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The Value of Information: The Impact of European Union Bank Stress Tests on Stock Markets

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Abstract We tested whether the 2010, 2011 and 2014 European Union bank stress tests produced useful and real information to the market. Using an augmented capital asset pricing model, we analyzed the impact of the information disclosures on each stress test (announcement, methodology and results events) on the stock market returns and risk of banks. Our approach allows an integrated analysis, as a sample of 41 banks that participated in all three stress tests was used. The most significant event was the methodology disclosure, in terms of its impact on risk and returns. In contrast, the results events did not have much impact in the stock market when considering the entire sample of banks. On the other hand, after dividing the sample of banks into two groups (those that passed the 2014 European Union stress test vs. those that failed), we observed a significant reaction of the stock markets in both groups. These findings are consistent with the hypothesis that stress tests provide real and valuable information to the markets about the banking system. A significant part of that information is conveyed by announcement and methodology events.

Keywords Stress testing · Information disclosure · Bank capital

JEL Classification G14 · G21 · G28

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Introduction

The year 2008 was a key moment for banking regulation. The financial crisis increased the exposure and scrutiny of the banking system due to the collapse of well-known American banks, such as Lehman Brothers and Bear Stearns, but also due to the sovereign debt crisis in Europe. In response, central banks improved an already existing tool: the stress tests. These tests are based on simulation methodologies that predict the future and apply adverse economic scenarios, to assess whether banks will be able to cope with those scenarios. The purpose is to determine whether a bank has sufficient capital (or not) to accommodate those negative impacts on their balance sheet.

In the United States (U.S.), the first supervisory stress tests were administered in 2009, with the goal of ensuring that the largest banks had sufficient capital to withstand a very adverse macroeconomic outcome. The U.S. exercises later evolved into a series of annual supervisory stress tests, starting in 2011, expanding the number of banks involved. In all instances, the Federal Reserve issued public disclosures about the test's methodology, results and conclusions, including on a bank-by-bank basis.

The European regulators introduced widespread stress testing in 2010 by the Committee of European Banking Supervisors (CEBS). Since 2011, these were led by the European Banking Authority (EBA). One of the main targets of European regulators, by imposing and disclosing the results of such stress tests, was to restore confidence in the banking sector, signaling to the market that the banks were resilient to those adverse scenarios. In fact, the European banks had been affected by the prospect of government defaults and the stock prices of financial stocks had devalued significantly. Stress tests were identified as an essential component of the design of an optimal disclosure of information between the banking authorities and the market (Gick and Pausch 2012).

In the 2010 European Union (EU) stress test, the minimum threshold adopted to pass the test was 6% of the core tier 1 ratio for the adverse scenario, a threshold that seven (out of 91) banks failed to achieve. However, the general perception was that this test was poorly received by the market. The cause for this skepticism was disclosure of limited information by the CEBS, which contributed to increasing the already existing uncertainty in the markets. In addition, there was a general opinion that the adverse scenario adopted was not reasonable or even that it could not be considered adverse, as it only assumed a 0.6% decrease in gross domestic product (GDP) Therefore, there was a general opinion that undercapitalized banks, unprepared to accommodate any real economic shock, still passed the test.

The 2011 EU stress test was seen as a successful reinforcement and upgrade to the 2010 test, namely by increasing the severity of the adverse scenario, assuming now a drop of 4% in GDP, as well as the disclosure and transparency of the methodology and data used, which contributed to the reliability of the results. The threshold was changed to 5% of the core tier 1 ratio. Twenty (out of 91) banks fell below this level and consequently failed the test.

In 2014, the EBA added an additional tool, the Asset Quality Review, to complement the stress tests and improve information provided to the market, therefore reducing systemic risk. The sample increased to 123 banks with the threshold for the adverse scenario set at 5.5% of the core tier 1 ratio. The aim was to investigate banks for hidden problems, test their ability to withstand crises and force weaker banks to

raise more capital. In total, 24 banks from 11 countries failed to stand up to its scrutiny of the strength of assets on the books. These latest EU stress tests were generally considered as being the best and the more realistic ones.

This study assesses the impact of the 2010, 2011 and 2014 EU stress tests events (announcement, methodology and results disclosure) on the stock markets, by measuring their impact on abnormal returns and bank risk. In short, the aim was to investigate whether the EU stress tests conveyed new information to the market.

Literature Review

The literature in this field has been increasing in recent years and started almost immediately after the first stress tests were implemented in the U.S. in 2009 and in Europe in 2010. Therefore, the literature mainly focuses on market price reactions to U.S. and EU stress tests, and the empirical results are somewhat mixed, but tend to confirm that these stress tests disclosures did convey new information to the markets.

Morgan et al. (2014) and Neretina et al. (2014) applied event study methodology to the U.S. stress tests. Morgan et al. (2014) found that the 2009 U.S. stress tests provided crucial information to the market and reduced the opaqueness of banks. They concluded that the banks facing larger capital gaps were the ones experiencing higher negative abnormal returns in the stock market. This meant that the capital gaps identified in the stress test were larger than the *ex-ante* expectation of the markets. Neretina et al. (2014) also studied the impact of the U.S. stress tests on systematic risk, equity returns and credit default swap (CDS) spreads in the period 2009–2013. They examined the effects of the disclosure of announcement, methodology and results of the stress tests, and concluded that there was weak suggestion of impact on equity returns, but there was significant evidence regarding the decline of CDS spreads after the results disclosure and the decrease of systematic risk in the years after the stress test.

Fernandes et al. (2017), Flannery et al. (2017) and Bird et al. (2019) examined different aspects of market reactions to nine U.S. stress tests, from 2009 to 2015. Although there were some differences in their methodology, all three studies observed cumulative abnormal returns (CAR), and cumulative abnormal trading volume. Fernandes et al. (2017) found that CAR was positive in the 2009 exercise and negative between 2011 and 2013. The results for the banks that passed the tests were large and positive, and negative for those that failed. They also found that untested banks showed a significant price reaction and that trading activity increased around announcement and results dates. The results of Flannery et al. (2017) are consistent with the former. They found that the disclosure of stress testing information about banks consistently provided relevant information to the market, evidenced by abnormal price and volume movements. Bird et al. (2019) examined the reactions in capital markets after the U.S. stress tests and found evidence of significant price and volume responses associated to the disclosures.

There are also relevant studies of the impact on markets of the EU stress tests. Apergis and Payne (2013), with the 2011 EU stress test as the relevant event, noted that after the disclosure of results, the market had two distinct reactions: information asymmetry declined, but information uncertainty increased. Ellahie (2013) emphasized transparency and credibility as the most important factors of a successful stress test,

contributing to maximize the value of information and the confidence transmitted to the market by the regulatory institutions. Alves et al. (2015) concluded that the 2010 and 2011 EU stress tests brought new information to the market environment and that the outcomes of the tests were not anticipated by the stock market but were partially anticipated by the CDS market. Both markets had a stronger reaction in riskier financial institutions than in the safer ones. Petrella and Resti (2013) stated that the 2011 EU stress test results were considered relevant by investors, thus affecting stock prices. CAR were higher in banks that had smaller impact on their capital, thus revealing to the market their strength. The authors also argued that the market is not able to anticipate the test's results, which is consistent with the idea of a high opaqueness level in banking activity. Cardinali and Nordmark (2011) concluded that the banks are opaque to an intermediate degree, sustaining this idea with the fact that the 2010 results and 2011 clarification events (by the EBA, concerning capital requirements) were uninformative to the stock market, but in contrast, the 2011 methodology disclosure event was very informative.

Candelon and Sy (2015) used event study methods to compare the effects of both U.S. and EU stress tests from 2009 to 2013. Their results showed that stress tests mattered for the market's valuation of stress-tested banks, as they found positive evidence in four out of six exercises, but CAR varied through time and jurisdictions. Specifically, they found that the disclosure of results typically had a positive impact on CAR. Sahin and de Haan (2016) examined the impact of the 2014 EU stress test, using an event study methodology similar to Petrella and Resti (2013) and Morgan et al. (2014). They found that the stress test did not have an effect on stock prices of banks for most countries that were analyzed. They believed that the most likely explanation is that the outcomes of the assessment were in line with market expectations.

On the critics' side, Goldstein and Sapra (2014) noted that, overall, the disclosure of stress test results was beneficial because it promoted financial stability. However, such disclosures may fail to promote the desired discipline for specific individual banks. For example, banks have an incentive to pass the tests rather than to promote prudent risk-taking behavior. Cornett et al. (2018) found that stress-tested banks increased their capital ratios at the beginning of the exercise, reduced them after, and spent more money on lobbying, with the aim of increasing their chances of passing the test. This negative view was also shared by Dowd (2015), who claimed that stress tests were based on foundations that are indefensible, including their dependence on discredited models of financial risk, and their reliance on a single unstressful scenario with very low capital hurdles. In addition, banks may resort to accounting creativity and applying the model in a way that delivers the results according to supervisors' expectations. Doing this, they promote a false sense of security.

Some studies also questioned the quality of the information provided by the central bank, as it may have an incentive to bias the disclosed information, in order to pursue multiple objectives that may be conflicting. Bird et al. (2019) found that the disclosed bank capital ratios by the Fed were biased up systematically for important banks (to signal financial stability) and biased down for poorly capitalized banks (to promote their capitalization and market discipline). Shapiro and Zheng (2019) claimed that central banks care about financial stability, but also about lending to the economy. As very demanding stress tests affect negatively the level of lending by the banks, the central bank may decide to act tough in the stress test and, thus, restrict lending or may

be soft and encourage thus more risk-taking and lending by the banks. Lazzari et al. (2017) claimed that the stress tests are probably more important in signaling the market about the supervisory stance on the market, both in terms of its severity and of the banking activities that it views as more risky, than in providing information about the strength and capital adequacy of each individual bank. Overall, the different studies found stronger informational effects on the markets from the U.S. stress tests, than from the EU stress tests, where the evidence is more mixed.

Data and Methodology

The purpose of this study was to analyze the impact of the EU stress tests of 2010, 2011 and 2014 on stock market's variables, such as risk and stock returns. By comparing the results across the different event dates in each of the stress tests (announcement, methodology and results), we sought to confirm or refute the hypothesis that the information disclosed to the market is reducing risk and generating abnormal returns, as the EU stress tests supposedly became more realistic and demanding. The nine event dates are identified in Table 1.

To examine the impact of EU stress tests on the stock markets, our main econometric technique was a regression analysis computed with dummies in order to signalize the events window as well as the interaction between the market returns and the applied dummies. An augmented capital asset pricing model (CAPM) was used, per Nijskens and Wagner (2011), who studied how trading and issuances of credit default swaps and collateralized loan obligations affected banks' β, and Neretina et al. (2014), who applied this methodology to study the impact of U.S. stress tests on banks' β.

In order to compute the regressions, samples of the stress-tested banks' stock prices were collected, including observations from one year before the first event date until one year after the last event date (from 18 December 2009 to 26 April 2015). All stock prices were obtained from Bloomberg (2017). Banks were excluded if no (or incomplete) data were available. Only the banks that were involved in the three stress tests were considered to provide consistent results since the entities analysed are the same, avoiding comparisons of different samples for each stress test, thus resulting in a final sample of 41 banks.[1] Descriptive statistics for the 41 banks are presented in Table 2, including for the subsamples of banks that passed or failed[2] the 2014 EU stress test.

To compute the stock returns across all data for the 41 banks, the constant-mean-return model was used, taking the logarithm:

[1] The sample includes 41 banks: Allied Irish Banks plc, Alpha Bank SA, Bank of Cyprus Public Company Ltd., Bank of Valetta plc, Bankinter SA, Barclays plc, Banco Bilbao Vizcaya Argentaria SA, Banco Comercial Português SA, BNP Paribas, Banco BPI SA, Commerzbank AG, Groupe Crédit Agricole, Danske Bank, Deutsche Bank AG, Dexia NV, Erste Goup Bank AG, Eurobank Ergasias SA, HSBC Holdings plc, ING Bank NV, Intensa SanPaolo S.p.A., Jyske Bank, KBC Group NV, Lloyds Banking Group plc, Banca Monte dei Paschi di Siena S.p.A., National Bank of Greece SA, Nordea Banck AB, OTP Bank Ltd., Piraeus Bank, SA, PKO Bank Polski, Banco Popolare – Società Cooperativa, Banco Popular Español SA, Royal Bank of Scotland plc, Banco de Sabadell SA, Banco Santander SA, Svenska Handelsbanken AB, Société Générale, Skandinaviska Enskilda Banken AB, Swedbank AB, Sydbank, UBI and Unicredit S.p.A..

[2] The banks included in our sample, that failed the 2014 EU stress test, were: Bank of Cyprus Public Company Ltd., Banco Comercial Português SA, Dexia NV, Eurobank Ergasias SA, Banca Monte dei Paschi di Siena S.p.A., National Bank of Greece SA, Piraeus Bank SA and Banco Popolare – Società Cooperativa.

Table 1 Dates of the European Stress Tests Events

EU Stress Test	Announcement	Methodology	Results
2010	Jun. 17, 2010	Jul. 7, 2010	Jul. 23, 2010
2011	Jan. 13, 2011	May 18, 2011	Jul. 15, 2011
2014	Jan. 31, 2014	Apr. 29, 2014	Oct. 26, 2014

$$R_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \tag{1}$$

where $R_{i,\,t}$ is the log-return for firm i at time t, $P_{i,\,t}$ is the current closing price and $P_{i,\,t-1}$ is last day's closing price. To measure the impact of the events and following Nijskens and Wagner (2011), the relationship between the stress test events and the bank's β in stock markets was tested using the below augmented CAPM:

$$R_{i,t} = \alpha + \beta_1 R_{M,t} + \delta D^{abn} + \beta_2 D^{temp} + \beta_3 D^{temp} R_{M,t} + \beta_4 D^{perm} + \beta_5 D^{perm} R_{M,t} + \varepsilon_{i,t} \tag{2}$$

In the model above, α is a constant and $R_{i,\,t}$ and $R_{M,\,t}$ are the returns on an individual bank and the market used as a proxy, respectively. Market return was measured by the Stoxx Europe Banks 600 Index, an index containing the majority of the banks in the sample of this study, as it includes the 600 banks with the largest market capitalization in Europe. Apart from a significant weight of UBS (Swiss banks were not included in the sample) on this index, all the remaining significant banks (each representing more than 3.5% of the index) were part of this analysis. D^{abn} is a dummy variable that takes the value of one in the 22 business days before and after the event date (the event window) and the value of zero otherwise, thus capturing any abnormal return associated with the event. D^{temp} is a dummy variable that takes the value of one in the 66 business days after the event. This dummy is used to measure any temporary β effect of the event. D^{perm} is a dummy to measure the permanent β effect, whose value is one from the event's date until the end of the period of the sample. Therefore, our analysis was begun by

Table 2 Descriptive Statistics of the Samples

	All banks	Banks that failed the 2014 EU stress test	Banks that passed the 2014 EU stress test
Number of Banks	41	8	33
Number of Observations	67,978	13,264	54,714
Mean (Return %)	−0.041	−0.231	0.005
Median (Return %)	0	0	0
Std. Dev. (Return %)	3.476	5.631	2.658
Minimum (Return %)	−45.059	−45.059	−43.825
Maximum (Return %)	69.315	69.315	36.101

Own calculations using data from Bloomberg (2017)

estimating nine regressions, each for one of the disclosure events. In each regression, the values of the dummy variables were defined relative to the relevant event date.

The most relevant variables in our model are the coefficients of the interaction terms $D^{temp}R_{M,\ t}$ and $D^{perm}R_{M,\ t}$, which measure temporary or permanent changes in the banks' β after the events. The β measures the security's volatility, so a higher β implies a higher risk associated with that stock. In our model, the banks who failed the stress test were expected to experience an increase in their risk (an increase in β). Banks that passed the stress test were expected to have a decrease or a neutral effect in their risk (either a decrease or no change in β). Note that these dummies overlapped, as the permanent effect and the temporary effect dummies shared the same data in the first 66 business days after the event. Therefore, to determine the total impact of the event on the β in the first two months after that event, we needed to add the two effects.

To test the impact of the stress tests on risk and abnormal return variables, the following hypotheses were considered:

(No abnormal return in the event window) H_0: $\delta = 0$ H_1: $\delta \neq 0$.

(No temporary effect on risk) H_0: $\beta_3 = 0$ H_1: $\beta_3 \neq 0$

(No permanent effect on risk) H_0: $\beta_5 = 0$ H_1: $\beta_5 \neq 0$

In the next section, we compare the impacts on the stock markets resulting from all the events across the three EU stress tests.

Results

All Events in the 2010, 2011 and 2014 EU Stress Tests

The results are presented in Tables 3, 4 and 5 for the announcement, methodology and results events, respectively, for all three EU stress tests. In all regressions, the market daily return coefficient was statistically significant at the 1% level indicating a high linearity, as expected, between the market returns and the sample's daily returns. The market return coefficient β_1 was always greater than one demonstrating that the sample of banks is riskier than the market. The constant term α was negative and statistically significant at least at 5% significance in all events in the 2014 EU stress test. In addition, the probability F-statistic was zero, confirming that the variables are all jointly significant and the regressions used fit the data well.

Regarding the announcement's events (Table 3), there were small negative abnormal returns in 2011 and positive abnormal returns in 2014 (at the 5% significance level). This confirms the better reaction of the market to the 2014 EU stress test, comparing to the 2010 and 2011 EU stress tests. There is no evidence of either a temporary β effect or a permanent β effect on risk from the announcement event, on any of the three stress tests.

In the methodology events (Table 4), there were statistically significant negative abnormal returns in the 2011 and 2014 stress tests, showing that the methodology disclosure event had a greater influence on the stock markets than the announcement event, consistent with Cardinali and Nordmark (2011).

The 2010 EU stress test displays a small positive abnormal return below 0.1%. The market did not consider this stress test to be an effective test on the resilience of the banks. In 2011 and 2014, the methodology disclosures were received differently by the

Table 3 Announcement Event for All Banks

	2010 EU stress test	2011 EU stress test	2014 EU stress test
Constant (α)	- 0.000,226 (0.000,219)	−0.000,402* (0.000,220)	−0.000,525*** (0.000,199)
Market return (β1)	1.015,052*** (0.051,666)	1.020,604*** (0.046,396)	1.011,473*** (0.048,041)
Abnormal return of the event (δ)	0.000,404 (0.000,528)	−0.000,797* (0.000,456)	0.000,976** (0.000,980)
Temporary mean effect (β2)	−0.000,575** (0.000,281)	0.000,382* (0.000,213)	0.000,567** (0.000,284)
Temporary β effect (β3)	0.019,922 (0.027,864)	−0.052,609 (0.034,667)	−0.013,294 (0.047,971)
Permanent mean effect (β4)	−0.000,261* (0.000,155)	−0.000,119 (0.000,191)	−0.000,099 (0.000,193)
Permanent β effect (β5)	−0.005,014 (0.047,305)	−0.005,512 (0.043,671)	0.016,971 (0.058,569)
F-statistic	3460.84	3461.09	3461.63
Adjusted R^2	0.234	0.234	0.234

Robust standard errors are in brackets. ***, ** and * signal the statistically significance at 1%, 5% and 10%, respectively. The regressions include all 41 banks, and the dummy variables values are defined relative to the announcement date of each stress test

Own calculations using data from Bloomberg (2017)

Table 4 Methodology Event for All Banks

	2010 EU stress test	2011 EU stress test	2014 EU stress test
Constant (α)	−0.000,281 (0.000,210)	−0.000,288 (0.000,205)	−0.000,465** (0.000,191)
Market return (β1)	1.017,165*** (0.051,800)	1.009,230*** (0.046,110)	1.010,824*** (0.047,943)
Abnormal return of the event (δ)	0.000,834* (0.000,494)	−0.000,842** (0.000,376)	−0.001,117** (0.000,472)
Temporary mean effect (β2)	−0.000,374 (0.000,244)	0.000,165 (0.000,356)	0.000,773** (0.000,368)
Temporary β effect (β3)	0.009,346 (0.027,497)	0.026,816 (0.032,171)	0.078,742 (0.060,767)
Permanent mean effect (β4)	−0.000,230 (0.000,144)	−0.000,251 (0.000,193)	−0.000,202 (0.000,232)
Permanent β effect (β5)	−0.006,332 (0.049,095)	0.003,697 (0.043,679)	0.006,803 (0.061,788)
F-statistic	3460.69	3460.92	3461.64
Adjusted R^2	0.234	0.234	0.234

Robust standard errors are in brackets. ***, ** and * signal the statistically significance at 1%, 5% and 10%, respectively. The regressions include all 41 banks, and the dummy variables values are defined relative to the methodology disclosure date of each stress test

Own calculations using data from Bloomberg (2017)

Table 5 Results Event for All Banks

	2010 EU stress test	2011 EU stress test	2014 EU stress test
Constant (α)	−0.000,268 (0.000,194)	−0.000,229 (0.000,190)	−0.000,416** (0.000,177)
Market return (β_1)	1.009,384*** (0.051,320)	1.021,642*** (0.045,274)	1.016,696*** (0.047709)
Abnormal return of the event (δ)	0.000,188 (0.000,403)	0.001,058 (0.000,789)	0.000,454 (0.000,439)
Temporary mean effect (β_2)	−0.000,018 (0.000,303)	−0.001,853*** (0.000,578)	−0.000,316 (0.000,276)
Temporary β effect (β_3)	0.014,762 (0.028,670)	0.010,806 (0.038,141)	−0.028,115 (0.043,033)
Permanent mean effect (β_4)	−0.000,260* (0.000,153)	−0.000,190 (0.000,221)	−0.000,327 (0.000,314)
Permanent β effect (β_5)	0.003,416 (0.048,727)	−0.016,029 (0.044,163)	−0.007,858 (0.065,480)
F-statistic	3460.49	3463.60	3460.86
Adjusted R^2	0.234	0.234	0.234

Robust standard errors are in brackets. ***, ** and * signal the statistically significance at 1%, 5% and 10%, respectively. The regressions include all 41 banks, and the dummy variables values are defined relative to the results disclosure date of each stress test

Own calculations using data from Bloomberg (2017)

Table 6 All Events of the 2014 EU Stress Test

	Announcement		Methodology		Results	
	Passed	Failed	Passed	Failed	Passed	Failed
Constant (α)	−0.000,045 (0.000,128)	−0.002,507*** (0.000,396)	0.000,004 (0.000,111)	−0.002,325*** (0.000446)	−0.000,005 (0.000,105)	−0.002,114*** (0.000,436)
Market return (β_1)	1.029,512*** (0.057,405)	0.937,064*** (0.060,732)	1.030,545*** (0.056,809)	0.932,152*** (0.061,735)	1.031962*** (0.056,678)	0.953,725*** (0.067,158)
Abnormal return of the event (δ)	0.000,912** (0.000,365)	0.001,238 (0.001,375)	−0.000,500 (0.000,418)	−0.003,635*** (0.001,377)	0.000,321 (0.000,529)	0.001,001** (0.000,488)
Temporary mean effect (β_2)	0.000,113 (0.000,220)	0.002,440*** (0.000,867)	0.000,119 (0.000,304)	0.003,391*** (0.000,836)	−0.000,034 (0.000,278)	−0.001,479** (0.000,688)
Temporary β effect (β_3)	0.053,853 (0.039,741)	−0.290,275** (0.147,187)	0.034,903 (0.059,022)	0.104,571 (0.225,390)	−0.009,721 (0.041,983)	−0.103,990 (0.133,272)
Permanent mean effect (β_4)	−0.000,042 (0.000,131)	−0.000,332 (0.000,823)	−0.000,126 (0.000,187)	−0.000,932 (0.000,978)	−0.000,136 (0.000,190)	−0.001,114 (0.001,370)
Permanent β effect (β_5)	−0.070,379 (0.049,566)	0.377,294** (0.167,756)	−0.102,483* (0.054,129)	0.374,676** (0.190,384)	−0.101,373* (0.054,193)	0.377,892* (0.198,872)
F-statistic	6017.90	208.53	6021.69	208.36	6021.34	206.83
Adjusted R^2	0.400	0.086	0.400	0.086	0.400	0.086

Robust standard errors are in brackets. ***, ** and * signal the statistically significance at 1%, 5% and 10%, respectively. The "Passed" regressions includes data from the 33 banks that passed the stress test, and the "Failed" regressions include data from the eight banks that failed the stress test. The dummy variables values are defined relative to the announcement, methodology or results disclosure dates of the 2014 stress test

Own calculations using data from Bloomberg (2017)

Table 7 Regressions Without the Temporary Effect

	2010 EU stress test	2011 EU stress test	2014 EU stress test
Announcement Events for All 41 Banks			
Market return (β_1)	1.024,457*** (0.049,773)	1.015,765*** (0.046,489)	1.011,267*** (0.048,135)
Abnormal return of the event (δ)	−0.000,107 (0.000,404)	−0.000,521 (0.000,363)	0.001,493*** (0.000,461)
Permanent β effect (β_5)	−0.013,342 (0.047,792)	−0.002,270 (0.043,411)	0.015,905 (0.057,313)
Methodology Events for All 41 Banks			
Market return (β_1)	1.022,146*** (0.048,969)	1.010,719*** (0.046,170)	1.012,325*** (0.048,119)
Abnormal return of the event (δ)	0.000,534 (0.000,431)	−0.000,727** (0.000,309)	−0.000,346 (0.000,288)
Permanent β effect (β_5)	−0.010,815 (0.047,537)	0.004,864 (0.043,315)	0.011,633 (0.061,898)
Results Events for All 41 Banks			
Market return (β_1)	1.016,195*** (0.048,060)	1.023,495*** (0.045,454)	1.015,962*** (0.047,825)
Abnormal return of the event (δ)	0.000,177 (0.000,354)	−0.000,718** (0.000,522)	0.000,192 (0.000,363)
Permanent β effect (β_5)	−0.002,829 (0.045,863)	−0.014,791 (0.041,906)	−0.014,516 (0.064,251)
Results Event for the 33 Banks that Passed the 2014 Stress Test			
Market return (β_1)	–	–	1.031,712*** (0.056,663)
Abnormal return of the event (δ)	–	–	0.000,298 (0.000,357)
Permanent β effect (β_5)	–	–	−0.103,693* (0.053,294)
Results Event for the 8 Banks that Failed the 2014 Stress Test			
Market return (β_1)	–	–	0.950,995*** (0.069,201)
Abnormal return of the event (δ)	–	–	−0.000,246 (0.001,119)
Permanent β effect (β_5)	–	–	0.353,338* (0.197,727)

Robust standard errors are in brackets. ***, ** and * signal the statistically significance at 1%, 5% and 10%, respectively. The dummy variables values are defined relative to the announcement, methodology or results disclosure dates of the 2014 EU stress test

Own calculations using data from Bloomberg (2017)

market, causing small negative abnormal returns. We interpret this negative impact on the returns of the bank's stocks as the market's expectation that the stress tests could cause reputational damages to the most vulnerable banks. In terms of risk, neither a temporary β effect, nor a permanent β effect was statistically significant, indicating that the methodology disclosure did not cause any relevant reaction on the market regarding the long- or short-term risk.

The results event (Table 5) demonstrates important differences in relation to the other two events. The most relevant outcome is the absence of abnormal returns associated with all the three EU stress tests in any of the samples. This led the U.S. to conclude that the results were already expected and incorporated by the market participants in the bank's stock prices. This finding is consistent with the argument that investors have their own models and can forecast the results of the EU stress tests within a confidence interval, consistent with the results of Sahin and de Haan (2016).

2014 EU Stress Test

Table 6 compares the impact of the 2014 EU stress test on two subsamples consisting of the eight banks that failed the test versus the 33 banks that passed the test. This subsample analysis was only performed on the 2014 EU stress test because first, these were the most complete and credible tests. Second, this was the only stress test with sufficient observations in both subsamples to obtain significant results. As in the analysis with the entire sample, all regressions presented a market daily return coefficient that was statistically significant at 1% and a probability F-statistic equal to zero.

The 33 banks that passed the 2014 EU stress test experienced a small positive abnormal return of approximately 0.1% following the announcement date, demonstrating that the market incorporated the press release with the belief that these banks were well prepared to pass the test. Interestingly, the eight banks that subsequently failed the test had no abnormal returns in the announcement date. In the methodology and results events, the banks that passed the test displayed a decline in permanent risk, consistent with the market having incorporated this information as positive news about those banks. In contrast, the eight banks that failed the test experienced a negative abnormal return of 0.36% after the methodology disclosure and a positive abnormal return of 0.1% after the results event. This is consistent with the test negatively affecting the stock's returns, at the first moment, but better results than expected, leading to an increase in stock's returns. In the expectation that some banks could fail the test, the stock markets incorporated the higher risk associated with these banks into the stock price, increasing their permanent risk (β) to 0.37 as soon as the 2014 EU stress test was announced.

Robustness Checks

In order to test the robustness of the results, and to prevent distorted results due to the overlapping dummy variables, the temporary dummy variable and its interaction with the market were excluded from the regression, as in (3).

$$R_{i,t} = \alpha_i + \beta_1 R_{M,t} + \delta D^{abn} + \beta_4 D^{perm} + \beta_5 D^{perm} R_{M,t} + \varepsilon_{i,t} \quad (3)$$

The results of this specification, presented in Table 7, are quite interesting. Again, the probability F-statistic equals zero, confirming that the variables are all jointly significant. To save space, only the results of the abnormal returns regressions and the permanent β effect are shown.

The sample of all banks considered in this study demonstrated a negative abnormal return after the 2011 methodology disclosure and a positive abnormal return after the 2014 announcement event. This suggests that investors were poorly satisfied with the 2011 methodology and responded positively to the announcement of the 2014 EU stress test. For the sample of all banks, there was no change in risk, as the parameter of the permanent β effect was not significant, in any of the regressions.

In the comparison between the banks that failed and those that passed the 2014 EU stress test, an increase in permanent risk of the banks that failed the 2014 stress test was detected, as well as a decrease in the permanent risk of the banks that passed that test. This is evidence of the impact that effective stress tests can have in the market's perception of the risks of banks, as was the case in the 2014 stress test.

To further check the robustness of the results, all regressions were re-computed with a different sample, including data from six months before the first event to six months after the last event (from 18 December 2009 to 26 April 2015). Additionally, re-computation of all regressions was done considering five business days before and after the event for the dummy variable D^{abn}, which measures abnormal returns. As the regression results were not significantly different from those presented in previous tables and did not add to the discussion, they are not presented here to save space.

Conclusions

Our main conclusion was that the announcement and methodology events had stronger effects on the stock market than the results event. This was evidenced by abnormal returns, but not in terms of temporary or permanent changes of the bank risk. The results event did not have any relevant impact on returns or risk, in any of the three EU stress tests. Note that our results are not consistent with the findings of Petrella and Resti (2013), who found that abnormal returns were higher in banks with better results in the 2011 EU stress test. However, they are consistent with the findings of Cardinali and Nordmark (2011), who claimed that the 2011 methodology conveyed relevant information and affected stock returns, but the results event did not. Our results are also consistent with those of Sahin and de Haan (2016), who found a very limited market response, which they interpreted as evidence that the outcomes of the tests were in line with market expectations.

On the other hand, the split of the 2014 EU stress test sample into two groups of banks revealed interesting facts. The group of banks that passed this stress test experienced a positive abnormal return after the announcement event and a decrease in their permanent risk after the methodology and results event. Therefore, the 2014 EU stress test was an important and credible tool to inform the market about the level of security of these banks. The group of banks that failed the 2014 EU stress test was the most affected in the stock markets. This group of banks experienced a negative abnormal return after the methodology event and a positive abnormal return after the results disclosure, supporting the notion that the market was expecting worse results.

Although this group experienced a decrease in temporary risk after the announcement event, the permanent effect offset the temporary effect, leaving the U.S. with an increase in risk in the long-term. This increase in risk was also experienced after the methodology and results events. We believe the market processed the information given by the stress test and, as expected, penalized the banks that failed the test increasing their risk and reducing their stock's returns.

Our results for the 2014 EU stress test also showed that it is important, in future studies, to separate the analysis of the banks that passed the test from the banks that failed the test. The study of all banks aggregated likely clouds any (expected) difference between the two groups and produces statistically insignificant results.

The beginning of EU stress testing in 2010 was clouded by distrust and uncertainty. The market seemed to be focused on the methodology's fragility, in part, due to its lack of maturity. Since then, the EU stress tests improved significantly. With a growing adherence to (actual or potential) loss events, the attention of the markets turned to observation of the specific bank's results on the EU stress tests. We concluded that the EU stress tests became more relevant from exercise to exercise, as they became more realistic and provided more useful information to the markets, enabling them to proceed with the necessary adjustments to their market valuations.

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