Banking stress test effects on returns and risks*

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April 2015

Abstract

We investigate the effects of the announcement and the disclosure of the clarification, methodology, and outcomes of the US banking stress tests on banks' equity prices, credit risk, systematic risk, and systemic risk during the 2009–15 period. We find little evidence that stress tests affected equity returns of large US banks in most years. CDS spreads declined in response to the disclosure of stress test results in 2009 and 2012–13. We also find that banks' systematic risk, as measured by betas, declined in some years after the publication of stress test results. Our evidence suggests that stress tests affect systemic risk.

Key words: stress tests, bank equity returns, CDS spreads, bank betas, systemic risk.
JEL classifications: G21, G28.

*We would like to thank Viral Acharya, Dirk Bezemer, Rob Nijskens, Maarten van Oordt, Andreas Pick, Auke Plantinga, Rodney Ramcharan, Robert Vermeulen, Razvan Vlahu, Wolf Wagner, Chen Zhou and conference participants of the joint Duisenberg School of Finance/Tilburg University banking research day in Amsterdam, the 3rd EBA policy research workshop in London, and seminar participants at the Wirtschaftsuniversitat Wien, De Nederlandsche Bank, and the University of Groningen for helpful comments and discussions. The views expressed do not necessarily reflect the views of De Nederlandsche Bank or the European System of Central Banks. Any errors or omissions are our own responsibility. Correspondence to Cenkhan Sahin <c.sahin@dnb.nl>, Research Department De Nederlandsche Bank, P.O. Box 98, 1000 AB Amsterdam, The Netherlands.

1 Introduction

Bank supervisors expect banks to hold sufficient capital to cover losses under adverse economic conditions. Stress testing has become an important tool for bank supervisors to achieve that goal. In stress tests the implications for individual banks' financial positions under several macroeconomic scenarios are examined, taking the banks' exposures and business models into account. Stress tests have several characteristics (Goldstein and Sapra, 2012). First, they are forward looking. Second, they generally put high weight on highly adverse scenarios, thereby providing supervisors with information about tail risks. Third, common scenarios are applied to banks so that stress tests have the ability to provide more consistent supervisory standards across banks. Finally, unlike traditional supervisory examinations that generally are kept confidential, the results of bank stress tests are frequently publicly disclosed in order to restore confidence and reduce market uncertainty (Federal Reserve, 2009b).

This paper examines the impact of banking stress tests in the US on banks' stock prices, CDS spreads, systematic risk (proxied by banks' betas), and systemic risk over the 2009–15 period. The first test considered is the Supervisory Capital Assessment Program (SCAP) of the 19 largest Bank Holding Companies (BHCs).[1] The outcomes of this test were disclosed on May 7, 2009. Since then the Federal Reserve implemented two supervisory programs. The first program, the Comprehensive Capital Analysis and Review (CCAR), assesses the capital planning processes and capital adequacy of banks and has been conducted annually since 2011. The CCAR links quantitative stress test results with qualitative assessments of capital planning processes of banks. The second program stems from the Dodd-Frank Act and requires assessing how bank capital levels would fare in stressful scenarios (Federal Reserve, 2013b). The first Dodd-Frank Act Stress Test (DFAST) results were publicly released on March 7, 2013.

It is widely believed that stress tests conducted in the US have provided valuable information to the market. Referring to post-crisis stress tests then Federal Reserve chairman Bernanke stated:

> "Even outside of a period of crisis, the disclosure of stress test results and assessments provides valuable information to market participants and the public, enhances transparency, and promotes market discipline." (Bernanke, 2013)

Indeed, according to Morgan et al. (2014), the disclosure of the SCAP test results caused credit default swap spreads to decline and equity returns to rise. We reassess this finding and examine whether it also holds for other stress tests.

Our paper adds to the literature in three ways. First, we examine the effects of all post-crisis stress tests in the US. Second, in contrast to most previous research, our analysis is not confined to the effects of stress tests on equity returns and CDS spreads but also considers the impact of stress tests on bank betas. Betas capture systematic risk based on the co-movement of returns with the overall market and are therefore

[1] We refer to BHCs as large banks. The size of the banks varies between the SCAP and subsequent stress tests. In 2009 all banks having total consolidated assets of $100 bln or more were subject to stress testing. In subsequent years the size was $50 bln or more.

particularly relevant for understanding the effects of stress tests. In addition, we study whether the change in betas is due to changes in individual bank risk, or due to changes in systemic risk following the approach suggested by Nijskens and Wagner (2011). Finally, we do not only consider the impact of the publication of the stress test outcomes, but also examine other disclosure events, such as the announcement of the stress test and the disclosure of the methodology to be used, as these may also provide information (Petrella and Resti, 2013; Gick and Pausch, 2012).

As will be pointed out in more detail in Section 2, our paper is related to three strands of literature. The first strand examines whether information provided by the disclosure of the outcomes of stress tests reduces the opacity of banks (Morgan et al., 2014; Cardinali and Nordmark, 2011; Beltratti, 2011; Ellahie, 2012; Petrella and Resti, 2013). Most (but not all) studies conclude that stress tests produce valuable information for market participants and can play a role in mitigating bank opacity. The second strand of related literature examines to what extent supervisory information should be disclosed (e.g. Goldstein and Sapra, 2012; Schuermann, 2013). Several of these studies conclude that it may not always be optimal to fully disclose stress test results. The final related strand of literature examines how stress tests can be used to set capital ratios, limit capital distributions, and set-up resolution regimes in case of financial distress (BCBS, 2012).

Our findings suggest that the release of the 2009 stress test outcomes had no effect on equity returns in contrast with the results of Morgan et al. (2014). Our findings for post-crisis stress tests show some reaction of equity returns in some years but the effects are small and statistically weak. In addition, we find evidence that the publication of stress test results reduced CDS spreads in 2009, 2012 and 2013. We find mixed results for other dates on which stress test information was released. Our analysis of systematic risk indicates that betas were affected by the publication of the outcomes of nearly all stress tests. Moreover, we find some evidence that the decline in betas is in part driven by the correlation of the banks' stocks with the market. We interpret these findings as a decrease in systemic risk.

The paper is structured as follows. Section 2 provides a summary of related literature and outlines how our research is related to this literature. Section 3 gives an overview of the stress tests conducted in the US. Section 4 outlines our methodology and Section 5 presents our findings. Finally, Section 6 concludes.

2 Related studies and contribution

Our paper is related to three strands of literature. First, several studies examine whether bank opacity differs from that of non-financial firms in 'normal' times (cf. Morgan, 2002; Flannery et al., 2004; Iannotta, 2006; Jones et al., 2012; Haggard and Howe, 2012). A good example is the recent paper by Flannery et al. (2013) who study bank equity's trading characteristics and find only limited evidence that banks are unusually opaque during normal times. From this perspective, some recent studies examine the information

value of stress tests. Morgan et al. (2014) conclude that market participants correctly identified which institutions had sufficient capital under the SCAP stress test, but were surprised by how much capital was required for under-capitalized banks.

Stress tests have also been conducted by European supervisors and several recent papers examine whether the disclosure of the outcomes affected financial markets. Petrella and Resti (2013) find significant but modest market responses to the European Banking Authority (EBA) stress test in 2011. Ellahie (2012) studies equity and credit market data of Eurozone banks that took part in the stress tests in 2010 and 2011. His findings indicate that equity and bid-ask spreads were not significantly affected by stress test announcements but declined after the disclosure of stress test results. Cardinali and Nordmark (2011) report that the announcements of the stress test and the clarification of the methodology in 2010 were relatively uninformative to markets. In contrast, they find that the disclosure in 2011 by EBA of the stress test methodology was highly informative for all stress-tested banks. Likewise, Beltratti (2011) argues that the 2011 EBA stress test produced new information, as investors could not a priori distinguish between capitalized and under-capitalized banks.

Table 1 provides a summary of recent empirical papers on the market response to stress tests. In line with some previous papers on European stress tests, in our analysis of US stress tests we distinguish between several tests-related events, such as the announcement of the stress test and the disclosure of the methodology and the stress test outcomes. We also distinguish between banks with and banks without capital shortfalls. So our paper complements the work of Morgan et al. (2014) by documenting the effects of stress tests on equity returns and CDS spreads for stress tests conducted in the US after the SCAP.

The literature on supervisory transparency and disclosure is also closely related to our work. The central question addressed in these studies is to what extent supervisory information should be disclosed. As shown by Liedorp et al. (2013), the transparency of banking supervisors differs considerably. According to Goldstein and Sapra (2012), in certain environments more disclosure is not necessarily better if one considers economic efficiency. Accordingly, the costs associated with disclosure of stress test results can be minimized in particular by disclosing aggregate, rather than bank-specific results. Also Schuermann (2013) argues that the degree of optimal disclosure may depend on the environment. During times of crisis, the need for bank-specific disclosure is greater while during normal times the cost-benefit of stress testing disclosure may lean towards more aggregated information. Gick and Pausch (2012) argue that a supervisory authority can create value by disclosing the stress-testing methodology together with the stress test result. Bischof and Daske (2013) investigate the interaction between mandatory supervisory disclosure and voluntary disclosure strategies of banks that were subject to the EBA stress test in 2011. Their findings indicate that lower market liquidity is attributable to banks that did not voluntarily disclose their sovereign risk exposures. Banks disclosing their exposures witnessed increases in liquidity and decreases in the equity bid-ask spread.

Our paper is related to this line of literature, as we do not only examine the effects of the publication of the stress test results, but also the effects of the announcement of the stress test (Petrella and Resti, 2013) and the disclosure of the methodology (Gick and Pausch, 2012).

Finally, our paper is related to the literature on the impact of regulation of Systemically Important Financial Institutions (SIFIs). Stress tests are used to set capital ratios, limit capital distributions, and set-up resolution regimes in case of financial distress (BCBS, 2012). Bongini and Nieri (2013) investigate the response of financial markets to the Financial Stability Board's publication of the list of institutions that are too-big-to-fail. They quantify the value of an implicit too-big-to-fail subsidy and find that financial markets did not strongly react to the proposed new regulation regarding SIFIs. Schaefer et al. (2013) investigate the reaction of the stock returns and CDS spreads of US and European banks to several regulatory reforms including the too-big-to-fail regulation in Switzerland. These authors report significant market reactions in response to this regulation, which strongly increased CDS spreads of systemic banks, but affected equity prices only mildly.

Our study is related to this literature as we examine the systematic risk of banks. We expect the beta of a bank to decline following the publication of the results of a stress test. The information provided by the stress tests could reduce the uncertainty on bank stability and therefore would lower the overall level of risk in the industry. This would lead to a decline in bank betas. To study the underlying shifts in systematic risk we decompose the changes in betas into changes in the correlation of stocks with the market (systemic risk) and changes in the relative variance (idiosyncratic risk) following a similar approach as Nijskens and Wagner (2011). These authors study credit risk transfers of banks through issuance of CDS and CLO contracts. They disentangle the changes in betas and find that the increase in betas was primarily due to an increase in the correlation of stocks with the market. Although banks became individually less risky using credit risk transfers, systemic risk increased. As we examine the changes in betas in a similar way we can examine how stress tests have affected systemic risk.

3 Stress tests in the US

The Federal Reserve's CCAR exercises conducted in 2011–15 can be classified as micro-prudential supervisory stress tests. They are 'top down' in the sense that the Fed independently produced loss estimates using its own supervisory models. Although the Fed publishes the results of stress tests, the specification of the models used to arrive at them remains a 'black box' (Bernanke, 2013). An important reason for this is to prevent the homogenization of stress test models, as banks would over time have fewer incentives to maintain independent risk management systems and adopt the specifications used by the Fed. These tests were conducted in the aftermath of the crisis and unlike the SCAP in 2009 were not crisis management stress tests. The latter differ in their emphasis on solvency, current risks, and their specific 'constrained bottom-up' approach (Oura and Schumacher, 2012). For the SCAP exercise the Fed relied more on the banks' own estimates.

Table 1: Related studies

Study	Stress test	Findings
Morgan et al. (2014)	SCAP 2009	Stress tests produce significant market reaction of stock prices. Under-capitalized banks have experienced more negative abnormal returns. CDS spreads, particularly for under-capitalized banks, decline following the release of stress test results.
Cardinali and Nordmark (2011)	EBA 2010, 2011	The 2010 EU stress test was uninformative to financial markets. The methodology release of the EBA stress test in 2011 on the other hand had a clear impact on banks. Stress tests showed no effects of GIIPS-banks being more opaque than banks from Northern Europe.
Ellahie (2012)	EBA 2010, 2011	The 2011 stress test reduced information asymmetry (i.e. equity-credit bid-ask spreads) and increased information uncertainty (measured by equity option implied volatilities and ratio of CDS spreads) of banks.
Alves et al. (2013)	EBA 2010, 2011	Both European stress tests have affected the stock prices of banks. The 2010 stress test reduced the volatility in stock prices while the volatility increased following the release of the 2011 stress test results.
Petrella and Resti (2013)	EBA 2011	Stress tests significantly affect the market and are a credible evaluation tool that reduce bank opaqueness.

Although stress tests have been criticized because of insufficient coverage or their implementation strategy, they have become an important instrument in supervisory authorities' toolkit. This is true for micro-prudential (BCBS, 2012) as well as macro-prudential stress tests (Borio et al., 2013).[2] Table 2 provides a descriptive overview of the stress tests conducted in the US on which we focus. Stress test design evolved.[3] In subsequent stress tests the Fed refined the hypothetical scenarios taking into account the procyclicality of the financial system and severe adverse developments on housing, equity, and asset markets (Federal Reserve, 2012, 2013a,b).

To see how much attention stress tests received we collected news articles from a variety of news sources from the Dow Jones Factiva database for the 2009–2015 period. We searched for all news containing the words "stress test" related to the banking stress tests procedure. The number of news articles related to stress test events provides a crude indication of how much attention stress tests received. Our final list of articles contains news on individual banks, the banking industry, and the US economy. The news was filtered with all the relevant bank names and with the names of related government agencies, such as the Federal Reserve, FDIC and the US Department of the Treasury. We verified all news manually for relevance.

Our news analysis suggests that the SCAP received considerable more attention than the subsequent CCARs and DFAST. The news index also reveals that stress tests were a substantial part of market sentiment in 2009–2015. About 10 percent of all news about the US banking industry in this period relates to stress tests. Not surprisingly, the highest frequency of news reports on this topic appeared when the stress test outcomes were disclosed. Other peaks occurred when the details of the stress tests were announced and when the results for participating banks were released. In the remainder of our paper, we use an event study approach to quantify the effects of the disclosure of stress test information on financial markets.

4 Data and methodology

4.1 Data

We use equity returns of banks that have participated in the US stress tests over the 2009–2015 period.[4] We employ the S&P 500 returns index as proxy for the market portfolio. Data were obtained from Bloomberg. Table 3 lists the participating banks considered in our research and shows the results of the stress tests.[5]

[2] Macro-prudential stress testing has evolved over time. This type of stress tests is discussed e.g. by Cihak (2007), Borio et al. (2013), FSA (2009), de Larosiere (2009), Sorge (2004), and Galati and Moessner (2013). Criticism raised has led to the development of new stress testing models, such as Foglia (2009), Chan-Lau (2013), Swinburne (2007), Breuer et al. (2009), Schechtman and Gaglianone (2012), and Huang et al. (2012).

[3] The design of stress tests also received attention in the literature. BCBS (2009) provides principles for sound stress testing. Greenlaw et al. (2012) propose conceptual principals for stress testing while Oura and Schumacher (2012) suggest operational principals. Spargoli (2012) argues that stress tests can remove information asymmetries only if supervisory authorities implement policies to fix under-capitalized banks.

[4] We have also considered the effects of stress tests using price to book ratios as a measure of investors' beliefs in the banks' ability to generate profits. The findings from this analysis are very similar to our main results.

[5] We include GMAC (Ally Financial) in our CDS analysis but exclude it from our stock analysis as it was not publicly traded. We also exclude MUFG Americas Holdings Corporation and Citizens Financial Group. The banks included in the stress tests cover at least 66% of total US banking sector assets.

Table 2: Description of US stress tests

	Purpose/Requirements	Results
SCAP 2009	Restoring confidence, identifying future conditions for banks with insufficient capital. Banks are well-capitalized with Tier 1 capital above 6% of RWA and solvent with 4% Tier 1 common equity ratio. A total of 19 banks is assessed.	Ten banks with a capital gap. Tier 1 common capital increased to $759 bln. and Tier 1 common equity ratio increased to 10.4%.
CCAR 2011	Quantitative assessment of capital levels and qualitative assessment of internal capital planning processes of banks. Banks submit capital plans to the Fed, largest 6 banks submit trading P&L statements.	Banks mostly had to lower their capital distributions, payout decreased to 15% in 2011 from 38% in 2006.
CCAR 2012	Banks that did not participate earlier are now subject to a Capital Plan Rule. Banks submit a description of internal processes for assessing capital adequacy; policies governing capital actions; planned capital actions; and results of company-run stress tests. Banks are solvent with a 5% Tier 1 common ratio.	Four banks had a capital gap. Doubling of weighted Tier 1 common equity ratio.
DFAST 2013	Quantitatively assess how bank capital levels would fare in adverse economic conditions. Financial companies with total consolidated assets between $10 bln and $50 bln are required to conduct their own stress tests.	One bank failed to adhere to the minimum of 5% Tier 1 common equity ratio.
CCAR 2013	Quantitative and qualitative evaluation of whether a bank's capital accretion and distribution decisions are prudent. Banks have to disclose their own estimates of stressed losses and revenues. The Fed also discloses whether or not it objected to each bank's capital plan.	Two banks conditionally approved, two banks not approved.
DFAST 2014	Assessment of additional banks with $50 bln or more total consolidated assets. The Fed independently projects balance sheets and RWAs of each bank. The Basel III revised regulatory capital framework is incorporated into the assessment. A total of 30 banks is assessed.	Over the nine quarters of the planning horizon, losses at the 30 banks under the severely adverse scenario are projected to be $501 bln. One bank did not pass the assessment.
CCAR 2014	Banks with significant trading activities are required to apply a hypothetical Global Market Shock to trading and counter-party exposures. Banks are subject to a new counter-party default scenario requirement and must include losses from the default of their largest stressed counter-party. A bank's projected capital ratios are interpreted relative to the minimum capital requirements in effect for each quarter of the planning horizon.	Five banks did not pass the test.
DFAST 2015	A total of 31 banks is assessed.	All banks passed the test.
CCAR 2015	Banks were required to reflect the transition arrangements and minimum capital requirements of the revised regulatory capital framework in their estimates of pro forma capital levels and capital ratios.	Two banks did not pass.

Sources: Federal Reserve (2009a,b, 2012, 2013b,a, 2014b,a, 2015b,a).

We also use daily data on 5-year senior CDS spreads for a subset of the banks.[6] We employ the CDX Investment Grade Index provided by Bloomberg as proxy for a market portfolio in the CDS market. This index represents the rolling equally-weighted average of 125 of the most liquid North American CDS series with relevant rating of at least "BBB-" or "Baa3" and with 5 years maturity. In all analyses we exclude official holidays and days with limited trading.

4.2 Methodology

To examine whether stress tests have affected equity or CDS markets we follow an event study methodology described e.g. in Brown and Warner (1985), Thompson (1995), or MacKinlay (1997). Figure 1 provides an overview of all the relevant stress test events. Following Morgan et al. (2014), we present findings for a 3-days event window (-1,+1). Our estimation window for equity returns and CDS spreads consists of 255 trading days, i.e. the (-265,-10) time interval, where $t = 0$ is the event date of the corresponding stress test.[7] This window is sufficiently long to conduct an event study using daily data (MacKinlay, 1997). When event windows are overlapping, or a single event affects multiple banks, we can no longer assume that the abnormal returns of securities are cross-sectionally uncorrelated. Figure 1 shows that the date of the methodology release and the date of the disclosure of the results of the CCAR in 2012 are particularly close. In this case the covariance may deviate from zero and we can no longer use the distributional results for the aggregated abnormal returns (MacKinlay, 1997). Consequently, we treat the disclosure of the methodology and the results of CCAR 2012 as a "large" event.[8]

To measure the impact of an event we set the abnormal return of a security as the difference between the actual (ex post) return and the normal return over the relevant event window. Normal returns are estimated using the following market model,

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \tag{1}$$

where $R_{i,t}$ is the daily return of equity of bank i at time t, and $R_{m,t}$ is the return of a market portfolio (the S&P 500 returns index). Similarly the CDS spread of bank i at time t is regressed on the overall index, the CDX Investment Grade Index (cf. Norden and Weber, 2004; Morgan et al., 2014). The residuals or abnormal returns (AR) implied by the market model are given by,

$$AR_{i,t} = R_{i,t} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{m,t}\right) \tag{2}$$

[6] The sample for our CDS analysis is smaller as credit default swaps of some banks were not available or not traded. The following banks are included in our CDS analysis: American Express, Bank of America, Capital One Financial, Citigroup, GMAC (Ally Financial), Goldman Sachs, JPMorgan Chase, Metlife, Morgan Stanley, and Wells Fargo.

[7] We have considered different event windows: (-2,0), (0,+2), (-2,+2), (-3,0), (0,+3), (-3,+3), (-10,0), (0,+10), (-10,+3) and (-3,+10) as well as a shorter estimation window (up to 150 trading days) to avoid overlaps with events related to stress tests in other years. These findings (available upon request) are in line with our main results.

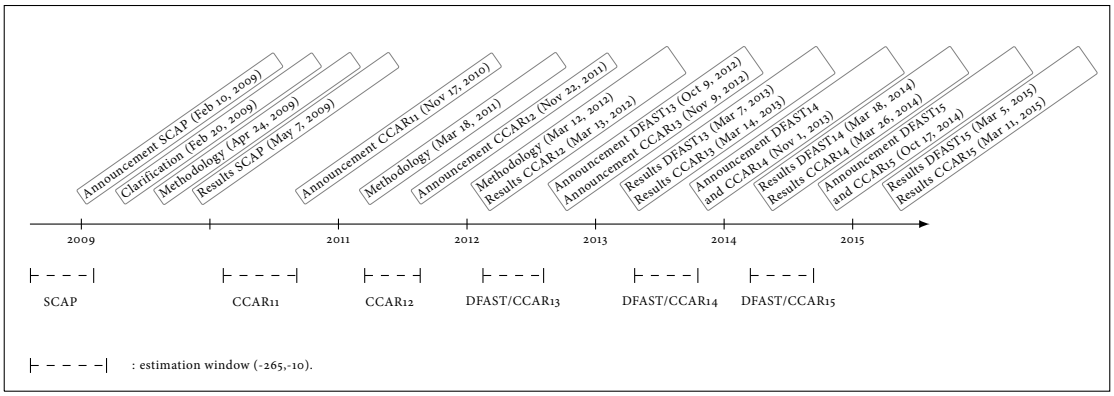
[8] In this respect our approach is similar to that of Morgan et al. (2014) who consider the clarification event of the SCAP in 2009, which actually consist of two events: Bernanke's testimony on 24 March 2009 and the release of further details about the stress test on 23 and 25 March 2009. They disentangle the effects of the events by considering how equity and bond-holders are affected. They reason that the former event mattered for both market participants but the release of the Capital Assistance Plan details mattered only for equity holders.

Table 3: List of the banks which passed/failed the stress tests

Banks	2009	2012	2013		2014		2015	
Global SIFIs	SCAP	CCAR	DFAST	CCAR	DFAST	CCAR	DFAST	CCAR
Bank of America	-	+	+	+	+	+	+	+
BNY Mellon	+	+	+	+	+	+	+	+
Citigroup	-	-	+	+	+	-	+	+
Deutsche Bank							+	-
Goldman Sachs	+	+	+	-	+	+	+	+
HSBC					+	-	+	+
JPMorgan Chase	+	+	+	-	+	+	+	+
Morgan Stanley	-	+	+	+	+	+	+	+
Santander					+	-	+	-
State Street	+	+	+	+	+	+	+	+
Wells Fargo	-	+	+	+	+	+	+	+
Domestic SIFIs								
Ally Financial	-	-	-	-	+	+	+	+
American Express	+	+	+	-	+	+	+	+
BB&T	+	+	+	-	+	+	+	+
Capital One	+	+	+	+	+	+	+	+
Fifth Third Bank	-	+	+	+	+	+	+	+
PNC	-	+	+	+	+	+	+	+
Regions Financial	-	+	+	+	+	+	+	+
SunTrust Banks	-	-	+	+	+	+	+	+
U.S. Bancorp	+	+	+	+	+	+	+	+
Non-SIFIs								
BBVA Compass					+	+	+	+
BMO					+	+	+	+
Comerica					+	+	+	+
Discover					+	+	+	+
Huntington					+	+	+	+
KeyCorp	-	+	+	+	+	+	+	+
MetLife	+	-						
M&T					+	+	+	+
Northern Trust					+	+	+	+
Zions Bancorporation					-	-	+	+

Notes: This table presents the list of the banks which passed/failed the 2009–2015 stress tests. '+' means that a bank passed the stress test without any frictions ('No-Gap' banks), and '-' indicates that a bank did not meet the minimum post-stress capital ratio requirements or had deficiencies in its capital planning process that undermine its overall reliability of capital planning process ('Gap' banks). An empty cell denotes that the bank did not participate in the corresponding testing procedure. The banks are divided into global SIFIs, domestic SIFIs, and non-SIFIs according to the classification of the Financial Stability Board (FSB, 2014).

Figure 1: Chronology of stress test events



where the circumflex indicates that the parameter concerned is estimated. The abnormal returns are summed over the relevant window around the event date to compute the cumulative abnormal return (CAR).[9] The t-statistics obtained from the estimation in (1) are adjusted for event clustering and event induced volatility following Kolari and Pynnonen (2010).[10] The adjusted t-statistics are employed to test whether the CAR significantly differs from zero.

In order to assess the possible changes in systematic risk caused by stress test events we decompose the beta into a market correlation component and a volatility component following Nijskens and Wagner (2011). We estimate the relation between returns and a banks' beta using the following model,

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \sum \delta_j D^j + \sum \beta_j D^j * R_{m,t} + \varepsilon_{i,t} \tag{3}$$

where α_i is the bank fixed effect, D^j is a dummy variable with value one up to ten trading days of the next event and $j \in \{A, C, M, R\}$ denotes the announcement, clarification, methodology, and result events, respectively. $D^A * R_{m,t}$, $D^M * R_{m,t}$, and $D^R * R_{m,t}$ are the interaction terms of interest. Their coefficients will capture the change in bank betas after the announcement events, methodology event, and after the result events, respectively.[11]

Next, we decompose the changes in betas into changes in the correlation of stocks with the market and changes in the relative variance. That is, the beta can be represented by,

$$\beta_i = \rho_{i,m} \frac{\sigma_i}{\sigma_m} \tag{4}$$

[9] With a slight abuse of notation, we denote the cumulative abnormal spreads obtained from the CDS counterpart of (1) also as CARs.

[10] In the presence of event clustering cross-correlation among securities may lead to over rejection of the null hypothesis of zero average abnormal returns. We have employed a GARCH analysis to verify that stress test events contributed to shift in volatility (not presented). Not all recent event studies adjust for clustering (e.g. Candelon and Sy, 2015), but in our view it is the proper procedure. See also Amici et al. (2013); Fratianni and Marchionne (2013); Elyasiani et al. (2014).

[11] Note that we exclude the clarification and methodology events of 2009 in our beta analysis as they are very close to the announcement and result release of SCAP, respectively. Similarly, we only consider the announcement of DFAST and the results release of CCAR as these are the first and last events of interest in 2013, respectively. Our post-stress-test periods for evaluating beta vary over the years.

where $\rho_{i,m}$ is the correlation coefficient between the equity and the market and σ_m the variance of the market.[12] The beta in (4) is the product of the correlation of a bank's equity price with the market and its standard deviation relative to that of the market. We then normalize our model in (3) by dividing the equity and market returns by their respective standard deviations.[13] As a consequence the coefficient of the normalized returns equals the correlation of the previous series, and (4) changes to $\beta_i = \rho_i$. The regression equation is then changed to,

$$\tilde{R}_{i,t} = \tilde{\alpha}_i + \rho_i \tilde{R}_{m,i,t} + \sum \delta_j D^j + \sum \rho_j D^j * \tilde{R}_{m,i,t} + \varepsilon_{i,t} \tag{5}$$

where

$$\tilde{R}_{i,t} = \begin{matrix} R_{i,t}/\sigma_{i,t<t_i} & \text{if t}< t_i \\ R_{i,t}/\sigma_{i,t\geq t_i} & \text{if t}\geq t_i \end{matrix} \quad \text{and} \quad \tilde{R}_{m,i,t} = \begin{matrix} R_{m,i,t}/\sigma_{m,t<t_i} & \text{if t}< t_i \\ R_{m,i,t}/\sigma_{m,t\geq t_i} & \text{if t}\geq t_i \end{matrix}$$

and t_i stands for the event date.

5 Results

5.1 How do stress tests affect equity returns and credit risk?

We present our findings in Tables 4 and 5. Table 4 shows reactions in the stock market and Table 5 shows reactions in the credit market. We discuss each market in turn, considering the announcement, clarification, methodology, and result events.

Stock market As shown in Table 4, the *announcements* of stress tests generally had a mixed effect on equity returns. The stock market reacted positively to the announcement of DFAST and CCAR in 2013 but negatively in 2012. The mixed effect on stock prices may reflect that generally stress test announcements provide limited (quantitative) information on the way the stress tests will be conducted or how their results will be used.

The market's reaction to then chairman Bernanke's *clarification* in 2009 that banks would not be nationalized caused an upward movement in equity returns. The clarification event notably increased the CARs of gap banks by 31.6 percent as these banks were at the time considered to be at risk to be nationalized (Morgan et al., 2014). Similar to Morgan et al. (2014) we find no evidence that the methodology disclosure of the SCAP has led to changes in stock prices. There is some evidence that the publication of

[12] To arrive at (4), note that individual stock beta $\beta_i = \frac{cov_{i,m}}{\sigma_m^2}$ can be represented as $\beta_i = \rho_{i,m}\frac{\sigma_i}{\sigma_m}$ using the correlation notation $\rho_{i,m} = \frac{cov_{i,m}}{\sigma_i \sigma_m}$.

[13] To identify shifts in the relative variance, σ_i/σ_m, we do the following decomposition: $\beta^1 = \beta^o + \Delta\beta$ where the superscripts denote the beta before and after the event. Using $\beta^1 = \rho^1_{i,m}\frac{\sigma^1_i}{\sigma^1_m} = (\rho^o_{i,m} + \Delta\rho_{i,m})\frac{\sigma^1_i}{\sigma^1_m}$ the relative variance can be rearranged as $\frac{\sigma^1_i}{\sigma^1_m} = \frac{\beta^o+\Delta\beta}{\rho^o_{i,m}+\Delta\rho_{i,m}}$ and, therefore, a change in relative variance is $\Delta\frac{\sigma^1_i}{\sigma^1_m} = \frac{\sigma^1_i}{\sigma^1_m} - \frac{\sigma^o_i}{\sigma^o_m} = \frac{\beta^o+\Delta\beta}{\rho^o_{i,m}+\Delta\rho_{i,m}} - \frac{\beta o}{\rho^o_{i,m}}$.

the methodology of CCAR in 2011 has affected stock prices negatively. In the other years the methodology and results were released jointly.[14]

Table 4 shows that, in contrast to Morgan et al. (2014), CARs of bank equity returns in 2009 were not affected after the release of stress test *results*. This holds for both gap and no-gap banks' stock prices. Our finding is different from that of Morgan et al. (2014) because our methodology accounts for event clustering (Kolari and Pynnonen, 2010).[15] Table A1 in the Appendix provides findings over extended event windows for the SCAP stress test. There is very little evidence of stock market reactions for the SCAP stress test except for the clarification event.

Overall the findings suggest that the release of stress test results after 2009 have had little effects on equity markets. As shown in Table 4 in some years stock markets reacted. In 2012, for example, for the sample of no-gap banks we find that the equity market reacted positively to the disclosure of the results of stress tests. However, the findings are statistically weak. Moreover, the magnitude of the impact in all years is lower than that in 2009 following chairman Bernanke's clarification. Arguably, during a crisis the need for credible information is greater than in calmer periods so the market may have valued the information disclosed in the clarification in 2009 more (Schuermann, 2013). Finally, the reactions in post-crisis stress tests are not always uniform. This is particularly so for the announcement effects (negative in 2012 and positive in 2013) but also for results (negative in 2014 and positive in 2015).

Credit market As Table 5 shows, the *announcement* events had a mixed effect on CDS spreads. Spreads were negatively affected in 2009 for no-gap banks and positively in 2012 for gap banks. Moreover, we see that Bernanke's clarification of the stress test in 2009 did not affect the CDS market. This response is expected due to the structure of the CDS agreements where any change in ownership due to nationalization would not bring additional losses to contract parties.[16]

For the *methodology* events we find mixed results. For 2009 we find no impact on CDS spreads. However, in 2011 CDS spreads declined significantly following the release of the stress test methodology. This suggests that the release of the methodology in 2009 was less informative for the market compared to 2011. In 2011 there was no disclosure of stress test results, which could have led the market valuing the information provided by the methodology disclosure relatively strongly.

Table 5 shows a decline in the average CDS spreads in 2009 for no-gap banks following the publication of the stress test *results*. Average spreads dropped 55.43 basis points for no-gap banks. The disclosure of the results of CCAR in 2012 and 2013 also have led to lower CDS spreads. In contrast, the results of DFAST

[14] In 2012 the methodology and results were released on two consecutive days. As discussed in our methodology section we treat these events as a single 'large' event.

[15] Another difference is the estimation period. Morgan et al. (2014) estimate their analysis over a relatively less volatile period (July 1, 2006 to June 30, 2007). Our findings are robust to a change in the estimation period. Using the same estimation period as Morgan et al. (2014) and correcting for clustering, we still find that the results of the SCAP stress test did not affect stock prices within a (-1,+1) window. Results are available upon request.

[16] Morgan et al. (2014) find a decline in CDS spreads following the clarification event (though only for gap banks). However, they consider CDS contracts with an MR document clause. This entails that these contracts do not suppose full coverage in case of a credit event. As we do not consider these types of contracts a possible nationalization would not affect the spreads.

Table 4: Stock market reaction to stress tests (in %)

	All	%>0	No-Gap	%>0	Gap	%>0
2009						
Announcement	-.4203	44.4	-.2026	44.4	-.6378	44.4
Clarification	21.13**	100	10.66*	100	31.60**	100
Methodology	.3583	50	4.002	66.7	-3.285	33.3
Results SCAP	14.31	77.8	11.28	77.8	17.33	77.8
2011						
Announcement	-2.348	27.8				
Methodology	-1.766*	16.7				
2012						
Announcement	-.2958	44.4	-.0333	53.3	-1.609***	0
Results CCAR	2.308	88.9	2.935*	93.3	-.8292	66.7
2013						
Announcement	2.320**	94.1				
Results DFAST	1.223	88.2				
Announcement	1.586	82.4	1.626	76.9	1.404***	100
Results CCAR	.6509	70.6	.9765	76.9	-.4072	50
2014						
Announcement	-.8483	25.9	-.9805	21.7	-.0883	50
Results DFAST	.6321	70.4	.7339	73.9	.6310	100
Results CCAR	-1.212	18.5	-1.389*	13	-.1971	50
2015						
Announcement	-1.363	25	-1.355	26.9	-1.464***	0
Results DFAST	1.584	85.7				
Results CCAR	1.448*	85.7	1.606*	88.5	-.6054	50

Notes: *** - 1%, ** - 5%, * - 10% significance level. This table presents CARs for the main stress test events over the 2009-2015 period calculated using Equation (1) with a (-1,+1) event window. Reported significance are based on corrected t-statistics. Column 'All' shows the effects of events on the average CARs of all banks. Columns 'No-Gap' and 'Gap' separate the effects into banks with and without capital shortfalls and/or disapproval of capital distribution plans. Column '%>0' indicates what fraction of the CARs of all banks were positive.

Table 5: Credit market reaction to stress tests (in bp)

	All	%>0	No-Gap	%>0	Gap	%>0
2009						
Announcement	-13.04	0	-10.81	0	-15.83	0
Clarification	18.65	55.6	32.15	60	1.762	50
Methodology	-11.28	33.3	-19.72	20	-.7275	50
Results SCAP	-81.70	0	-55.43**	0	-114.7	0
2011						
Announcement	3.496	60				
Methodology	-11.04**	0				
2012						
Announcement	11.64	70	9.152	57.1	17.42***	100
Results CCAR	-10.63	0	-10.54*	0	-10.84	0
2013						
Announcement	-1.459	33.3				
Results DFAST	.8788	66.7				
Announcement	-8.848	11.1	-9.394	20	-8.167	0
Results CCAR	-4.877*	0	-4.429	0	-5.438*	0
2014						
Announcement	2.369	100	2.258	100	3.251	100
Results DFAST	-.8816	33.3				
Results CCAR	.9118	66.7	.4411	62.5	4.677	100
2015						
Announcement	1.556	89.9				
Results DFAST	-.1971	44.4				
Results CCAR	.8564	89.9				

Notes: *** - 1%, ** - 5%, * - 10% significance level. This table presents CARs for the main stress test events over the 2009-2015 period calculated using CDS spreads for an (-1,+1) event window. Reported significance are based on corrected t-statistics. Column 'All' shows the effects of events on the average CARs of all banks. Columns 'No-Gap' and 'Gap' separate the effects into banks with and without capital shortfalls and/or disapproval of capital distribution plans. Column '%>0' indicates what fraction of the CARs of all banks were positive.

seem to have been uninformative to the credit market. The fact that CCAR in 2013 affected CDS spreads stronger than DFAST could be due to two reasons. Firstly, as Table 3 shows, in DFAST all the banks in our stock sample received approval while in CCAR three of these banks were not approved. The market may therefore have attached more importance to the results of CCAR. Alternatively, it could be due to the underlying assumptions of the stress tests. While DFAST was conducted conditional on no change in the capital distributions, CCAR incorporated the capital plans proposed by the banks and, therefore, may have better reflected creditworthiness (Federal Reserve, 2013a). Table A1 provides, again, findings over extended event windows for the SCAP stress test. The results over longer event windows are in line with our main findings for the credit market: spreads decline following the publication of stress test results.[17]

Overall, the findings indicate that stress tests in some years after the crisis have provided new information to CDS markets.

5.2 How do stress tests affect systematic and systemic risk?

Systematic risk Table 6 presents event dummies associated with the stress tests and the interaction terms with betas. We focus our discussion on these interaction terms. Table 6 shows that the impact of the *announcement* effects are mixed. In 2009 the announcement of SCAP has led to an increase in systematic risk. For the remaining years there is no consistent evidence of movement in betas. Considering *results* events, in 2009 the betas were reduced following the publication of the results of the SCAP. Specifically, we find a strong decline in systematic risk (-.2305) after the publication of results. Similarly, the beta of banks declined after the release of stress test results in 2013 (-.2174). These findings suggest that market participants expected stress test results to be worse than they ex-post turned out to be and as a consequence betas declined in 2009 and 2013.

Systemic risk Table 7 presents the estimation results for our standardized model (Equation (5)). We are interested in the coefficients of the interaction terms, denoted by ρ. Following Nijskens and Wagner (2011), we interpret a decline in the correlation component as a decline in systemic risk. Except from a weak effect in 2012, we see no evidence that the *announcement* events affected systemic risk of banks. However, the *methodology* release in 2011 increased ρ and contributed to the increase in beta reported in Table 6. For *results* events there is a decrease in the correlation of the stock series with the market in 2009 and 2012, suggesting that systemic risk declined.[18]

Gap vs no-gap banks To examine whether systematic and systemic risk of gap and no-gap banks were affected differently, we re-estimate Equations (3) and (5) for no-gap banks and gap banks. The resulting

[17] The findings over extended windows are, however, suggestive at best as the probability that other factors may affect spreads increases as the event window is extended.

[18] We attribute the insignificance of the corresponding beta for CCAR 2012 in Table 6 to the relative variance component, which may have added sufficient noise to make the overall change in beta insignificant.

regressions are shown in, respectively, Table 8 and Table 9. In what follows we focus our discussion on the beta effects associated with the results events.

Considering the first two columns, we see that the decrease in the beta in 2009 as reported in Table 6 was due to the effects on no-gap banks. The results of SCAP seem to have caused a significant decrease in betas of no-gap banks while the betas of gap banks were not affected. This finding complements the findings of Morgan et al. (2014) who show that market participants' ex ante expectations of capital shortfalls were worse than they ex post turned out to be. Earlier we reported that the results of CCAR in 2012 did not affect the betas. It turns out that the publication of the CCAR 2012 result did affect the betas of gap banks (.2284). In 2013, there is a large change in the overall beta following the results of CCAR for both gap (-.2617) and no-gap (-.2110) banks. Overall there is strong evidence of a decline in systematic risk following stress test results in most years.

Table 8 also shows that the changes in betas of gap banks significantly differ from changes in betas of no-gap banks in 2012. As revealed by the stress test results, most banks had sufficient capital to maintain their operations under the adverse economic scenario employed, but some banks appeared to be under-capitalized. The signs of betas in 2012 associated with stress test results for gap and no-gap banks suggest that the betas move in opposite directions.

Considering systemic risk for gap banks, Table 9 suggests that the publication of the stress test results affected systemic risk also in 2009 and 2012. The release of stress test results in 2009 decreased the beta of gap banks (-.0846) while the release of results in 2012 lowered the systemic risk component of the beta (-.1236).

6 Conclusion

As stress tests are an important tool for banking supervisors, it is important to consider their effects on stock and credit markets. We have quantified the market reactions of US stress tests performed after the start of the financial crisis by considering their effects on stock returns, CDS spreads, systematic risk, and systemic risk. Considering stock markets, our findings indicate that the publication of stress test results had little effect on stock returns. The clarification event in 2009 by then Fed chairman Bernanke and the results of CCAR in 2012 did affect stock markets positively. Considering credit markets, our findings show evidence of decline in CDS spreads following the release of the stress test results in 2009, 2012, and 2013.

We conclude that the release of information about stress tests did occasionally move markets. In other words, stress tests may have provided information to markets.

Our analysis of banks' betas suggests that the publication of stress test results has affected banks' systematic risk in 2009 and 2013. Studying the changes in betas we find that stress tests reduced systemic risk in 2009 and 2012. Overall, we conclude that stress tests have produced valuable information for market participants and can play a role in mitigating bank opacity. So, our findings suggest that stress tests are a useful tool in mitigating systematic and systemic risk in stock and credit markets.

Table 6: Systematic risk

	2009	2011	2012	2013	2014
Market β	1.792***	1.426***	1.566***	1.442***	1.196***
	(.0625)	(.0564)	(.0424)	(.0591)	(.0485)
Announcement dummy	.0001	.0012	.0012	-.0000	.0004
	(.0038)	(.0013)	(.0013)	(.0008)	(.0006)
Result dummy	-.0018	-.0003	.0009	.0001	-.0004
	(.0023)	(.0010)	(.0010)	(.0007)	(.0005)
Announcement β effect	.9535***	.0493	.1309	-.1211	.0304
	(.1491)	(.1420)	(.1173)	(.0978)	(.0817)
Methodology β effect		.1269*			
		(.0723)			
Result β effect	-.2305*		-.0927	-.2174**	-.0562
	(.1267)		(.0995)	(.0873)	(.0867)
Constant	-.0001	-.0027**	-.0022**	-.0003	.0000
	(.0024)	(.0011)	(.0013)	(.0008)	(.0006)
Number of id	18	18	18	17	28
Trading days	597	406	371	445	367
R^2	.4720	.6260	.6392	.4881	.4456

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

Table 7: Systemic risk

	2009	2011	2012	2013	2014
Market ρ	.7409***	.7616***	.8589***	.7413***	.6881***
	(.0331)	(.0291)	(.0278)	(.0339)	(.0303)
Announcement dummy	-.0100	.0477	.0269	-.0110	.0396
	(.0664)	(.0512)	(.0523)	(.0524)	(.0489)
Result dummy	-.0580	.0056	.0186	.0015	-.0339
	(.0404)	(.0415)	(.0420)	(.0464)	(.0461)
Announcement ρ effect	.0595	-.0756	-.0897*	-.0583	.0076
	(.0670)	(.0518)	(.0520)	(.0526)	(.0487)
Methodology ρ effect		.0860**			
		(.0415)			
Result ρ effect	-.0706*		-.1296***	-.0313	-.0547
	(.0398)		(.0421)	(.0466)	(.0462)
Constant	-.0002	-.1001***	-.0515	-.0057	.0060
	(.0405)	(.0387)	(.0408)	(.0456)	(.0460)
Number of id	18	18	18	17	28
Trading days	597	406	371	445	367
R^2	.4902	.6156	.6391	.5093	.4526

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

Table 8: Systematic risk gap and no-gap banks

	2009		2012		2013		2014	
	No-gap	Gap	No-gap	Gap	No-gap	Gap	No-gap	Gap
Market β	1.774***	1.744***	1.575***	1.542***	1.415***	1.372***	1.184***	1.184***
	(.0574)	(.0552)	(.0411)	(.0384)	(.0502)	(.0442)	(.0459)	(.0407)
Announcement dummy	.0008	.0011	.0010	.0012	-.0000	-.0000	.0004	.0006
	(.0036)	(.0035)	(.0013)	(.0013)	(.0001)	(.0007)	(.0006)	(.0005)
Result no-gap dummy	-.0020		.0009		.0002		-.0005	
	(.0017)		(.0010)		(.0007)		(.0006)	
Result gap dummy		-.0011		.0005		-.0001		.0003
		(.0028)		(.0009)		(.0006)		(.0006)
Announcement β effect	.9726***	1.002***	.1225	.1553	-.0674	-.0244	.0406	.0406
	(.1470)	(.1464)	(.1169)	(.1162)	(.0918)	(.0890)	(.0802)	(.0774)
Result no-gap β effect	-.3160***		-.1647*		-.1700**		-.0278	
	(.0923)		(.0950)		(.0775)		(.0845)	
Result gap β effect		-.0767		.2494**		-.1682***		-.1560*
		(.1480)		(.1189)		(.0646)		(.0889)
Constant	-.0014	-.0008	-.0021	-.0021	.0002	.0003	.0001	-.0002
	(.0019)	(.0026)	(.0013)	(.0013)	(.0008)	(.0008)	(.0006)	(.0006)
R^2	.4721	.4710	.6390	.6388	.4915	.4907	.4455	.4454
Number of id	18		18		17		28	
Trading days	597		371		394		367	

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

Table 9: Systemic risk gap and no-gap banks

	2009		2012		2013		2014	
	No-gap	Gap	No-gap	Gap	No-gap	Gap	No-gap	Gap
Market β	.6845***	.7207***	.8474***	.8061***	.7399***	.7250***	.6735***	.6728***
	(.0208)	(.0194)	(.0250)	(.0213)	(.0276)	(.0234)	(.0276)	(.0234)
Announcement dummy	.0155	.0141	.0248	.0238	-.0084	-.0155	.0372	.0561
	(.0624)	(.0616)	(.0512)	(.0495)	(.0489)	(.0461)	(.0477)	(.0452)
Result no-gap dummy	-.0497		.0150		.0125		-.0462	
	(.0365)		(.0416)		(.0450)		(.0473)	
Result gap dummy		-.0492		.0353		-.0219		.0339
		(.0428)		(.0457)		(.0445)		(.0480)
Announcement β effect	.0623	.0261	-.0782	-.0369	-.0487	-.0339	.0222	.0230
	(.0621)	(.0615)	(.0506)	(.0493)	(.0480)	(.0458)	(.0471)	(.0448)
Result no-gap β effect	.0204		-.1236***		-.0371		-.0243	
	(.0217)		(.0381)		(.0387)		(.0442)	
Result gap β effect		-.0846***		-.0493		-.0021		-.1346
		(.0246)		(.0344)		(.0325)		(.0390)
Constant	-.0404	-.0067	-.0499	-.0464	.0074	.0133	-.0014	-.0218
	(.0294)	(.0407)	(.0404)	(.0364)	(.0444)	(.0385)	(.0459)	(.0418)
R^2	.4892	.4906	.6386	.6359	.5122	.5199	.4522	.4525
Number of id	18		18		17		28	
Trading days	597		371		394		367	

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

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A Appendix

Table A1: Market reactions to the 2009 SCAP stress test over extended windows

Event window	All	No-Gap	Gap	All	No-Gap	Gap
	Stock market (in %)			Credit market (in bp)		
Announcement						
(0)	-8.602	-4.016*	-13.19	-4.615	-5.069	-4.049
(-1,+1)	-.4203	-.2027	-.6378	-13.04	-10.81	-15.83
(-1,0)	-5.682	-3.327*	-8.038	-16.15*	-15.06**	-17.52
(0,+1)	-3.340	-.8917	-5.788	-1.507	-.8228	-2.363
(-2,+2)	4.709	-1.650	11.07	-26.87**	-21.41***	-33.69*
(-2,0)	2.728	-1.117	6.627	-26.40**	-21.16***	-32.96*
(0,+2)	-6.621	-4.495	-8.747	-5.082	-5.319	-4.785
(-3,+3)	2.050	-4.256	8.357	-28.76*	-30.89***	-26.10
(-3,0)	3.303	-.9386	7.544	-32.05**	-31.34***	-32.93
(0,+3)	-9.854	-7.333	-12.38	-1.325	-4.617	2.790
(-10,+3)	-1.726	1.386	4.838	-45.37*	-53.99***	-34.60
(-10,0)	-.4734	4.703	-5.650	-48.66**	-54.44***	-41.44
Clarification						
(0)	8.750***	.7.335***	10.17***	10.51	15.42	4.372
(-1,+1)	21.13**	10.66*	31.60**	18.65	32.15	1.762
(-1,0)	15.32***	9.637***	21.01***	20.44	21.15	19.54
(0,+1)	14.56*	8.361*	20.75**	8.721	26.42	-13.41
(-2,+2)	29.37*	19.84*	38.91*	37.51	52.81	18.39
(-2,0)	15.87**	11.97**	19.76**	47.68*	40.97**	56.08
(0,+2)	22.26*	15.20	29.31*	.3420	27.26	-33.31
(-3,+3)	14.97	12.90	17.05	48.02	72.14	17.87
(-3,0)	9.403	8.109	10.70	64.14*	52.65*	78.50
(0,+3)	14.32	12.13	16.51	-5.610	34.91	-56.26
(-3,+10)	12.79	4.756	20.82	178.0	217.7*	128.4*
(0,+10)	12.14	3.981	20.29	124.4	180.4	54.31
Methodology						
(0)	1.244	2.324	.1649	-9.797	-11.34	-7.862
(-1,+1)	.3583	4.002	-3.285	-11.28	-19.72	-.7275
(-1,0)	3.922	7.018	.8250	-2.956	-5.241	-.1009
(0,+1)	-2.319	-.6926	-3.945	-18.12	-25.83	-8.488
(-2,+2)	-5.445	-.3120	-10.58	1.302	-12.67	18.77
(-2,0)	.1950	4.081	-3.691	5.265	4.514	6.205
(0,+2)	-4.396	-2.069	-6.722	-13.76	-28.53	4.699
(-3,+3)	.8916	7.978	-6.195	19.28	.1463	43.20
(-3,0)	4.675	9.999	-.6495	22.52	20.11	25.54
(0,+3)	-2.539	.3024	-5.380	-13.04	-31.31	9.803
(-10,+3)	8.398	11.29	5.507	-62.80	-89.86	-28.96
(-10,0)	11.72	12.94	10.49	-58.70	-69.96	-44.64
Result						
(0)	-1.213	-.4244	-2.001	-34.68*	-27.47	-43.70**
(-1,+1)	14.31	11.28	17.33	-81.76	-55.43**	-114.7
(-1,0)	6.536	5.724	7.347	-64.06	-44.26**	-88.82
(0,+1)	6.559	5.136	7.982	-52.38	-38.63**	-69.56*
(-2,+2)	8.067	3.270	12.86	-93.79	-61.38**	-134.3*
(-2,0)	5.171	3.456	6.883	-65.59	-45.43**	-90.79*
(0,+2)	1.683	-.6141	3.981	-62.88	-43.41**	-87.21*
(-3,+3)	11.99	5.093	18.90	-82.49	-53.12**	-119.2
(-3,0)	12.85	8.043	17.66	-58.69	-38.91	-83.42*
(0,+3)	-2.067	-3.374	-.7587	-58.48	-41.67*	-79.49
(-3,+10)	11.21	6.451	15.97	-116.3***	-94.19***	-144.0***
(0,+10)	-2.855	-2.017	-3.693	-92.33***	-82.74**	-104.3***

Notes: *** - 1% ** - 5%, * - 10% significance level. This table presents CARs for the 2009 SCAP stress test calculated using Equation (1) over extended event windows. The final rows of the announcement and methodology sections in the table do not extend to +10 trading days due the occurrence of respectively the clarification and results events. Column 'All' shows the effects of events on the average CARs of all banks. Columns 'No-Gap' and 'Gap' separate the effects into banks with and without capital shortfalls and/or disapproval of capital distribution plans. Reported significance is based on corrected t-statistics.