal return (CAR, $\overline{CAR}_{t_1,t_2}$) and average cumulative abnormal spread change (CAS, $\Delta\overline{CAS}_{t_1,t_2}$) are calculated in the event window by summing the average abnormal returns and spread changes between t_1 and t_2, respectively. Theoretically, the abnormal returns and CDS spread changes can be used to directly quantify the value effects of the event. The average abnormal returns and spread changes as well as the aggregates are tested for their significance. The aim is to analyze whether LiST contains new information for owners and creditors. A statistically significant average abnormal return or CDS spread change could be interpreted as an effect of the new information on prices. The exact conception of the event study and models used will be specified step by step in the following.

2. Data

Based on the explanation of the research approach, the data used for the empirical analysis and their operationalization are treated. The sample consists of 17 European banks, whereby the data are taken from Thomson Reuters Eikon. The sample was selected from the banks monitored by the ECB at the time of the LiST, where both a stock exchange listing and thus stock prices and CDS spreads were available. Furthermore, banks were excluded if their stocks were not fungible. An example is DZ Bank AG, whose stocks are held within the cooperative structure. In addition, banks were removed if stock prices or CDS spreads were missing for more than ten consecutive days. After the adjustment, the following banks remained part of the sample: Swedbank AS, Bankinter S.A., Eurobank Ergasias S.A., Banco de Sabadell S.A., Banco BPM S.p.A., Intesa Sanpaolo S.p.A., Ing Groep N.V., BNP Paribas S.A., Caixabank S.A., Barclays PLC, HSBC PLC, Deutsche Bank AG, Commerzbank AG, Société Générale S.A., Banco Santander S.A., UniCredit S.p.A., Banca Monte dei Paschi S.p.A. It should be noted that the HSBC PLC is represented by subsidiaries in the Eurozone, such as France and Malta, which are under the direct supervision of the ECB. In addition, Barclays PLC has one subsidiary and several branches in the Eurozone, including the Italian branch, which is directly supervised by the ECB. As the branches and subsidiaries are owned by the respective banks, their stock prices and CDS spreads are used, although it is questionable whether the stress test results have a direct impact on the parent company level. Of course, the database used has a direct influence on the parameters of the statistical analysis and, consequently, on the quality of the tests. In this context, daily versus weekly and monthly stock returns and CDS spread changes are preferred because the ability to detect information-related abnormal returns and spread changes can be increased (*Morse* 1984). Stock prices are end-of-day prices, which applies to the stock and volatility index as well. The CDS contracts used have a term of five years and are concluded on senior unsecured bonds. With regard to CDSs, the mid-spread, i.e., the mean of supply and demand, is used to approximate the price. This is used to quantify creditors' counterparty risk. The specification of the CDS index corresponds to that of bank-specific CDS contracts. It should be emphasized that the CDS spreads are available only for newly concluded contracts.

The swaps used in this paper have terms of one, five and ten years, and the reference is the 3-month EURIBOR. These are therefore plain vanilla swaps. Interest is given in the unit 0.01=1 % and corresponds to the mid-spread. A European sample means that trading days diverge due to different bank holidays. Furthermore, a CDS is not closed by every bank every day. To ensure consistency and comparability, the stock prices and CDS spreads of all banks were prepared in such a way that they are available on identical days. October 3, 2019, was removed from the event window for both samples due to unavailable data. Furthermore, September 23, 2019, is not part of the event window for the CDS spread changes. The data series therefore covers the stock price returns from November 20, 2018, to October 21, 2019, while the CDS spread changes are available from October 26, 2018, to October 21, 2019. The stock price returns and CDS spread changes are therefore available for 17 banks on 221 trading days, which results in a cumulative total of 3,757 individual data points in each case.

3. *Estimation of Abnormal CDS Spread Changes and Returns*

After the calculation of the abnormal effect is described, the models for estimating the expected and thus the abnormal returns and CDS spread changes must be specified. Since the procedure was originally developed for returns, it is explained in this subchapter only for returns, whereby it is applicable congruently for CDS spread changes. Although various methods to calculate expected returns are available, this study follows the literature and uses the market model of *Sharpe* (1963). This model postulates a linear relationship between the market index and the stock return of company *i*. It applies:

(3) $$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t}$$

with

(4) $$\varepsilon_{i,t} \sim \left(0, \sigma_\varepsilon^2\right).$$

Here, α_i denotes the part of the return that is independent of the market index $R_{m,t}$. β_i measures the historically determined relationship between the market index and the individual stock. $\varepsilon_{i,t}$ is the error term, which is normally distributed by assumption with an expected value of zero and constant variance. The parameters of the market model are calculated with a linear regression in the estimation window, primarily by using ordinary least squares (OLS), and used to calculate the expected return in the event window.

Based on the market model, a model for estimating the returns and CDS spread changes is derived. In this context, the single index model is extended by further (control) variables, which are included as regressors based on economic considerations. This has the advantage that the variance in the abnormal returns can be reduced by explaining the variation in the expected returns more accurately (*MacKinlay* 1997). Thus, as R^2 increases, the variance in the abnormal returns decreases, which implies that the ability to identify the event effects of LiST may increase (*MacKinlay* 1997).

a) CDS Spread Changes

The aim of this paper is to evaluate the implications of LiST on the capital market. Following the literature, CDS spreads are used to illustrate the effects on the debt market within the event study.

Basically, a decision has to be made regarding the calculation of changes in CDS spreads. Relative and absolute changes can be differentiated, whereas with regard to stock prices, it is common to use relative changes expressed by the return. Spread change measures the change in the premium of newly closed CDSs with constant maturity (*Doumet* 2013). Absolute daily changes represent the difference in spreads, measured in BP, from t_{-1} to t, whereas relative changes express the percentage change in daily spreads. The use of relative changes in relation to CDS spreads is more similar to the concept of returns, which is why they are used in this paper (*Doumet* 2013). Relative changes can also be divided into continuous and discrete changes. In the case of daily changes, the discrete changes represent an approximation of the continuous ones such that the choice between the two forms is negligible[1] (*Thompson* 1988; *Kaup* 2008). On this basis, discrete changes are used, where $S_{i,t}$ represents the CDS spread of bank i at time t:

$$\Delta S_{i,\,t} = \frac{S_{i,\,t} - S_{i,\,t-1}}{S_{i,\,t-1}}. \tag{5}$$

$\Delta S_{i,\,t}$ is the relative, discrete change in the spread of bank i at time t. Based on this, a factor model is constructed that serves to determine the parameters during the estimation window that are subsequently used to calculate the expected spread changes $\Delta \hat{S}_{i,\,t}$ in the event window. The estimation model is derived according to *Doumet* (2013). The first regressor is the discrete change in the iTraxx Europe Financials $\Delta S_{index,\,t}$. It is assumed that the CDS index, with its focus on 30 financial companies is more sensitive to the results of the LiST than a broader index. It is supposed that the expected and thus abnormal spread changes, can be better estimated. An increase in the change in the index could lead to an increased change in the spread of bank i and imply that an increase in risk in the CDS market increases risk at the individual level. This single index

[1] To validate the results, the event study was additionally carried out with continuous changes. This does not affect the results. The data are not attached, but can be provided by the authors upon request.

DOI https://doi.org/10.3790/ccm.54.2.223 | Generated on 2025-12-12 08:43:35

model as a basis will be extended by further (control) variables to a factor model. Credit spreads represent the difference between a risky and a risk-free interest rate, e.g., the return difference of corporate and government bonds. Consequently, they are, in addition to CDS spreads, an indicator of default risk in a similar way so that the factors that explain CDS spreads and credit spreads can be considered comparable. The determinants of changes in credit spreads are examined empirically by *Collin-Dufresne* et al. (2001), who conclude that, in contrast to the theory that describes company-specific factors as essential, they are determined primarily by aggregated or macroeconomic variables. Against this background, aggregated and not company-specific variables are included as exogenous variables.

Ericsson et al. (2009) empirically investigate the theoretical determinants of CDS spreads. By analogy to *Collin-Dufresne* et al. (2001), they perform a regression for CDS spreads, identifying risk-free interest rates and implied stock volatility as significant influencing factors. *Meine* et al. (2016) expand this strand of literature by analyzing and identifying the upper tail dependence between a single CDS and a CDS market index as a determinant of CDS spreads, calling this CDS tail beta. This indicator expresses the propensity of an individual bank to jointly crash with the banking sector. They confirm the results of *Ericsson* et al. (2009) and conclude that the CDS tail beta complements the previous findings and explains CDS spreads especially during financial crisis. Within their comprehensive analysis, *Pelster/Vilsmeier* (2018) provide evidence for the tail risk and common factors as determinants of CDS spreads. The finding of the tail risk as a driver of CDS spreads, especially during financial turmoil, is also confirmed by *Irresberger* et al. (2018). CDS tail beta is an important determinant of CDS spreads especially during financial stress, whereas no significant stress was observed in the capital market during the LiST period. Due to this circumstance, as well as the fact that the classical CDS determinants remain significant, the CDS tail beta is not considered further (*Meine* et al. 2016).

The level of the five-year swap rate $Level_t$ is used as a proxy for the risk-free interest rate. It is assumed that there is a diametral relationship between $Level_t$ and $\Delta S_{i,t}$. An increase in the drift of the risk-free interest rate theoretically increases the risk-neutral drift of the firm value process so that the risk-neutral PD and consequently the spreads decrease (*Longstaff/Schwartz* 1995). Economically, it is assumed that low interest rates often occur during crises with increased insolvencies of companies and vice versa (*Alexander/Kaeck* 2008) However, it must be considered that interest rates in the Eurozone are kept low by the ECB's expansive monetary policy. The extent to which the postulated correlation is still empirically valid can be tested only through statistical analysis.

A further regressor is the slope of the risk-free yield curve $Slope_t$, whereby a steeper curve implies that the expected interest rates are higher (*Alexander/*

Kaeck 2008). The argumentation regarding the relationship between $Slope_t$ and $\Delta S_{i,t}$ corresponds to that used in the consideration of how the risk-free interest rate affects $\Delta S_{i,t}$. *Doumet* (2013) uses the difference between the ten-year and one-year swap rates as a proxy. Neither the risk-free interest rate nor the slope of the yield curve uses percentage changes due to changes in sign.

Since higher equity volatility also increases the probability of default of debt, it implies rising CDS spread changes. The implied volatility is the volatility inherent in current option prices, which is assumed by market participants at a given option price (Deutsche Börse AG 2007). Thus, the discrete change in equity volatility $\Delta Vola_t$ is included as a regressor. The proxy of the stock volatility is the VSTOXX. This index indicates in percentage points what volatility is to be expected for the EURO STOXX 50 in the next 30 days and is calculated from EURO STOXX 50 index options quoted at and out of the money (Eurex Frankfurt AG 2021). It thus has a prospective character. Furthermore, the discrete return $R_{m,t}$ of the STOXX Europe 600 Banks market index is included in the model and is assumed to have a negative effect on the CDS spread changes. Compared to the choice of the iTraxx Europe Financials, a sector index is used based on the possible advantages already discussed. It is assumed that increasing returns result in higher company values and therefore in a lower PD. Before the estimation, the regressors in both models are checked for multicollinearity using variance inflation factors (VIFs) to rule out any problems associated with them in advance. In the first step, the pairwise correlations are calculated according to Kendall because this method is robust if variables are not normally distributed. As shown in Table 1, the correlation of $Slope_t$ and $Level_t$ with 0.96 indicates a problem with multicollinearity. Based on this, Table 1 postulates a VIF of $Level_t$ and $Slope_t$ of 53.36 and 53.39, respectively, whereas the other regressors show values of 2.05 and less. The regressor $Slope_t$ is removed, and the VIF decreases to values not exceeding 2.03. This allows the model to be set up to estimate the CDS spread changes and thus to calculate the abnormal CDS spread changes:

$$(6)\quad \Delta AS_{i,t} = \Delta S_{i,t} - (\hat{\alpha}_i + \hat{\beta}_{1,i} \Delta S_{index,t} + \hat{\beta}_{2,i} R_{m,t} + \hat{\beta}_{3,i} Level_t + \hat{\beta}_{4,i} \Delta Vola_t).$$

$\Delta AS_{i,t}$ is the abnormal CDS spread change of bank *i* at time *t*. The minuend is the actual CDS spread change of bank *i* at time *t*. The subtrahend reflects the calculation of the expected CDS spread change $\Delta \hat{S}_{i,t}$, whereby the estimators were determined by performing the regression in the estimation window.

b) Stock Price Returns

By analogy to the previous chapter, a factor model is used to estimate the returns. The starting point is the market model of *Sharpe* (1963) with the return

$R_{m,t}$ of the STOXX Europe 600 Banks as the market index. In accordance with the discrete spread changes, discrete returns are calculated, abstracting from dividends and capital measures. As a further regressor, $Level_t$ is included, for which the argumentation can be taken from the previous chapter. In contrast to the effect on CDS spreads, it is assumed that a higher risk-free interest rate increases the stock price return. $Slope_t$ is not included due to the discussed multicollinearity problem. The change in implied equity volatility $\Delta Vola_t$ is included as a further explanatory variable. It is conceivable that a higher implied volatility unsettles investors and encourages them to invest at lower risk. The equality of the estimation models can be justified, on the one hand, by the inclusion of aggregated variables following the argumentation and, on the other hand, by the fact that equity and debt are closely related so that the regressors address both types of capital. Therefore, $\Delta S_{index,t}$ is included as a further proxy for the default risk. Based on these considerations, the following model is used to calculate the abnormal returns:

$$(7) \qquad AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_{1,i} R_{m,t} + \hat{\beta}_{2,i} \Delta S_{index,t} + \hat{\beta}_{3,i} Level_t + \hat{\beta}_{4,i} \Delta Vola_t)\cdot$$

The mechanics of formula (7) correspond to formula (6) and can be interpreted analogously.

4. *Regression Requirements and Significance Tests*

After the models for the calculation of expected returns and changes of CDS spreads are derived, the significance tests for abnormal returns and CDS spread changes are explained below. Since the requirements of regressions and significance tests are comparable, they will be discussed in a first step. To avoid redundancies and because the tests were originally developed for abnormal returns, they will be discussed based on the returns but apply congruently to abnormal CDS spread changes. In the first step, the regressions are tested for homoscedasticity using the Breusch-Pagan test (BP test) in the estimation window. The opposite heteroscedasticity means that the variance of the residuals depends on the exogenous variables. The estimators are then unbiased and consistent but no longer efficient, and due to biased standard errors, the significance tests of the estimators are incorrect (*Bey/Pinches* 1980). In addition, the residuals must be uncorrelated because otherwise, it is not ensured that the OLS estimators are efficient (*Bonse* 2004). This condition must apply to the abnormal returns of the event period as well. However, since the effects of autocorrelation are small for the event study and an explicit consideration of autocorrelation does not allow for significant improvement, no corresponding analysis will be made in this paper (*Brown/Warner* 1985; *Henderson* 1990). The significance tests regarding the regressions and the abnormal returns in the event window presuppose a normal distribution, whereby due to the size of the estimation window of 200 days for the regressions, an approximate normal distribution can be assumed (*Bonse* 2004). In addition to the parametric test regarding the abnormal returns, which demands a normal distribution, a nonparametric test is used, which is not based on a distribution assumption. In both procedures, a two-sided test is performed because no clear statement can be made about the direction of the expected reactions.

It should be noted that abnormal returns of the estimation period can be interpreted as regression residuals and that they are calculated only to perform the significance tests. In this paper, an extreme form of event clustering is present because the event period is identical for all banks and the possible cross-sectional correlations are reinforced by considering a homogeneous sector (*Pfauth* 2008). A positive cross-sectional correlation will underestimate the variance of the residuals so that the null hypothesis will be rejected too often even though no abnormal returns are present (*Pfauth* 2008). Therefore, as a parametric procedure, the portfolio t-test is used, which takes into account the cross-sectional dependence by using the standard deviation of the average abnormal returns of the regression period instead of the standard deviation of individual securities (*Brown/Warner* 1985; *Pfauth* 2008). The null hypothesis that the $\overline{AR}_t$ correspond to their expected value and are therefore equal to zero is tested, in contrast to the alternative hypothesis that they are not equal to zero. The test statistic at time t is given as follows:

(8) $$T_{p,\,t} = \frac{\overline{AR}_t}{S\left(\overline{AR}_t\right)}.$$

$\overline{AR}_t$ is the average abnormal return at time t in the event window, and $S(\overline{AR}_t)$ corresponds to the mentioned standard deviation in the estimation window from t_{-210} to t_{-11}. The test statistic is student distributed, and the use of 195 (200-4-1) degrees of freedom is appropriate because the standard deviation is determined by the estimated residuals using the factor model (*Pfauth* 2008). The test statistic of the average cumulative abnormal returns can be defined using the square-root-of-time rule (*Heiden* 2002):

(9) $$T_{p,(t_1,\,t_2)} = \frac{\overline{CAR}_{t_1,\,t_2}}{S\left(\overline{AR}_t\right)\cdot\sqrt{n}}.$$

$\overline{CAR}_{t_1,\,t_2}$ denotes the average cumulative abnormal return between t_1 and t_2, $S(\overline{AR}_t)$ corresponds to formula (8), and $n\,(= t_2 - t_1 + 1)$ is the number of days in the interval on which the average abnormal returns are cumulated.

Test procedures also fail if the new information leads to an increase in the variance of the abnormal returns in the event period, and the tests are based on the variances of the estimation period (*Brown/Warner* 1985). The nonparametric rank test according to *Corrado* (1989) is correctly specified even in the case of an event-induced variance increase, is robust against event clustering and is performed as an addition (*Campbell/Wasley* 1993). $K_{i,t}$ denotes the rank of the abnormal return of security *i*, where $AR_{i,t} \geq AR_{i,j}$ implies a higher rank (*Corrado* 1989). The abnormal returns in the estimation and event period are considered, so 221 ranks are assigned per security. The average rank is 0.5 plus half of the total period, ergo 111. The hypothesis that the average rank of the research group in *t* corresponds to the expected value of 111 is tested, whereas the alternative hypothesis postulates that this value is not equal to 111. The test statistic on day *t* is obtained by dividing the average rank on day *t* by the standard deviation *S(K)* of the average ranks from t_{-210} to t_{+10} (*Corrado* 1989). In this study, the test statistic is student distributed and given as follows:

$$T_{c,t} = \frac{\frac{1}{17}\sum_{i=1}^{17}\left(K_{i,t} - 111\right)}{S(K)} \tag{10}$$

with

$$S(K) = \sqrt{\frac{1}{221}\sum_{t=-210}^{+10}\left(\frac{1}{17}\sum_{t=1}^{17}\left(K_{i,t} - 111\right)\right)^2}\,. \tag{11}$$

Regarding the consideration of $\overline{CAR}_{t_1,t_2}$, the average ranks between t_1 and t_2 are cumulated, and the denominator is adjusted with the square-root-of-time rule. With the transformation into ranks, an equal distribution of the abnormal returns is modeled, independent of the original one (*Corrado* 1989). As the hypotheses have shown, it will also be analyzed whether southern and northern European (or central European) institutions are affected differently by the publication of the stress test results. The parametric two-sample t-test (Welch test) as well as the nonparametric Mann-Whitney U-test will be used for examination. The first test proves the null hypothesis that the means of the samples are equal, whereas the second test examines this for the central tendencies. Similarly, a two-sided test is performed. The subsample "North" includes the following banks: Swedbank AS, Ing Groep N. V, BNP Paribas S. A, Barclays PLC, HSBC PLC, Deutsche Bank AG, Commerzbank AG, Société Générale S.A. The remaining banks are pooled in the subsample "South". For each subsample, $\overline{\Delta AS}$ and $\overline{AR}$ were calculated on each day of the event period. These serve as the basis for the tests that were not specifically designed for event studies.

IV. Findings

1. Descriptive Statistics and Regression Parameters

The pairwise correlations and VIFs are documented in Table 1, and the analysis was already performed within the derivation of the model for estimating CDS spread changes. Based on this, Table 2 presents the descriptive statistics of the exogenous variables as well as those of the returns and CDS spread changes for the entire period.

With the exception of *Level*, the variables tend to be positively skewed. Furthermore, the distributions of R_m, $\Delta Vola$, R and ΔS are leptokurtic (Kurtosis > 3), and the other data are distributed conversely. The regression parameters as well as corresponding tests can be found in appendices 3 and 4.

Table 1

Pairwise Correlations According to Kendall and Variance Inflation Factors Based on the Estimation Window of CDS Spread Changes

	ΔS_{index}	R_m	*Level*	$\Delta Vola$	*Slope*
ΔS_{index}	1				
R_m	–0.28	1			
Level	0.01	0.01	1		
$\Delta Vola$	0.26	–0.47	–0.03	1	
Slope	0.01	0.02	0.96	–0.03	1
VIF	1.22	2.05	53.36	1.91	53.39
VIF	1.22	2.03	1	1.91	

Since the estimation windows used to calculate the parameters of the returns and CDS spread changes diverge, appendix 1 provides the same analysis for the returns. The interpretation is consistent.

Table 2

Descriptive Statistics of Exogenous Variables Related to the Estimation of CDS Spread Changes, as well as Endogenous Variables

	N	*Mean in %*	*Standard Deviation in %*	*Skewness*	*Kurtosis*	*Max in %*	*Min in %*
ΔS_{index}	221	–0.1649	4.1402	0.2221	2.8697	11.5225	–11.2746
R_m	221	–0.0002	1.3803	0.1698	3.6253	4.9249	–3.9268
Level	221	–0.1165	0.2768	–0.2731	1.8049	0.3248	–0.64
$\Delta Vola$	221	0.1149	7.5715	1.3774	6.7516	34.8417	–19.5687
R	3757	0.0064	2.2091	0.3439	7.7564	18.0706	–13.2767
ΔS	3757	–0.1625	4.0780	1.9888	59.5902	68.7297	–45.2605

By analogy, the regressors refer to the estimation of CDS spread changes, whereas the descriptive statistics of the exogenous variables for the estimation of returns can be found in appendix 2. There are no significant differences. R and ΔS represent the returns and spread changes, respectively, with values of 221 trading days from 17 banks.

2. *Robustness*

With a total of 34 estimates, only five regressions show heteroscedasticity problems (cf. appendices 3 and 4). Alternative methods that explicitly consider heteroscedasticity, such as feasible generalized least squares, could lead to more efficient estimates, which, in turn, would result in other problems (*Greene* 2012). *Schremper* (2002), for example, finds no significant difference due to explicit considerations. In this paper, significance tests for abnormal returns and CDS spread changes were additionally carried out after removing banks for which heteroscedasticity exists. This does not change the significance of the tests. Due to this result and the low number of regressions with the problem, the abnormal returns and CDS spread changes of all 17 banks are still calculated with the OLS estimators. However, this should be taken into account when interpreting abnormal spread changes and returns. A potential cause of heteroscedasticity in volatile financial markets can be outliers in the banks' observed values (*Greene* 2012). The endogenous variables R and ΔS from Table 2 may provide related evidence.

DOI https://doi.org/10.3790/ccm.54.2.223 | Generated on 2025-12-12 08:43:35

3. *Event Study*

The daily abnormal CDS spread changes and returns of all i banks can be found in appendices 5 and 6. In Table 3, the average abnormal returns and CDS spread changes, their aggregates and the test statistics are summarized. $\overline{\Delta CAS}$ and $\overline{CAR}$ are shown in Table 4 for different timeframes, which allows for a more specific examination of the hypotheses. The results of the analysis of possible differences in geographical subsamples are presented in Table 5. Regarding $\overline{\Delta AS}$, it is shown that only the values at the time points t_{-9} and, at least for the Corrado test, t_{-10} are statistically significant. On both days, the CDS spread changes of the sample increased abnormally on average, that is, by 6.71 % on t_{-9} and by 1.38 % on t_{-10}. The $\overline{\Delta CAS}$ are statistically significant for both tests from t_{-9} to t_{+9}. Since the $\overline{\Delta AS}$ from t_{-8} on are no longer significant, the $\overline{\Delta CAS}$ are driven primarily by the high average abnormal CDS spread change in t_{-9}, which is also indicated by the fact that their significance decreases over time. Regarding $\overline{AR}$, it can be stated that they have significance from t_{+4} to t_{+6}. On t_{+4}, an average abnormal return of –2.12 % is obtained, which is significant at the 1 % level for both tests. The following day, it is 0.84 % and at t_{+6} –0.82 %, both are statistically significant. However, there is no day with an average cumulative abnormal return that is statistically significant. This finding is consistent with the analyses of Table 4, which represent the $\overline{\Delta CAS}$ and $\overline{CAR}$ for different intervals within the event window. With respect to $\overline{\Delta CAS}$, the [−10; −1] interval is statistically significant at the 5 % level for both tests. The value of $\overline{\Delta CAS}_{t_{-10},\, t_{-1}}$ represents an average abnormal increase in CDS spread changes per bank of 11.77 % in this interval. For the entire event period, i.e., from t_{-10} to t_{+10}, there is a cumulative abnormal average CDS spread change of 10.53 %, which is significant only for the Corrado test. The comparison implies that information processing took place ex ante because after t_{-9}, no significant $\overline{\Delta AS}$ occurs. The $\overline{CAR}$ are not significant in any time window, although significant $\overline{AR}$ are obtained from t_{+4} to t_{+6}. On the one hand, the explanation lies in the relatively small amount of $\overline{AR}$; on the other hand, the direction of the effect is not clear. This explains the absence of statistical significance of $\overline{CAR}_{t_{+1},\, t_{+10}}$. For both tests to detect differences in the geographical subsamples, the null hypothesis cannot be rejected.

Table 3

Average Abnormal and Average Cumulative Abnormal Returns and CDS Spread Changes

Time-frame	$\overline{\Delta AS}$ *in %*	$T_p \vert T_c$	$\overline{\Delta CAS}$ *in %*	$T_p \vert T_c$	$\overline{AR}$ *in %*	$T_p \vert T_c$	$\overline{CAR}$ *in %*	$T_p \vert T_c$
t_{+10}	–0.79	–0.54 | –0.42	10.53	1.57 | 1.72*	–0.23	–0.50 | –1.06	–1.45	–0.70 | –0.19
t_{+9}	–1.07	–0.73 | –1.04	11.32	1.73* | 1.86*	0.20	0.44 | 0.68	–1.23	–0.61 | 0.04
t_{+8}	1.71	1.17 | 1.43	12.39	1.94* | 2.14**	0.12	0.27 | 0.43	–1.42	–0.72 | –0.11
t_{+7}	0.03	0.02 | 0.18	10.68	1.72* | 1.86*	0.09	0.20 | 0.20	–1.55	–0.81 | –0.22
t_{+6}	–1.98	–1.35 | –1.24	10.65	1.77* | 1.88*	–0.82	–1.82* | –2.04**	–1.64	–0.88 | –0.27
t_{+5}	1.39	0.95 | 0.88	12.63	2.16** | 2.24**	0.84	1.85* | 2.15**	–0.81	–0.45 | 0.23
t_{+4}	–0.81	–0.56 | 0.09	11.24	1.98** | 2.09**	–2.12	–4.68*** | –3.98***	–1.65	–0.94 | –0.32
t_{+3}	–0.44	–0.30 | 0.05	12.05	2.20** | 2.14**	0.43	0.96 | 1.32	0.47	0.28 | 0.73
t_{+2}	–0.70	–0.48 | –0.59	12.49	2.37** | 2.21**	0.03	0.06 | 0.39	0.03	0.02 | 0.39
t_{+1}	0.40	0.27 | –0.01	13.19	2.60*** | 2.47**	0.12	0.25 | 0.35	0.01	0 | 0.30
t_0	1.03	0.70 | 1.18	12.79	2.64*** | 2.58**	–0.12	–0.27 | –0.12	–0.11	–0.07 | 0.21
t_{-1}	0	0 | –0.05	11.77	2.54** | 2.33**	0.26	0.58 | 0.88	0.01	0.01 | 0.25
t_{-2}	1.54	1.06 | –0.7	11.77	2.68*** | 2.48**	0.33	0.73 | 0.12	–0.25	–0.19 | –0.02

(continue next page)

(Table 3 continued)

Time-frame	$\overline{\Delta AS}$ *in %*	$T_p \mid T_c$	$\overline{\Delta CAS}$ *in %*	$T_p \mid T_c$	$\overline{AR}$ *in %*	$T_p \mid T_c$	$\overline{CAR}$ *in %*	$T_p \mid T_c$
t_{-3}	–1.01	–0.69 | –0.84	10.23	2.47** | 2.38**	0.49	1.07 | 1.74	–0.58	–0.45 | –0.07
t_{-4}	–0.01	0 | 0.37	11.24	2.91*** | 2.86***	–0.20	–0.43 | –0.42	–1.07	–0.89 | –0.73
t_{-5}	–0.12	–0.08 | 0.50	11.25	3.14*** | 2.94***	0.03	0.07 | 0.25	–0.87	–0.79 | –0.62
t_{-6}	0.23	0.16 | 0.09	11.37	3.48*** | 3.00***	–0.09	–0.20 | 0.06	–0.90	–0.89 | –0.79
t_{-7}	2.17	1.48 | 1.49	11.14	3.81*** | 3.31***	–0.06	–0.12 | 0.37	–0.81	–0.90 | –0.91
t_{-8}	0.88	0.60 | 0.17	8.97	3.54*** | 2.97***	0.13	0.29 | –0.14	–0.76	–0.97 | –1.27
t_{-9}	6.71	4.59*** | 3.10***	8.09	3.91*** | 3.51***	–0.32	–0.71 | –0.40	–0.89	–1.39 | –1.45
t_{-10}	1.38	0.94 | 1.86*	1.38	0.94 | 1.86*	–0.57	–1.25 | –1.65	–0.57	–1.25 | –1.65

Significance level 1 %=*** 5 %=** 10 %=*

T_p corresponds to the test statistic for the parametric test and T_c to that for the non-parametric test. The average abnormal CDS spread changes and returns are cumulated from t_{-10} to t_{+10}, i. e. in t_{-10} $\overline{\Delta AS}$ equals $\overline{\Delta CAS}$ and $\overline{\Delta AR}$ equals $\overline{\Delta CAR}$. For example, on t_{+1}, $\overline{\Delta CAS}$ includes the $\overline{\Delta AS}$ and $\overline{\Delta CAR}$ includes the $\overline{\Delta AR}$ from t_{-10} up to t_{+1}.

Table 4

Average Cumulative Abnormal Returns and CDS Spread Changes for Different Timeframes

Timeframe	$\overline{\Delta CAS}$	T_p	T_c	$\overline{CAR}$	T_p	T_c
[0]	1.03 %	0.70	1.18	–0.12 %	–0.27	–0.12
[–1; 1]	–1.42 %	0.56	0.64	0.25 %	0.33	0.64
[–10; –1]	11.77 %	2.54**	2.33**	0.01 %	0.01	0.25
[+1; +10]	–2.26 %	–0.49	–0.21	–1.35 %	–0.94	–0.49
[–10; +10]	10.53 %	1.57	1.72*	–1.45 %	0.70	–0.19
Significance level 1 %=*** 5 %=** 10 %=*						

T_p corresponds to the test statistic for the parametric test and T_c to that for the non-parametric test. Within the different timeframes, the $\overline{\Delta AS}$ and $\overline{\Delta AR}$ are cumulated and tested for their significance. The timeframe [0] implies a single $\overline{\Delta AS}$ and a single $\overline{\Delta AR}$.

Table 5

Average Abnormal Returns and CDS Spread Changes of Geographical Subsamples

	Characteristic	*Mean*	*p-value*	*Median*	*p-value*
$\overline{\Delta AS}$	North	0.45 %	0.87	0.38 %	0.65
	South	0.55 %		0.54 %	
$\overline{AR}$	North	–0.14 %	0.52	0 %	0.22
	South	0 %		0 %	

The first p-value refers to the two-sample t-test (Welch test), whereas the second refers to the Mann-Whitney-U-test.

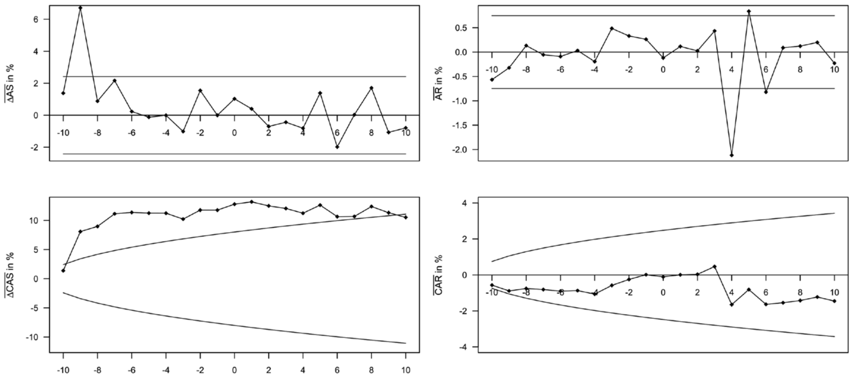
V. Discussion

1. *The Capital Market Reaction to the LiST*

According to the hypotheses, the findings can be interpreted as follows: Hypothesis 1 deals with the "good" stress test results postulated by the ECB and insinuates that their publication represents a positive market signal; therefore, rising returns and falling CDS spread changes are expected. There is no significant negative trend in the $\overline{\Delta AS}$. On the other hand, a statistically significant and positive $\overline{AR}$ at t_{+5} can be observed, whereby the values the day before and after are negative.

The second hypothesis supposes a negative development in the form of falling returns and rising CDS spread changes. It is assumed that abnormal developments are triggered by uncertainty. Possible scenarios include the "leakage" of results before October 7, 2019, and the fact that aggregated stress test results restrict the ability to act and therefore increase uncertainty. The $\overline{AR}$ are statistically significant and negative at t_{+4} and t_{+6}. The direction of the effect is not clear because $\overline{AR}_{t_{+5}}$ is positive. The $\overline{CAR}$ are not significant in any timeframe. The $\overline{\Delta AS}$ in t_{-10} and t_{-9} are statistically significant and positive, which can also be proven for the aggregate $[-10; -1]$. It can be concluded that creditors assume a higher risk of default.

Hypothesis 3 postulates the absence of abnormal effects. It is argued that the publication of stress test results does not provide new or essential information for owners and creditors, so no abnormal developments occur. With regard to CDS spread changes, the empirical findings indicate an increase in risk, which is priced before the event date. This development is statistically secure, and the increase in $\overline{\Delta CAS}$ is visible in the first days of the event window in Figure 2, in which the coherence from Table 3 is graphically presented. For the $\overline{AR}$, significant values result ex post, whereas this is not detectable for any cumulated value. Only if other relevant events for the valuation are excluded can these developments be interpreted monocausally as the pricing of the stress test results such that hypothesis 3 can be rejected. On closer examination, overlapping events seem to play a non-inconsiderable role. This is especially true for the analysis of the $\overline{\Delta AS}_{t_{-9}}$ on September 20, 2019. The average abnormal CDS spread change on that day is 6.71 % and statistically highly significant with respect to both tests. This implies a higher PD for the banking sector. Appendix 5 documents that this development is not the result of a singular outlier because several banks report values of approximately 10 % for t_{-9}. On September 20, 2019, Commerzbank AG announced a reduction of approximately 4300 full-time jobs and the closure of up to 1000 branches. The $\overline{\Delta AS}_{i,\,t_{-9}}$ of Swedbank AS, Eurobank Ergasias S.A., Ing Groep N.V. and HSBC PLC are slightly more than 11 % even higher than that of Commerzbank AG itself. It can be argued that banks are closely interlinked via the interbank market through deposits, loans and derivatives. In this respect, the imbalance of Commerzbank AG could immediately spill over to other institutions. The most recent financial market crisis provides evidence of this phenomenon. Furthermore, the news can be interpreted as a negative market signal that credit institutions that have similar characteristics,



The area enclosed by the two parallels lying symmetrically around the abscissa and the function courses represents the 90 % confidence interval of the parametric test for the null hypothesis that the respective $\overline{\Delta AS}$ / $\overline{\Delta AR}$ and their aggregates are equal to zero. Values above and below this range are therefore significant at the 10 % level. The x-axis corresponds to the points in time or, in the case of cumulative values, to the respective timeframe of the event period. When interpreting the values, it is important to note that the scaling of the y-axes diverges.

Figure 2: Graphic Illustration of $\overline{\Delta AS}$*,* $\overline{\Delta AR}$ *and its Aggregates*

such as size and internationalization, are not economically sound, either. Empirically, it can be proven for bank insolvencies that institutions that are not affected by insolvency are more negatively affected if they have more similar characteristics to affected institutions (*Aharony/Swary* 1996).

Nevertheless, the question of why there is no significant $\overline{AR}$ at t_{-10} (different event windows) remains open. The different effects on returns and CDS spread changes can be explained, among other things, by the greater responsiveness of the players in the CDS market, which is conditioned by higher professionalism (*Alves* et al. 2015). While the stock market is also used by private investors for long-term investment purposes, the CDS market is characterized by professional participants who continuously evaluate market events so that CDS spreads are more sensitive. For the CDS market, professionalism is also confirmed by strong information efficiency in that the information of Commerzbank AG is priced on the same day and no further significant $\overline{\Delta AS}$ arises. Already on the day before the announcement, at t_{-10}, a significant and positive $\overline{\Delta AS}$ is achieved regarding the Corrado test. This allows the conclusion that "leaked" information has already been processed before the announcement. Regarding the significant $\overline{AR}$ ex post, the direction of the effect is not clear, and the strength is small compared to the reaction of the CDS market regarding the Commerzbank AG message. A possible event around October 14, 2019 (t_{+4}), could not be identified. Nevertheless, the negative abnormal return in t_{+4} is not the result of a singular outlier because 15 institutions report a negative effect, as documented in appendix 6. Beyond that, there is no significant $\overline{CAR}$. Furthermore, it would be expected that the processing of the stress test results on the capital market would start more quickly and not only on October 14, 2019. The sensitively reacting CDS spread changes show no significance in this period. The three-day event window of [−1; +1] serves to absorb effects if the markets process information immediately upon announcement. However, neither individual $\overline{\Delta AS}$ nor $\overline{AR}$ is significant, nor are their aggregates. Based on the analysis so far and the already discussed inconclusive direction of the effects (see Figure 2) as well as the low strength of the abnormal returns, it is concluded that the stocks are not significantly affected by the stress test results, which is also true for the CDSs. Thus, hypothesis 3 is confirmed, whereby hypothesis 1 and hypothesis 2 are rejected. In particular, with regard to hypothesis 2 and the rising CDS spread changes that actually confirm the hypothesis, as already discussed, an overlapping event in the form of the announcement of Commerzbank AG is probably responsible. This seems to be more plausible than the assumption that the CDS spread changes are caused by uncertainty regarding the stress test results because the movement takes place on the day of the Commerzbank AG announcement.

Regarding this overlapping event, it could be argued to shorten the event window in such a way that September 20, 2019 (Commerzbank AG announcement date) is not part of the event window. In fact, it would lead probably to statistically clear results, i.e. that no abnormal returns and CDS spread changes occur. This seems to be not adequate, since the overlapping event lies within the event window and thus influences the event study results economically in any case. Hence, it is more persuasive to deal with this problem openly and discuss its implications.

Although the LiST does not have any implications for the capital market as a whole, the question of whether it influences southern and northern European banks differently, as postulated in hypothesis 4, must be clarified. An example is the CDS spreads of southern European banks, which are generally higher, express a higher PD expected by the market. A higher risk profile of these banks could potentially lead to significantly different returns and CDS spread changes compared to the other institutions. Since a higher risk is inherent in these banks a priori, creditors and shareholders could react more sensitively to new information and uncertainty, which would lead to deviating capital market reactions. At higher risk, positive news could lead to higher returns and lower CDS spread changes than at other institutions, and negative news could be processed conversely. However, the statistical analysis reveals the absence of different effects on the average abnormal returns and CDS spread changes regarding the distinction between southern and northern European institutions, as Table 5 shows. With regard to both test procedures, the null hypothesis cannot be rejected. It can be concluded that southern European institutions do not experience significantly different abnormal returns or CDS spread changes. Two explanations come into question. First, creditors and shareholders of southern European banks could not act divergently. In this case, a different risk profile would not lead to a different assessment of the stress test results and thus to a different capital market reaction. On the other hand, it is conceivable that this is because the stress test as a whole does not provide any information, so no information processing takes place at all, which could have been different. Hypothesis 4 is rejected because neither the CDS spread changes nor the returns of southern European banks perform significantly differently.

2. *The ECB's Potential Objective*

According to the EMH, information is immediately priced when it becomes known, given that it is relevant and could not be anticipated ex ante. This defines the starting point for the analysis of the effects of the LiST. The event study provides evidence for the lack of importance of the publication of stress test results for the valuation of equity and debt. Basically, neither event-induced positive nor negative abnormal returns or CDS spread changes can be documented. It can be concluded that the publication of the results is not relevant for valuation, although various explanations are plausible. For example, market participants may already have been informed about the liquidity situation by their own analyses. Then, the information would be priced in beforehand. On the other hand, the irrelevance could also be due to the way the results are published. An explanatory approach is the publication of only aggregated results. The market participants are thus deprived of concrete information such that the benefits and the possibility of action cannot be assessed directly. If concrete information at the institution level reveals an exemplary "bad" performance in the test, it may lead to positive abnormal CDS spread changes and negative abnormal returns. Furthermore, the literature presented indicates that stress tests represent valuation-relevant messages. Based on this, the differences between the stress tests analyzed there and the LiST become apparent in the focus of the study, the type of results published and the possibility of failing the test. It should not be overlooked that the LiST evaluates the liquidity and not the capital situation of an institution, which provides immediate information about insolvency risk. It is possible that market participants would have paid more attention to a capital stress test, especially in the public announcement of the failure of individual institutions. The result of this investigation can also be justified with past empirical findings, which are discussed in chapter II. As *Fernandes* et al. (2015) show, the capital market reacts to new information, especially when the market is under stress. It is possible that the actors react more sensitively, analyze information more thoroughly and act accordingly in times of stress. Although in 2019, the financial industry suffered from low interest rates, the uncertainty of Brexit and trade tensions between China and the US, these issues are in no way comparable to the problems experienced during the financial market and sovereign debt crisis, during which time appropriate stress tests were conducted. In this respect, this argument supports the acceptance of hypothesis 3. The missing signal effect of not passing the test has already been discussed. Empirically, *Alves* et al. (2015) show that no abnormal effects occur for banks that pass the stress test. This supports the argument of a missing signal effect and further implies an asymmetric effect in that the market assesses negative information more strongly than positive information.

To evaluate the stress test, the objective of the LiST needs to be clarified. It was conducted as a mandatory stress test to simplify the interpretation of the SREP, which is primarily for internal use. However, the publication of the results was nevertheless announced and carried out; it is not clear why this was done on an aggregated level, and thus, the information basis is reduced. It is possible that the liquidity situation of some institutions, especially in those southern Europe, is so tense that the announcement of individual negative stress test results could lead to massive financing problems. Evidence for problematic liquidity reserves is given due to the fact that even in the baseline scenario, four banks fail. Such institutions would then have problems raising funds on the capital market, which exacerbates an already tense situation. This in turn could force the regulator itself to take measures. From this point of view, not triggering a capital market reaction is advantageous. The way the results were published seems to be designed for that purpose. In contrast to hypothesis 2, there is no evidence that aggregated results cause uncertainty and thus a capital market reaction, although the exemplary news releases draw a contradictory picture. Obviously, the ECB succeeds in the trade-off between reducing asymmetric information and gaining welfare effects through the publication of aggregated results on the one hand and avoiding panic in the capital market on the other hand.

3. *Limitations and Further Research Approaches*

Making valid statements about a bank's individual capital market reaction is not possible because of the aggregated nature of the data as well as the event clustering. Event clustering is not only problematic regarding the test statistics. Since the event window is the same for all banks, overlapping events affect all banks in the same way, which reinforces them compared to event studies, where each observation in the sample has its individual event window. This is true for overlapping effects in the estimation window as well, which in turn would influence the parameter estimation. The announcement of Commerzbank AG provides evidence of the distorting impact of overlapping events and the fragility of the banking sector with its contagion channels, which supports the ECB's decision to publish aggregated results.

In addition, it must be noted that after data cleaning, only 17 banks are part of the sample. Nevertheless, it covers the most important banks from various European countries. In this respect, it appears to be sufficiently representative for checking a capital market reaction. The test statistics are all robust due to sufficient sample size and thus 195 degrees of freedom.

For a further course of investigation, it could be analyzed whether the ECB's stress test announcement on November 30, 2018, leads to significantly abnormal capital market reactions. This can be demonstrated for the stress tests in the EU in 2011 and 2012 (*Candelon/Sy* 2015). In addition, the liquidity positions and the methods of liquidity risk management of the banks before and after the stress test could be examined by means of annual financial statements and disclosure reports. The ECB has used the stress test results for the SREP and is thus in a position to sanction participating banks with far-reaching measures. Substantial changes with regard to liquidity or risk management could be interpreted as measures taken by the supervisor.

VI. Conclusion

In conclusion, it can be stated that the LiST 2019 is irrelevant for capital market valuation. Either it does not provide any new information, or the new information is irrelevant for the pricing. Causes of this phenomenon include the publication of only aggregated results that reduce the information base and prevent the deduction of actions, as well as the fact that there is no signal effect in the form of individual failing. The actors could also have been informed by their own analyses so that the returns and CDS spread changes already reflect this information. Moreover, there are no differences in the reactions of southern and northern European institutions. The regulator's possible objective, that is, to examine the banks thoroughly without triggering panic and consequently compounding a severe liquidity situation, is reached.

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Appendix

Appendix 1

Pairwise Correlations According to Kendall and Variance Inflation Factors Based on the Estimation Window of the Returns

	ΔS_{index}	R_m	*Level*	Δ*Vola*	*Slope*
ΔS_{index}	1				
R_m	–0.29	1			
Level	0.02	–0.01	1		
Δ*Vola*	0.25	–0.46	–0.02	1	
Slope	0.02	0	0.96	–0.02	1
VIF	1.22	2.07	45.69	1.93	45.67
VIF	1.22	2.05	1	1.93	

Appendix 2

Descriptive Statistics of Exogenous Variables Related to the Estimation of Returns

	N	*Mean in %*	*Standard Deviation in %*	*Skew-ness*	*Kurtosis*	*Max in %*	*Min in %*
ΔS_{index}	221	–0.1547	4.1925	0.2910	2.8727	11.5225	–9.5129
R_m	221	–0.0058	1.3390	0.1344	3.7250	4.9249	–3.9268
Level	221	–0.1530	0.2573	–0.2029	1.7186	0.2561	–0.6230
$\Delta Vola$	221	0.1695	7.4794	1.5797	7.3199	34.8417	–14.4270

Appendix 3

Regression Parameters of CDS Spread Changes

Bank	$\hat{\alpha}_i$	ΔS_{index} $(\hat{\beta}_{1,i})$	R_m $(\hat{\beta}_{2,i})$	*Level* $(\hat{\beta}_{3,i})$	$\Delta Vola$ $(\hat{\beta}_{4,i})$	R^2	*BP test p-value*
Swedbank	–0.0028	0.0369	–0.7793***	0.2467	0.0033	11.19 %	0.67
Bankinter	–0.002	0.0083	–0.1049	0.213	0.0243	1.70 %	0.92
Eurobank Ergasias	–0.0016	0.075***	–0.318***	0.5489	0.068***	34.80 %	0.43
Sabadell	–0.0016	0.0363	–0.1137	–0.0515	–0.0116	1.75 %	0.01
BPM	–0.0027***	0.0632**	–0.3311***	0.299	–0.0181	13.21 %	0.02
Intesa Sanpaolo	–0.0028	0.2478***	–0.6002***	0.5853	0.0448	31.66 %	0.12
Ing Groep	–0.0015	0.1946***	–0.6171***	0.7323	0.0926**	27.98 %	0.69
BNP Paribas	–0.0013	0.2617***	–0.5909**	0.5861	0.1051**	31.26 %	0.68
Caixabank	–0.0005	0.1039**	0.074	0.124	–0.0149	3.31 %	0.35
Barclays	0	0.3125***	–0.2934	0.8878	0.0615*	34.38 %	0.09
HSBC	–0.0002	0.2596***	–0.5923**	0.4384	0.1312***	32.47 %	0.33
Deutsche Bank	0.0003	0.3529**	0.2487	0.7142	0.0378	3.95 %	0.20

(continue next page)

(Appendix 3 continued)

Bank	$\hat{\alpha}_i$	ΔS_{index} $(\hat{\beta}_{1,i})$	R_m $(\hat{\beta}_{2,i})$	*Level* $(\hat{\beta}_{3,i})$	$\Delta Vola$ $(\hat{\beta}_{4,i})$	R^2	*BP test p-value*
Commerzbank	–0.0026	0.2352***	–0.4989**	0.6201	0.1008**	26.80 %	0.70
Société Générale	–0.0015	0.22***	–0.9469***	0.2561	–0.0064	16.63 %	0.27
Santander	0.0015	0.3988**	–1.3966*	0.5889	0.0041	9.23 %	0.50
UniCredit	–0.003	0.2262***	–0.8087***	0.5041	0.0513	36.26 %	0.09
Monte dei Paschi	0	0.0697**	–0.1587	0.4166	–0.0032	8.26 %	1
Significance level 1 % = *** 5 % = ** 10 % = *							

Appendix 4

Regression Parameters of the Returns

Bank	$\hat{\alpha}_i$	R_m $(\hat{\beta}_{1,i})$	ΔS_{index} $(\hat{\beta}_{2,i})$	*Level* $(\hat{\beta}_{3,i})$	$\Delta Vola$ $(\hat{\beta}_{4,i})$	R^2	*BP test p-value*
Swedbank	–0.0018	0.7695***	0.0271	–0.2456	0.0376	13.38 %	0.58
Bankinter	–0.0009	1.1248***	–0.0096	–0.067	0.0372**	59.18 %	0.35
Eurobank Ergasias	0.0041*	0.2216	–0.0693	0.4943	–0.0946**	11.22 %	0.77
Sabadell	–0.0009	1.8149***	–0.0349	–0.1931	0.1053***	60.71 %	0.64
BPM	0.0008	1.5532***	–0.0687*	–0.0521	0.053**	48.80 %	0.89
Intesa Sanpaolo	0.001	1.1156***	0.0194	–0.0621	0.0067	65.16 %	0.05
Ing Groep	–0.0001	1.223***	–0.0137	0.0301	0.0048	76.91 %	0.46
BNP Paribas	0.0001	1.2239***	–0.0067	–0.2561	0.0063	83.33 %	0.67
Caixabank	–0.002*	1.396***	0.0024	–0.269	0.0638***	55.95 %	0.16
Barclays	–0.0001	0.9603***	–0.0353**	0.0362	0.0148	64.67 %	0.65
HSBC	0.0003	0.5107***	0.041***	0.1787	–0.0363***	50.23 %	0.92

Bank	$\hat{\alpha}_i$	R_m $(\hat{\beta}_{1,i})$	ΔS_{index} $(\hat{\beta}_{2,i})$	*Level* $(\hat{\beta}_{3,i})$	$\Delta Vola$ $(\hat{\beta}_{4,i})$	R^2	*BP test p-value*
Deutsche Bank	–0.0008	1.7057***	–0.0214	–0.5866	0.0276	73.45 %	0.80
Commerz-bank	–0.0009	1.917***	–0.0139	–0.0066	0.0435**	72.12 %	0.44
Société Générale	–0.0016*	1.3407***	0.0095	–0.8562***	0.0058	69.42 %	0.95
Santander	0.0002	1.0732***	–0.0096	0.2873	–0.0008	79.24 %	0.90
UniCredit	0.0008	1.6145***	–0.0252	–0.0089	0.0446**	67.30 %	0.38
Monte dei Paschi	0.0003	1.1701***	0.0196	–1.1477	–0.0087	22.56 %	0.14

Significance level 1 % = *** 5 % = ** 10 % = *

Appendix 5

Abnormal CDS Spread Changes

	Swed-bank	*Bank-inter*	*Euro-bank Ergasias*	*Sabadell*	*BPM*	*Intesa Sanpaolo*	*Ing Groep*	*BNP Paribas*	*Caixa-bank*
t_{+10}	2.0500	0.6078	–0.4990	–0.0308	0.8409	–3.6405	–3.0130	–1.6945	0.4211
t_{+9}	0.0914	0.1330	0.5297	–0.0097	0.3618	–2.3011	–0.3098	–2.1754	–0.0016
t_{+8}	0.3458	0.2996	0.2099	–0.1235	0.1735	–0.7089	0.2288	1.9794	4.1259
t_{+7}	1.0373	0.3219	–0.5699	0.3842	0.5247	–0.0547	1.5676	0.1766	0.5896
t_{+6}	2.1946	0.7102	–1.1700	0.0896	0.3362	–2.5577	–0.9715	–1.9172	–2.4565
t_{+5}	–0.1619	0.2190	0.1791	–0.2809	–0.2911	2.2623	1.9980	0.1887	–4.2463
t_{+4}	4.6378	1.1275	0.1099	0.7384	2.8654	–0.4473	–1.7508	0.1344	0.1888
t_{+3}	2.0363	0.6259	1.2503	0.4247	–0.0944	–0.0111	–0.6599	–2.5583	–0.2385
t_{+2}	0.3322	0.3505	–1.0830	0.1298	0.3118	–2.9623	0.8103	–0.7921	0.3418
t_{+1}	–0.7248	–0.0426	–0.7473	–0.0809	0.2767	0.4377	0.1033	–0.6864	–0.4960

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(Appendix 5 continued)

	Swed-bank	*Bank-inter*	*Euro-bank Ergasias*	*Sabadell*	*BPM*	*Intesa Sanpaolo*	*Ing Groep*	*BNP Paribas*	*Caixa-bank*
t_0	0.9519	0.4611	1.4703	0.2312	–0.1008	2.7411	1.7842	4.6386	0.3566
t_{-1}	–0.3622	0.4476	3.4590	–0.2553	0.2697	–0.3847	5.1938	1.9566	–0.8845
t_{-2}	–1.9095	–0.5165	0.7633	0.5986	–0.7828	0.8618	–1.2709	–3.3624	1.1696
t_{-3}	–1.1726	–0.0535	–1.4332	0.1159	1.1731	–2.8662	–2.6650	–0.7035	0.6434
t_{-4}	0.7754	0.3655	0.8173	0.4566	–0.1406	1.5939	–0.4214	0.0363	0.0083
t_{-5}	1.2459	0.5309	0.9532	0.5212	0.7454	–1.5908	–2.2071	1.2754	0.3038
t_{-6}	0.4313	0.3659	0.6686	–0.1557	0.0577	3.4217	4.4238	2.0736	–0.4434
t_{-7}	0.1310	0.0531	0.9669	0.2822	–0.0051	1.6822	5.2254	1.9903	–2.8056
t_{-8}	–1.8156	–0.3271	0.2321	–0.6902	0.0021	1.2286	–1.3115	–0.6261	6.6051
t_{-9}	11.1470	9.4984	10.4311	5.5602	3.7668	6.9617	10.2536	8.5261	2.2983
t_{-10}	1.8619	0.5970	1.5807	0.4125	1.7887	2.7376	2.7380	1.1594	0.2557

	Barclays	*HSBC*	*Deutsche Bank*	*Com-merzbank*	*Société Générale*	*Santander*	*Uni-Credit*	*Monte dei Paschi*
t_{+10}	–5.1684	–5.7723	3.1198	–0.6785	–1.3615	3.5067	–2.2132	0.0509
t_{+9}	–2.9625	–3.9911	–0.8590	1.5431	–1.9648	–4.1531	–1.2599	–0.8323
t_{+8}	1.5741	3.3898	3.6582	3.0088	4.9134	3.2523	1.3748	1.3190
t_{+7}	–1.7508	–0.5914	1.2201	0.0526	–1.6954	4.9229	–1.9368	–3.6710
t_{+6}	–8.3404	–6.9840	–2.9184	–1.8533	–0.7419	–6.5884	–0.3613	–0.1183
t_{+5}	2.6436	0.9506	0.0830	4.0568	0.8431	8.2320	2.9427	4.0096
t_{+4}	–8.6767	–8.5294	–3.1843	–2.5892	1.3160	–0.4963	–0.1917	0.9354
t_{+3}	0.3384	–1.9103	–5.3245	–0.9146	–3.5563	2.2481	0.5154	0.3774
t_{+2}	–0.5552	–1.7577	–4.1201	–1.5822	–0.4306	1.7407	–2.5602	–0.0969
t_{+1}	1.4577	–0.0085	5.6957	–0.1232	3.8327	–5.4244	–0.7032	4.0272
t_0	1.7618	5.0959	–0.1757	2.5570	–2.4844	–1.1969	3.3163	–3.9656

	Barclays	*HSBC*	*Deutsche Bank*	*Commerzbank*	*Société Générale*	*Santander*	*UniCredit*	*Monte dei Paschi*
t_{-1}	–0.6168	–1.5476	–2.8590	3.3088	0.2429	–4.3596	0.5018	–4.1834
t_{-2}	5.9312	2.8491	7.6263	1.9675	2.3835	9.6159	0.4406	–0.1319
t_{-3}	0.8604	–0.2458	–2.8835	–4.6386	1.0527	–0.9757	–3.7169	0.2565
t_{-4}	0.9841	–1.2873	–0.4101	–2.7154	–3.7489	1.5103	1.6064	0.4675
t_{-5}	–2.4095	–1.3505	3.0067	1.1741	2.3081	–6.8433	–1.2575	1.4922
t_{-6}	0.4824	–1.8382	–3.9797	–2.6815	–1.4454	0.4879	3.1057	–1.0186
t_{-7}	1.5724	0.3778	2.4684	4.1619	4.9435	9.6258	2.2107	3.9408
t_{-8}	0.7798	0.0748	2.3348	5.1802	1.5265	2.9205	1.0895	–2.2222
t_{-9}	3.1650	11.1475	4.6276	10.0242	7.2205	0.2092	7.8561	1.4186
t_{-10}	2.3184	–0.0671	–1.0770	2.3353	0.8384	2.2147	3.0661	0.7005

Values in %

Appendix 6

Abnormal Returns

	Swedbank	*Bankinter*	*Eurobank Ergasias*	*Sabadell*	*BPM*	*Intesa Sanpaolo*	*Ing Groep*	*BNP Paribas*	*Caixabank*
t_{+10}	–0.2336	2.6127	0.3064	0.5740	–2.9190	–1.3151	–0.4105	–0.7062	1.1762
t_{+9}	0.4479	0.2998	1.3250	0.4783	–0.0170	0.1270	0.3239	0.0989	–0.3037
t_{+8}	1.3082	0.8963	–0.3152	0.4610	0.0650	–0.0833	–0.2329	–0.2978	–1.3942
t_{+7}	–0.0016	0.2517	–1.8915	0.5302	1.5273	0.5091	0.9032	–0.5161	0.8845
t_{+6}	–0.8570	–0.6170	–1.2939	–0.3494	–0.6819	–1.4612	–0.8942	0.5409	–0.4908
t_{+5}	2.9008	0.1364	–0.6387	2.1998	2.5914	0.5277	0.9366	0.0915	0.6320
t_{+4}	–2.3920	–1.6933	0.4990	–2.0663	–3.8173	–3.7525	–2.1214	–1.4102	–0.8469
t_{+3}	–0.1490	2.1799	1.0699	1.3493	–0.1136	–0.1468	1.9261	0.1920	2.2074
t_{+2}	0.1622	0.6379	0.5795	0.1282	–0.1668	0.4753	–0.2735	0.0289	0.4848

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(Appendix 6 continued)

	Swed-bank	*Bank-inter*	*Eurobank Ergasias*	*Sabadell*	*BPM*	*Intesa Sanpaolo*	*Ing Groep*	*BNP Paribas*	*Caixa-bank*
t_{+1}	−0.8781	0.0026	0.7219	−0.8342	2.2333	0.1065	0.1574	0.6923	−0.3138
t_{0}	1.0604	0.2255	−0.2394	0.0569	0.4978	−0.1033	0.0306	−0.0687	1.2401
t_{-1}	−2.1474	0.7465	−2.6993	3.1293	−1.1771	0.4860	1.1712	0.1749	0.9343
t_{-2}	−0.7607	0.5050	−1.3768	1.5553	3.0897	0.2459	−0.1235	−0.1121	−0.1296
t_{-3}	0.8371	0.1188	−0.0634	1.4744	2.9653	0.7867	0.4267	0.4215	0.2549
t_{-4}	1.0613	0.5477	−0.6231	−1.0873	0.9352	0.1230	−0.3050	0.3835	−0.2366
t_{-5}	0.8985	0.5307	0.3013	0.6888	−0.3439	−0.3661	0.4695	−0.4828	0.3573
t_{-6}	1.0504	−0.0492	0.8704	0.1563	0.3163	0.1111	−0.2691	0.5048	0.0425
t_{-7}	−2.3237	−0.0112	−0.1104	1.0377	−0.3132	0.1268	0.4899	−0.5736	0.8896
t_{-8}	0.2805	0.5884	3.2782	1.1670	−0.6764	−0.0007	−0.4943	−0.0295	0.4871
t_{-9}	1.2437	−1.1720	−0.9847	0.5804	−0.4228	0.9426	0.5528	−0.4289	0.2979
t_{-10}	−0.2788	−2.8431	2.6714	−1.5127	−0.9248	−1.0971	0.3037	0.2359	−0.4271

	Barclays	*HSBC*	*Deutsche Bank*	*Commerz-bank*	*Société Générale*	*Santander*	*Uni-Credit*	*Monte dei Paschi*
t_{+10}	−1.5533	−0.3895	−0.4327	1.8385	−0.6390	0.4312	−1.0161	−1.1997
t_{+9}	0.7878	−0.6429	−0.5439	−0.7426	0.0505	0.5625	0.6232	0.4969
t_{+8}	0.1392	0.7181	0.6166	0.5660	0.4714	−1.1741	0.5775	−0.2515
t_{+7}	−0.6820	−0.4061	−0.4389	0.1398	−0.1088	−0.0294	0.3991	0.4431
t_{+6}	1.8592	−1.7921	−1.2612	−3.3061	−1.3173	1.1691	−0.5078	−2.7019
t_{+5}	−1.0153	0.4871	2.0170	2.3316	0.7612	−0.0208	0.6964	−0.3977
t_{+4}	2.7879	−0.9855	−3.2900	−4.9600	−1.4069	−0.9580	−4.3768	−5.2001
t_{+3}	0.9135	−2.1654	−0.9106	0.1719	0.4118	0.4659	0.7223	−0.7582
t_{+2}	0.6612	0.6414	−0.5819	−0.2661	−0.0332	0.5429	−0.2694	−2.3160
t_{+1}	0.9689	−0.0047	−0.9453	0.5862	−0.3801	0.4730	0.5232	−1.1510
t_{0}	0.3984	0.1518	−1.1587	−1.4101	−0.4794	0.3175	−0.1740	−2.3830

	Barclays	*HSBC*	*Deutsche Bank*	*Commerz-bank*	*Société Générale*	*Santander*	*Uni-Credit*	*Monte dei Paschi*
t_{-1}	0.0885	–0.6053	–0.0619	–0.4818	–0.5168	1.1022	1.0992	3.2205
t_{-2}	–1.0016	–0.3185	2.6144	2.8443	–0.4180	–0.9442	–0.3002	0.2498
t_{-3}	0.8856	0.6087	–0.4962	–0.6240	–0.0579	0.2278	0.9298	–0.4473
t_{-4}	–0.8458	–0.0133	–1.8666	–1.7277	–0.0204	0.5971	–0.7191	0.4725
t_{-5}	0.4032	0.2047	0.1825	–0.9024	–1.4738	0.8224	–0.0012	–0.7511
t_{-6}	0.6721	0.3791	–2.3548	–0.3613	–0.3430	–0.1689	0.6469	–2.7484
t_{-7}	0.7883	1.0666	0.2456	2.0798	–0.5573	0.6240	–1.4065	–2.9897
t_{-8}	–0.8492	0.1267	–1.2211	0.2193	–1.1413	0.0429	0.0102	0.4708
t_{-9}	0.4751	1.0316	–0.3587	–3.7661	–0.5037	–0.3194	–0.5449	–2.1186
t_{-10}	0.4401	–0.9999	–1.9406	–0.6801	–0.4939	0.3672	–0.7285	–1.7224

Values in %