Capital Market Consequences of EU Bank Stress Tests

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Abstract

This paper investigates the capital market consequences of government stress testing of banks in the European Union during the global financial crisis of 2007-2012. Theory suggests that the announcement of imminent public disclosure as well as subsequent disclosure can induce changes in information asymmetry and information uncertainty. I find that compared with propensity score matched control firms, stress test announcements do not significantly affect measures of information asymmetry or information uncertainty for tested banks. I also find that upon disclosure of 2011 test results, information asymmetry declines for tested banks while information uncertainty increases indicating either imprecision of revealed information or a worsening sovereign credit crisis. Furthermore, I document evidence that the detailed credit "Exposure At Default" disclosures in the 2011 test results had directional information content for measures of information asymmetry, information uncertainty, credit spreads and equity prices. The evidence in this paper suggests a role for transparent government stress tests in improving the information environment in capital markets during crises.

Keywords: stress testing, mandatory disclosure, information asymmetry, information uncertainty, credit term structure, bid-ask spreads, implied volatility

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1. Introduction

Policy-makers, academics and practitioners are interested in the capital market consequences of government intervention. One recent intervention, namely government stress testing of banks in the European Union (EU) and the mandatory public disclosure of their results, aimed to improve the information environment during the global financial crisis of 2007-2012. In this paper, I conduct two main sets of analyses to investigate the capital market consequences of the EU bank stress tests in 2010 and 2011. Firstly, I use equity and credit market data to study the announcement and disclosure effects of the tests on *information asymmetry* ("IA"), defined as information differences across investors, as well as on *information uncertainty* ("IU"), defined as ambiguity about the implications of information for value.[1] Secondly, I examine the directional *information content* of the test results when they are eventually disclosed. I develop testable hypotheses based on rational expectations theories on private information gathering, market-microstructure, disclosure commitment and the information content of accounting disclosures.

The recent financial crisis has heightened concern about the continued health and stability of banks because of their central economic role as lenders, depositories, intermediaries and counterparties. The US subprime mortgage crisis of 2008 and the subsequent Eurozone sovereign debt crisis negatively affected the quality and value of assets held by banks, especially in the EU. Many banks shrank the size of their risk weighted assets and raised additional capital in order to meet regulatory capital requirements and to maintain liquidity. Also, several banks were provided government support either through direct equity ownership or through restructuring mechanisms to ring-fence troubled assets and to bolster capital and liquidity.

[1] An observed signal (s) can be characterized as a firms' fundamental value (v) plus a noise term (e) such that the variance of this signal can be expressed as $var(s) = var(v) + var(e)$. The first term $var(v)$ refers to underlying fundamental volatility, while the second term $var(e)$ can be viewed as the quality or precision of information about value revealed by the accounting system.

As part of their normal course of business, banks hold a portfolio of relatively illiquid assets such as private loans to individuals and businesses which can be hard to value. Government regulation tries to mitigate potential bank opaqueness by requiring detailed periodic disclosure to public investors. However, during the crisis, investors and regulators demanded *real-time* information on the financial condition of banks. In response, bank regulators around the world conducted "stress-tests" to evaluate the impact of adverse macroeconomic scenarios and shocks to asset values on the stability of their bank systems.

This paper uses the setting of European Banking Authority (EBA) stress tests of selected EU banks in 2010 and 2011 to test whether these tests improved the information environment for capital markets participants.[2] Specifically, tested banks were simultaneously subjected to hypothetical adverse macroeconomic shocks and each bank's resulting capital shortfall was assessed against minimum capital ratio thresholds. Furthermore, the stress tests subjected bank assets to a hypothetical sovereign credit shock, and in 2011, each tested bank was also required to divulge detailed country-by-country information on retail, commercial, institutional and sovereign credit Exposure At Default (EAD) (see Appendix A for details on the disclosure contents of the 2010 and 2011 tests). Alternative sources of such information, such as Pillar III risk reports under the Basel II Accords, are mostly narrative in nature, detailed stress scenario analyses are not consistently disclosed and credit exposure information is only at an aggregate level. Furthermore, there is significant cross-sectional variation in the quantity and quality of information provided in these reports. The EBA hoped that the stress tests would enhance cross-country comparability and transparency.

[2] The stated objective of the tests was to "assess the resilience of financial institutions to adverse market developments, as well as to contribute to the overall assessment of system risk in the EU financial system" (see Committee for European Banking Supervisors [2009]). Collectively, the EBA and its predecessor organization, the CEBS stress tested 22 banks in 2009, 91 banks in 2010 and 90 banks in 2011. This paper focuses on the 2010 and 2011 tests as banks were not individually identified in 2009.

While the primary audience for the stress tests was banking regulators, the desire to restore investor and public confidence through increased transparency prompted the EBA to publicly disclose the 2010 and 2011 test results.[3] The public disclosure decision was made in light of the positive capital market response attributed to the public disclosure of similar stress tests conducted by the US Federal Reserve in 2009 on 19 of the largest US banks (see Peristani, Morgan and Savino [2010]).[4] Furthermore, the reported data points in the 2011 EBA test increased significantly to 3,200 from the 142 data points in the 2010 test administered by the CEBS. In addition to providing more detailed information, the EBA increased the transparency of the stress testing process in 2011 by publicly communicated key events and process details such as bank sample identification, the timeline of events, scenario and methodology, as well as the results release date (see Appendix B for a list of the stress test events). As a result, the EBA stress tests of EU banks provide a rich institutional setting to examine the capital market consequences of a mandatory disclosure mechanism.

I use a difference-in-differences (DID) methodology to compare tested EU banks with propensity score matched control firms in an event study around stress test announcement and disclosure events in 2010 and 2011.[5] I use equity, short maturity bond and long maturity bond bid-ask spreads as measures of IA, and equity option implied volatilities and CDS1Y/CDS5Y as measures of IU. I then examine the information content of the test result disclosures and evaluate whether cross-sectional directional predictions about measures of IA, IU, credit spreads and equity prices are possible using the disclosure.

[3] The 2010 and 2011 test results are available at http://www.eba.europa.eu/EU-wide-stress-testing.aspx
[4] On November 22, 2011 the US Federal Reserve announced new stress tests and annual capital plan reviews of the 19 largest US bank holding companies. The stress tests of US banks were conducted in early 2012 and the results were also publicly disclosed on March 13, 2012.
[5] Tested EU Banks are compared with Untested EU Banks, EU and Non-EU Banks, and EU Non-Banks.

The main findings of the paper can be summarized as follows. Firstly, the announcement of the EU bank stress tests in 2010 and 2011 do not appear to have significant cleanly identifiable effects on measures of IA and IU, especially over the short horizon of a few days around the test events. This non-response could be due to noise from market micro-structure effects, weak identification or a lack of response to the anticipated information content of the tests due to their perceived laxness. The short and long bid-ask spreads do appear to drift wider and become more volatile after the announcement of 2011 tests.

Secondly, the disclosure of results in 2011 is associated with moderate declines in IA across equity and credit instruments and is more pronounced over the longer horizon of one month after the test results. While the negative sign is consistent across all three control groups used, the statistical significance is strongest for the comparison with EU banks and EU non-banks. This indicates that the public disclosure of stress test results helped to reduce IA consistent with disclosure theory. However, measures of IU increase significantly in the short and long horizon after the disclosure of results suggesting increased uncertainty about the value of bank assets. I cannot empirically disentangle whether the increased uncertainty is due to greater underlying fundamental volatility from the worsening sovereign credit crisis or due to poor quality information contained in the stress test disclosures.

Finally, the credit Exposure At Default (EAD) disclosure across corporate and sovereign market segments provided by the 2011 test results appears to have directional information content for measures of IU, and to a lesser degree for measures of IA. Furthermore, the level of sovereign credit exposure and geographic exposure of banks to different macroeconomic growth prospects enabled clear first moment predictions about CDS spreads and equity returns for tested banks. The results are robust to a variety of tests and research design choices. Nevertheless, the

selection issue of why certain EU banks were tested cannot be fully resolved and this makes it challenging to make clean inferences.

This paper contributes to prior political economy literature by providing timely empirical evidence on the usefulness of centralized stress testing of banks as a government intervention mechanism. The findings of this paper should be of interest to bank supervisors, policy-makers, accounting standard setters, practitioners and academics. There is an active debate about the appropriate mechanism to monitor the systemic and contagion risk of financial institutions through the disclosure of transparent information and the enactment of new regulation. A related debate on stress testing as a monitoring mechanism is concerned with the scope and frequency of tests, and the level of detail and transparency to provide to capital market participants.[6] The empirical evidence from this paper adds to this debate.

The study also contributes to previous accounting literature that has examined the usefulness of mandatory disclosure in various settings. While not unequivocal, on the whole the empirical evidence has pointed to the positive economic consequences of increased mandatory disclosure.[7] I use a unique institutional setting of stress tests in the midst of a crisis, where an exogenous shock affected some banks (i.e. those EU banks subjected to the tests) but not all firms. Prior literature has largely ignored banks and focused primarily on longer term effects after the mandatory disclosure regime has been implemented. I contribute by providing empirical evidence over a shorter horizon, focusing on banks and taking advantage of a broad set of measures of IA and IU using equity and credit market data.

[6] For example, Duffie [2011] has suggested a 10x10x10 network-based approach where a regulator analyzes 10 Systemically Important Financial Institutions (SIFIs), subjects them to 10 stress scenarios, and discloses the gains and losses for these 10 firms as well as for their 10 counterparties with the largest gains and losses. See also, Greenlaw, Kashyap, Schoenlholtz and Shin [2012] for a framework to evaluate stress testing exercises.

[7] Previous settings studying disclosure regulation include the switch to IFRS, The Sarbanes-Oxley Act of 2002 (SOX), Regulation FD, and the Capital Market Directives in the EU, among others (for example, see Leuz and Verrecchia [2000]; Daske, Hail, Leuz and Verdi [2008]; and Armstrong, Barth, Jagolinzer and Riedl [2010]).

A growing literature has explored the relation between information and the pricing and trading of credit instruments. The use of credit market data provides three main benefits in exploring the effects of information in the current setting. Firstly, credit market investors are comprised of a greater proportion of institutional investors who may be more informed, and this could affect the diffusion of information into prices (see De Franco, Vasvari and Wittenberg-Moerman [2009]; and Wittenberg-Moerman [2008]). Secondly, stress tests disclose downside-risk information which reduces uncertainty about measuring distance to default. As a result, the credit market response to this information may be stronger for a set of firms that are closer to default, such as banks during the financial crisis (see Lok and Richardson [2011]). Finally, Duffie and Lando [2001] provide theoretical support to examine the short end of the credit term structure for evidence of accounting imprecision in disclosure mechanisms such as the stress tests. Arora, Richardson and Tuna [2012] present empirical evidence that a sample of US banks with lower asset reliability (a concept related to IU) have steeper credit term structures. This paper provides corroborating evidence using EU banks.

The rest of the paper proceeds as follows. Section 2 reviews relevant prior literature and develops hypotheses. Section 3 describes the empirical research design and Section 4 describes the sample selection and data. Section 5 presents the main empirical findings and Section 6 covers potential limitations of the study and robustness tests; Section 7 concludes.

2. Literature Review and Hypotheses Development

2.1. Stress Test Announcement and Disclosure Effects on Information Asymmetry (IA)

Prior theoretical literature has presented multi-period noisy rational expectations models where the anticipated disclosure of 'news' can result in changes in the information equilibrium. For example, forthcoming public disclosure may increase incentives for investors to acquire and

trade on private information (see Kim and Verrecchia [1991], Demski and Feltham [1994], and McNichols and Trueman [1994]). As a result, IA between informed and uninformed traders can increase, which manifests itself in the adverse selection component of bid-ask spreads quoted by market-makers (see Copeland and Galai [1983]; Glosten and Milgrom [1985]; and Kim and Verrecchia [1994]).

In the EU stress test setting, the announcement of forthcoming tests may increase the activities of investors to revisit recent bank-specific financial and regulatory disclosure documents to glean additional information. Investors may also try to develop their own models for bank shares and bonds that incorporate various macroeconomic and financial market shock scenarios. My review of equity research and credit ratings analyst reports for tested banks suggests that during the course of the stress tests, such probabilistic assessments and judgments were being formulated. As a result, these private information acquisition activities can alter the composition of informed and uninformed investors that wish to trade in bank shares and bonds, causing market-makers to price protect by widening bid-ask spreads. However, it is also possible that the announcement of the stress tests has no effect on IA due to a lack of sufficient private information gathering, or an already sufficient level of widely disseminated information about banks, or even due to illiquidity in bank shares and bonds. Thus, the following hypothesis about information asymmetry can be formulated:

H1a: The announcement of stress tests increases equity and credit bid-ask spreads for tested banks as measures of information asymmetry.

Once the outcome of the stress tests is released to investors, market-microstructure theory suggests that informed trading takes place, at least in the short horizon as investors adjust their portfolios, causing bid-ask spreads set by market-makers to widen. However, economic theory

also suggests that IA reduces if accounting disclosure is backed by a credible *ex-ante* commitment to an increased level of disclosure (see Diamond and Verrecchia [1991]; Baiman and Verrecchia [1996]; and Verrecchia [2001]). While prior accounting literature has focused primarily on disclosure commitment in the context of voluntary disclosure by firms, Bushee and Leuz [2005] note that mandatory disclosure has a potential role as a commitment device as it binds firms to reveal information in both good and bad states. Hence, the announcements of the stress tests in 2010 and 2011 can be viewed as commitments by the EBA with implied commitments for the tested banks to disclose more information. However, the costs and benefits of mandatory disclosure in general, and disclosure of stress test results in particular, are subject to debate (see Admati and Pfleiderer [2000]; Dye [1990]; and Goldstein and Sapra [2012]). It can also be argued that the disclosure commitment by the EBA is not deemed credible and market participants do not expect the tests to be repeated in future or the information revealed by the tests to be useful. One reason for this is investor's perceptions of the laxness of the stress tests. Commentary from equity and credit research analysts has highlighted this potential concern regarding the 2010 and 2011 tests.[8] Another reason is if alternative disclosure mechanisms, such as Pillar II reports, provided by banks act as substitutes for the information revealed by the stress tests. Therefore, I test whether the stress test disclosures affect IA using the following hypothesis:

H1b: The release of stress tests results reduces equity and credit bid-ask spreads for tested banks, as measures of information asymmetry.

[8] For example: "We consider the assumptions in the adverse scenario slightly disappointing and relatively mild for a recession scenario….sovereign haircuts will apply to the trading book only…limited relevance for valuations, as we believe the market is already considering tougher requirements" (see JP Morgan [2011]). Some of the laxness concerns have also been borne out *ex-post*. For example, Allied Irish Bank "passed" the 2010 stress tests and Dexia "passed" the 2011 stress tests, and both banks were subsequently bailed out.

2.2. Stress Test Announcement and Disclosure Effects on Information Uncertainty (IU)

The announcement of stress tests can also increase IU due to anticipated information content which allows investors to reassess the probabilistic distribution of future cash flow realizations. Patell and Wolfson [1979] show that equity option implied volatility, as a proxy for IU, captures *ex ante* the anticipated information content of future disclosures because of the expected increase in price variability at the time of potentially informative future disclosures, such as quarterly earnings announcements and management earnings forecasts (also see Rogers, Skinner and Van Buskirk [2009]). Therefore, upon the announcement of the stress tests, as well as in the period prior to and through disclosure of the results, IU as measured by equity option implied volatility may increase.

Furthermore, the precision of financial information generated by accounting systems can affect information uncertainty which manifests itself in other characteristics of security prices. Duffie and Lando [2001] provide the theoretical basis for using credit market data to assess the role of the precision of accounting information on credit spreads. In particular, they show that the effect of accounting imprecision is most evident at the *short* end of the credit term structure resulting in a flatter yield curve. This insight motivates the use of a simple measure of the slope of the credit term structure (i.e., the ratio of the one year CDS spread to the five year CDS spread, or CDS1Y/CDS5Y) to examine the market's perceptions about the expected precision of information revealed by the stress tests. Hence, I test the following hypothesis about information uncertainty:

H2a: The announcement of stress tests increases equity option implied volatilities and CDS1Y/CDS5Y for tested banks as measures of IU.

If the information revealed by the stress tests is of high quality and reduces investor ambiguity about the value of bank assets, IU should decline after the results are released. However, there are also factors that may negatively affect the precision of the information from the stress tests and hence information uncertainty when the test results are released. Firstly, political incentives, supervisory forbearance and lack of stress testing experience may affect information precision. For instance, the banking supervisors in Ireland and Greece had limited experience with stress testing prior to the CEBS test in 2010. Therefore, the stress tests may not provide information of comparable quality for tested banks in these countries. Secondly, and related to the laxness concern, the regulators face the challenge to test scenarios that are strict enough to elicit useful information without providing an overly negative signal to investors about the perceived health of the EU economy. Therefore, I test the following hypothesis to study how the stress test results affect IU:

H2b: The release of stress tests results reduces IU for tested banks, as measured using equity option implied volatilities and CDS1Y/CDS5Y.

2.3. Stress Test Information Content

Prior accounting literature suggests that earnings and accounting numbers have information content for capital markets (see Beaver [1968]). A vast literature on earnings response coefficients has studied the effect of accounting earnings and numbers on stock returns (see Easton and Zmijewski [1989]; Collins and Kothari [1989]). The null hypothesis of efficient markets supports the evaluation of the information content of accounting disclosure by studying the capital market responses to this information. Using this literature as motivation, I hypothesize that if the stress test results have information content, the disclosures should enable directional first moment predictions to be made about the changes in my measures of IA and IU, as well as CDS spreads and equity returns.

The basic information revealed by the 2010 and 2011 tests was a pass or fail assessment as well as quantification of the capital shortfall relative to a capital threshold. Furthermore, during the course of the tests certain banks were provided government bail-outs in the form of access to liquidity or a capital injection in return for government ownership. Therefore, one can expect cross-sectional variation in the capital market response for certain banks. For example, two banks that are very similar with the exception of the level of government ownership can be expected to respond differently to the stress tests. Although other arguments can be made, the effect for government owned banks may be weaker.

I also develop two additional continuous firm-specific measures using the information disclosed in the 2011 stress test results. One measure encapsulates the sovereign risk exposure of each bank ($SovRisk$) and the other measure represents each banks' exposure to macroeconomic growth prospects ($MacroShock$) of different countries (see Section 3.3 for further details on the construction of these measures). Comments extracted from equity research analyst reports after the release of results suggest that the credit exposure information that I use from the 2011 test results was deemed informative: "the EBA stress test result is of limited value to us…however, it offers transparency with excellent new input data, especially in respect to sovereign risk and credit exposure at risk…the credibility and disclosure is improved" (see JP Morgan [2011] and Morgan Stanley [2011]). Therefore, I expect $SovRisk$ and $MacroShock$ to have information content relevant for capital markets. For example, an increase in the $SovRisk$ measure would indicate higher risk in a bank's portfolio of sovereign debt holdings and may predict an increase in CDS spreads and a decline in stock prices. Similarly, to the extent certain banks are exposed to geographies with positive macroeconomic growth prospects, the $MacroShock$ measure may

predict positive equity returns.[9] The directional predictions for bid-ask spreads, implied volatilities, and CDS1Y/CDS5Y are less clear, but to the extent the information disclosed by the test results reduces IA and IU, a cross-sectional analysis may identify the effect.

H3: The information content of the stress test results can be used to make directional first moment predictions about changes in equity and credit bid-ask spreads, equity option implied volatilities, CDS spreads and equity returns of tested banks.

3. Empirical Research Design

3.1. Difference-in-Differences Tests for Announcement and Disclosure Effects

To estimate the treatment effect, I could compare the measures of IA and IU for tested banks before and after the stress tests. However, this comparison does not allow adjustment for the effects of other contemporaneous factors that may impact IA and IU. The empirical strategy used in this paper exploits the fact that not all firms were stress tested. The use of a comparable group of firms allows for the treatment effect of the stress tests to be more cleanly identified. The basic research design is a quasi-experiment with a pre-test and post-test measurement for both the treatment and control groups. The average effect of the treatment is measured as the outcome difference-in-differences (DID) estimator. This research design has the advantage of interpretability of outcomes and enables me to make causal inferences.

Using an event study methodology, the effect of nine stress test events in 2010 and 2011 is evaluated on three measures of IA: equity bid-ask spreads, short bond bid-ask spreads (maturing within 36 month of the tests), and long bond bid-ask spreads (maturing 48 months after the tests); and two measures of IU: equity option implied volatilities and CDS1Y/CDS5Y. The

[9] Li, Richardson and Tuna [2012] find that country exposures based on geographic segment data improves the explanatory power of characteristic regressions of equity returns incremental to standard risk factors.

nine events used in the DID analysis are described in Appendix B. These are events when the CEBS and the EBA publish a press release regarding the stress testing process in 2010 and 2011. Event C and Event I are related to the eventual release of the test results in 2010 and 2011, respectively.[10] Consistent with event study literature, I use a longer event window than just the day of the announcement in order to capture the full informational effect (see Campbell, Lo and MacKinlay [1997]). Hence, each instrument of interest is examined for eight consecutive trading days centered on the day of the event (four days before the event and four days after the event).[11] I estimate the following difference-in-differences model along the lines of Bertrand and Mullainathan [2003]:

$$y_{it} = \alpha_0 + \beta_1 EventX_t + \beta_2 Tested_i + \beta_3 EventX_t * Tested_i + X\beta + \varepsilon_{it} \qquad (1)$$

where, y_{it} is the IA or IU measure for the eight-day window centered on the event day for the tested and untested banks; $EventX_t$ is an indicator variable with 0 before the event day and 1 after the event day; $Tested_i$ is an indicator variable denoting the treatment group; and X is a matrix of control variables. The coefficient β_3 for the interaction term is the DID estimator and is the main coefficient of interest. I also lengthen the horizon to one month and focus on the events when stress tests results are released in 2010 and 2011.

The DID research design is more appropriate when the treatment is randomly assigned. Unfortunately, in the EU stress test setting, the selection of a bank by the regulator for stress testing is likely not random, resulting in potential selection bias if the tested banks and untested firms are different even in the absence of the treatment. Therefore, to mitigate potential selection

[10] In many instances in 2010 and 2011, local regulators released the results for the banks within their respective jurisdictions at the same time as the EBA. With the exception of the release of 2010 and 2011 results, all other stress test events were announced exclusively by the EBA on its website at http://www.eba.europe.eu.

[11] In robustness tests, I also use three day and (five day) windows and the magnitude of the coefficients is slightly smaller (larger) but the results remain statistically significant.

concerns, I use propensity score matching to identify a more comparable group of control firms. However, this will still not fully resolve selection concerns.

I identify three sets of potentially control group firms: i) "Untested EU Banks"; ii) untested EU banks and untested non-EU banks from Australia, Canada and the US, collectively labeled "Untested EU and Non-EU Banks"; and iii) "Untested EU Non-Banks" comprised of non-banking firms drawn from a large sample of EU firms across several industries, including insurance firms (see Table 1, Panel A and B for the sample of firms).

I identify matched tested and control firms based on observable characteristics. The basic assumption underlying this matching technique is that the relevant differences between the tested and untested firms, which may explain why tested banks were selected for the treatment, can be captured by the distribution of these observable variables.[12] The variables I use include size (total assets and market value of equity), profitability (return on equity), credit risk (financial leverage), and prior year growth in total assets. When matching using the bank controls (i.e., other than EU non-banks), I expand the set of matching variables to incorporate additional characteristics relevant for banks, such as risky assets (risk-weighted assets as a proportion of total assets), Tier 1 capital deflated by risk weighted assets, and loan loss provisions as a proportion of total assets (see Appendix C for a description of the matching variables). While matching will not fully mitigate selection bias, I use all three alternative control groups in my analyses in order to strengthen inferences.

3.2. Treatment of Dependent Variables and Strengthening Statistical Inferences

Consistent with prior research investigating IA, I estimate the adverse selection component of the relative bid-ask spreads by removing the relatively small and fixed order

[12] Specifically, matching is performed over the common support region using propensity scores to find the nearest matching firm without replacement.

processing costs and the larger trading volume related inventory holding costs of the market-maker (see Stoll [1978, 1989]). In all the regression analyses and the tests presented in this paper I use the estimated adverse selection components of equity, short bond and long bond relative bid-ask spreads.[13] To maintain economic interpretability, I present the raw bid-ask spreads in Figures 1, 2 and 3 and in Table 3, Panel A.

I estimate the adverse selection component of the relative bid-ask spread using daily price data in the following rolling cross-sectional model:

$$y_{it} = \alpha_0 + \beta_1 Size_{it} + \beta_2 Volume_{it} + \beta_3 Value\_Traded_{it} + \beta_4 Volatility_{it} + \varepsilon_{it} \qquad (2)$$

where, y_{it} is the log of relative equity bid-ask spread, $Size_{it}$ is log of daily market capitalization, $Volume_{it}$ is trading volume as a proportion of free float shares outstanding, $Value\_Traded_{it}$ is log value of shares traded in local currency, and $Volatility_{it}$ is the rolling standard deviation of stock returns for the previous twelve months. The residuals from this model provide estimates of the adverse selection component of equity bid-ask spreads and are used in the subsequent tests. I further control for the price level in order to remove any apparent trends in bid-ask spreads due to trends in the deflating price. I estimate the adverse selection component of bond bid-ask spreads in a similar manner with one important difference. Since I do not have high quality bond trading volume data, I use two substitute controls for bond liquidity that have been documented in prior literature, namely issue size outstanding (positive sign) and bond age (negative sign) (see Hong & Warga [2000]). This will inevitably increase the measurement error in the estimated adverse selection component of bid-ask spreads for the short and long bonds used in the analyses.

[13] The relative bid-ask spread is the difference between the ask price and the bid price deflated by the average of the two prices. The prior six month average price as a deflator does not change the results.

Each firm's equity option implied volatility as a measure of IU is adjusted for market wide effects by subtracting the average equity option implied volatility for all other firms. Specifically, for each firm-day observation, the following calculation is performed:

$$IVOLa_{it} = IVOL_{it} - \frac{1}{N-i}\sum_{\substack{j=1 \\ j\neq i}}^{N} IVOL_{jt} \qquad (3)$$

where, $IVOLa_{it}$ is the market adjusted implied volatility, $IVOL_{it}$ is the unadjusted implied volatility for firm i and the adjustment factor is the average of all other firms where $j \neq i$.[14]

In conventional event studies of firm events, such as dividends or stock-splits, all the events across firms are aggregated. Conversely, in the EU stress test setting, all the events are clustered in time making statistical inferences using regular test statistics invalid. Therefore, following Lo [2003] and Zhang [2007], I calculate bootstrapped *p*-values using placebo event dates. For each event, I estimate coefficients using an equivalent number of non-event days with a random placebo event date. A sample of 1,000 coefficients is drawn with replacement, and the two-tailed *p*-values are estimated as twice the fraction of observations in the sample with values greater (lower) than the coefficient of interest, if larger (smaller) than zero.

3.3. Cross-sectional Tests for Directional Information Content

Along with tests of the announcement and disclosure effects, I also conduct cross-sectional analyses for the tested banks after the release of 2011 test results in order to evaluate the directional information content of the stress tests. The primary outcome variable that the CEBS announced in 2010 was the number of banks that exceeded or fell short of a Tier 1 capital ratio. Unfortunately, only 7 banks in 2010 and 8 banks in 2011 fell below the threshold and there is not much variation in this measure to be highly informative (see Appendix A for more details on the

[14] Prior to matching on propensity scores there are 481 firms in my sample with implied volatility data; for each firm the average of the other 480 firms is used as the representative "market" adjustment.

disclosure). While I do use these pass/fail indicators, I also develop two continuous firm-specific measures using credit exposure information revealed by the 2011 stress test results to evaluate their information content and value relevance for capital market participants. I test whether these measures can be used to make directional predictions about changes in bid-ask spreads, implied volatilities, CDS1Y/CDS5Y, five year issuer CDS spreads (CDS5Y) and stock returns. Specifically, I use the following cross-sectional regression:

$$\Delta y_i = \alpha_0 + \beta_1 SovRisk_i + \beta_2 Bailout_i + \beta_3 GovtOwn_i + \beta_4 Pass2010_i + \beta_5 Pass2011_i + X\beta + \varepsilon_i \quad (4)$$

where, Δy_i is the change in the relevant dependent variable of interest; $SovRisk_i$ is a firm-specific measure of sovereign risk developed using the EAD information provided in the 2011 stress test results; $Bailout_i$ is an indicator variable for an announced bailout for the bank prior to the release of test results, $GovtOwn_i$ is the percentage government ownership in December 2010; and X is a matrix of controls which varies depending on the dependent variable, i.e., *Size* for equity spreads, *Market Leverage* for credit spreads and CDS1Y/5YΔ, and historic *Stock Return Volatility* for the implied volatility specifications. In an alternative specification of (4), $SovRisk_i$ is replaced with $MacroShock_i$ which is a firm-specific measure of macroeconomic growth using OECD Composite Leader Indicator (CLI) forecasts from two months prior to the release of results. The change in the variable of interest is measured over the four consecutive trading days and one month after the 2011 test results.

The $SovRisk$ measure is developed using a matrix of sovereign debt EAD for $Bank_i$ in $Country_j$. The sum product of the country-by-country sovereign EAD disclosed in the 2011 test results and the one-month average of the five year sovereign CDS spread (in percent) for the

respective countries yields a firm-specific measure of overall sovereign risk exposure for the tested banks.

The $MacroShock$ measure is created using the methodology developed by Li, Richardson and Tuna [2012]. I use the trend-restored forecast series of OECD CLI for each country that the banks are exposed to.[15] This series is first differenced, smoothed to develop a measure of changing expectations and finally scaled by its own historical volatility. The $MacroShock$ variable is the sum product of the total EAD for each bank across countries and the CLI data for each country. The EAD matrix used is different from the one used for the $SovRisk$ measure. While the $SovRisk$ measure uses only sovereign debt EAD, the $MacroShock$ measure uses total EAD across all credit and market segments including institutional, corporate, retail, real estate, sovereign, securitization and counterparties. Therefore, it is a measure of overall credit exposure of banks to countries with different forecasted economic performances.

Finally, I review financial reports, as well as bank and regulator press releases to identify banks that announce a bailout by their relevant government prior to the release of test results. Many of the EU country level regulators, whose banks participated in the stress tests, announced some form of support for the banks in their jurisdiction. This government support ranges from direct ownership through common or preferred shares, to the availability of a liquidity facility or asset restructuring program. I also develop a more continuous measure of direct government support by using the historical percentage government ownership from ThomsonOne. While undoubtedly measured with error, these variables attempt to identify tested banks for which the information content of the test results may be different.

[15] The CLI forecasts are updated monthly and are available at the OECD website at http://stats.oecd.org/Index.aspx?querytype=view&queryname=14001.

4. Sample Selection and Data Description

The initial sample of "Tested Banks" is comprised of 97 banks across 21 EU countries that were tested by the EBA in either 2010 or 2011 (see Table 1, Panel A). I exclude 7 banks that were tested in 2010 and subsequently were not tested in 2011 because they were either acquired or no longer existed independently.[16] I further exclude banks that do not have public equity or credit instruments (9 banks). These exclusion criteria result in a final sample of 81 tested banks of which 72 are matched using propensity scores with a control firm. Spain with 16 banks (22%) and Germany with 7 banks (10%) have the highest country representation; 53 banks (74%) are publicly listed while 19 banks (26%) are privately held.

For the group of "Untested EU Banks" I identify 107 EU banks in the 21 EU countries where banks were tested, but that were not stress tested in either 2010 or 2011. I search local regulator websites and use FactSet screens using SIC codes for financial institutions. Many of the identified banks are small Danish and Norwegian banks. I exclude those banks below US$ 5 billion in total assets as the smallest tested bank around this size. I further exclude 8 banks whose parent Bank Holding Company (BHC) was tested and one bank with no market data. Of these 42 potential banks, 39 are matched with the tested banks and these are the "Untested EU Banks" used in the analyses.[17]

In order to identify a set of commercial and universal banks that are similar in size to the EU tested banks, I consider Australian, Canadian and US banks as potential comparable banks. My prior is that the EU stress tests should directly affect the tested banks but the non-EU banks should not be directly affected. However, I cannot rule out the possibility that the non-EU banks

[16] The sample of banks tested in 2010 and 2011 as well as the test results can be downloaded from the EBA's website. I exclude these 7 banks in order to maintain a consistent sample across the two years. Including these banks for the 2010 test events does not change the tenor of the results.
[17] Including the banks that are stress tested at the BHC level does not change the results.

experience indirect secondary effects from the stress tests. I identify 60 banks across these three countries. I remove 2 banks with no equity or credit market data. This exclusion results in 58 non-EU banks, 31 of which are matched with the EU tested banks. I create the group of 68 "Untested EU and Non-EU Banks" by matching the combined set of 42 potential EU banks and 58 potential non-EU banks with the 81 tested banks.

Finally, I identify a third group of potential control firms of 840 EU non-bank firms using a combination of Compustat Global, Datastream Worldscope and FactSet. These non-bank EU firms should not be directly affected by the stress tests, and comparison with this group may help to control for market-wide effects in order to sharpen identification. However, these firms may still experience spill-over effects of the stress tests. I exclude 413 firms that are below US$ 5 billion in assets, and match 63 firms to form a control group of "Untested EU Non-Banks" across 11 EU countries and 10 GICS industry groups. The larger firms in this control group are insurance firms. Table 1, Panel A presents the geographical distribution of firms, and Table 1, Panel B lists the names and total assets of the largest 25 firms in each of the groups. Note that the tested banks are generally significantly larger, with 9 banks over US$ 1 trillion in total assets in 2009 (prior to the tests). By comparison, only one other control group has firms with assets over US$ 1 trillion (4 Non-EU banks).

I use Datastream to collect equity bid-ask spread data and Bloomberg to collect credit instrument bid-ask spread data ensuring that I pick up the highest quality executable quotes where available.[18] First, I identify the largest outstanding publicly traded non-convertible, non-callable recently issued (on-the-run) bond for each bank. Bond size and age is positively related

[18] I use the composite bid-ask quotes on Bloomberg by setting the default as CBBT on the ALLQ (All Quotes) and PCS (Pricing Sources) screens. The Bloomberg CBBT quotes are a composite developed by Bloomberg based on the average of at least three dealer quotes for a particular credit instrument, where available. Where a composite quote is not available, ALLQ shows all available quotes for the credit instrument, highlighted either in orange (not executable and hence less liquid) or white (executable and hence more liquid).

with bond liquidity and will affect the quality of bid-ask spread data (see Hong & Warga [2000]). Descriptive statistics for the selected credit instruments for both groups of banks are shown in Table 2. The large number of public bonds ensures that after matching, I have a sufficient number of firms with available credit market data. While the mean size of the outstanding short bonds for the tested banks is larger than for the other groups, the size of the long bonds is broadly comparable. The median issue year for short and long maturity bonds for the tested banks is 2009, and the untested control groups it is either 2008 or 2009. The yearly frequency of issue and maturity years is also presented in Table 2. Based on the main credit instrument characteristics, such as maturity year, coupon rate (floating versus straight), target market, instrument credit rating distribution and modified duration, the four groups of short and long bonds are comparable. As a result, I expect the credit market data for the groups to be of comparable quality further strengthening inferences.

I collect the continuous series of equity call option implied volatilities calculated by Datastream using exchange traded option prices. In addition, I collect 6 month, 1, 3, 5, 7 and 10-year issuer senior Credit Default Swap (CDS) mid premiums from Datastream.[19] For each firm I calculate the ratio of the 1 year CDS spread to the 5 year CDS spread or CDS1Y/CDS5Y (see Arora, Richardson and Tuna [2012]). Table 3, Panel A reports the descriptive statistics for the raw bid-ask spreads for equity, short bonds and long bonds as well as the implied volatilities and CDS1Y/CDS5Y for the firm-day observations over the sample period from January 4, 2010 to February 15, 2012. A few observations can be made. First, equity bid-ask spreads for the untested EU banks are much larger, primarily since these are smaller banks. Second, the long bond bid-ask spreads are wider than the short maturity credit bid-ask spreads suggesting that the long bonds may incorporate a larger liquidity premium. Prior bond trading literature has used bid-ask spreads

[19] The CDS data provider is Thomson Reuters. CDS spread and implied volatility data is not available for all the firms, which reduces the number of observations in regressions where these are used.

as a proxy for illiquidity and I cannot rule out that this is not the case for the selected long bonds (see Sarig and Warga [1989]; and Hong and Warga [2000]). Therefore, inferences from results relying on the bond data will be weakened. Finally, equity implied volatility and CDS1Y/CDS5Y as the two measures of IU are larger for the tested banks compared to each of the other groups.

Finally, I collect fundamental data for all the firms from Compustat Global and Datastream Worldscope.[20] I supplement this information with hand collected data for the privately held banks and also collect additional variables that are not available in Datastream or FactSet (for example, Risk Weighted Assets). I then calculate several accounting ratios relevant for banks. The independent variables used for the empirical analyses are presented in Table 3, Panel B. Size (log of market value), rolling twelve month stock and bond return volatility, trading volume and bond size are used to estimate the adverse selection component of bid-ask spreads (see Section 3.2). Market volatility and market returns are used as controls in the regression specifications.

A full description of all the variables and the calculation methodologies is in Appendix C. Descriptive statistics for the variables used for propensity score matching are reported in Table 3, Panel C. The table reports only the 68 tested banks that are matched with the "Untested EU and Non-EU Banks" control group. On all characteristics except risky assets and financial leverage, the two groups are not statistically different. Similarly, the matching groups of 39 "Tested EU Banks" and "Untested EU banks" are not significantly different. It is important to note that the mean differences test statistic for the EU banks and the EU non-banks are reported based on the matching number of tested banks (i.e., 39 tested banks for the comparison with the EU banks, and 63 tested banks for the comparison with EU non-banks). Also, the untested EU non-banks are

[20] I collect information on the US bank holding companies from their US Federal Reserve FR Y-9C reports.

smaller in terms of size and have lower leverage. I perform all my analyses using propensity score matched samples of firms.[21]

Table 4 reports correlations for all the variables with Pearson correlations above the diagonal and Spearman correlations below the diagonal. The Spearman correlation between size and equity bid-ask spreads is -0.39, and the correlation between trading volume and equity bid-ask spreads is -0.28. Similarly, the Spearman correlation between bond size and bid-ask spreads is -0.26 for the short bond and -0.17 for the long bond, justifying their use in the estimation of the adverse selection component. Equity implied volatility is negatively related to size and is highly correlated (0.65) with CDS1Y/CDS5Y as the other measure of IU. $SovRisk$ and $MacroShock$ are highly negatively correlated (Pearson of -0.55).

5. Empirical Results

I conduct two primary analyses in this paper. Firstly, I test the announcement and results disclosure effects of the stress test events in 2010 and 2011 on IA and IU. Hypotheses H1a and H2a are related to the effect of test announcements on measures of IA and IU, while hypotheses H1b and H2b are related to the effect of test result disclosures on IA and IU. Secondly, I examine Hypothesis H3 related to the information content of the stress test results for measures of IA and IU, as well as CDS5Y spreads and equity returns.

5.1. Announcement and Results Disclosure Effects of 2010 and 2011 EU Stress Tests

Table 5 reports the difference-in-difference (DID) estimator (β_3) for each of the nine events, the three different propensity score matched control groups for each event, and the five measures of IA and IU in the columns. For the sake of brevity I focus the discussion on those results that are relatively consistent across the three control groups in order to strengthen

[21] In robustness tests, I also use the full sample of firms in each control group with largely similar results.

inferences. Generally, the signs of the coefficients across the three control groups are consistent for each event (one notable exception is Event H for implied volatility). Note that Event A and Event D are the initial announcement events, while Event C and Event I are the results release dates for the 2010 and 2011 stress tests, respectively.

Announcement effects on IA. The 2010 stress test announcement (Event A) was a non-event for all measures of IA using the three control groups. Conversely, the 2011 test announcement (Event D) elicited a widening of the short and long bond bid-ask spreads with the long bond widening significantly with an average coefficient of 0.25 (29%) across the three control groups (1% significance level).[22] The credit market result is corroborated by Figure 1, which plots the mean raw short and long bond bid-ask spreads over the span of the two tests for the tested banks and the three control groups. For the tested banks, the estimated adverse selection component of bid-ask spreads is also plotted. The jump at Event D and the upward drift and increased volatility in the bid-ask spreads for tested banks through Event I (results release) are easy to see. Figure 2, Panel B shows the plot for the equity bid-ask spreads and there is no significant jump around the announcement of the 2011 test or around any of the other events. Indeed, in column 1 of Table 5, none the coefficients for the equity bid-ask spreads are statistically significant for any event across the three control groups. Thus the equity market and credit markets appear to show inconsistent results for the 2011 stress test announcement, suggesting two possible interpretations. The first interpretation is that the credit market data is evidence of illiquidity rather than IA, and this illiquidity may be exacerbated during a crisis when liquidity is reduced and financial intermediaries are capital constrained.[23] In comparison, the

[22] I use log bid-ask spreads in the regression analyses. The coefficients can be interpreted by taking the exponent and subtracting 1 to calculate the level of relative bid-ask spreads in percent. I present the log coefficient from the tables and report the translated percent change in parentheses.

[23] Duffie [2010] has suggested that the financial crisis saw large distortions in arbitrage-based pricing relationships due to depletion of dealer capital.

equity market data may be more liquid and any short term distortions are not driving spurious results. The second possibility is that some shock has specifically affected the credit markets. For example, the continued worsening of the Greek sovereign credit crisis and a credit down grade rating action by Fitch on January 14, 2011 may create a potential confounding event with spillover effects on bid-ask spreads. It is also possible that correlations between firm and sovereign credit risk increased during the recent crisis. Therefore, I remove banks from Portugal, Ireland, Greece, Italy and Ireland (PIIGS) and the widening in bond bid-ask spreads for the remaining banks is significantly lower, although the gradual upward drift remains. As a result, I am unable to make strong inferences that IA increased upon announcement as predicted by H1a.

Announcement effects on IU. As reported in columns 4 and 5 of Table 5, the 2010 (Event A) and 2011 (Event D) stress test announcements have no significant effect on IU with the exception of implied volatility in 2011 when compared with untested EU banks, which increases to 0.16 (statistically significant at the 5% level). The remaining announcement events show a similar lack of response, with the exception of Event G when the banks to be tested are identified where IU declines marginally. For the same event, the other measure of IU (CDS1Y/CDS5Y) has a similar sign but the coefficients are not significant. Figure 2, Panel B and Figure 3, Panel A plot the two IU measures over the span of the two tests for each group, while Figure 3, Panel B also reports CDS5Y/CDS10Y to further validate the IU measure. Overall, the IU measures do not show a significant announcement effect and I am unable to find evidence in support of H2a.

Results disclosure effects on IA. The disclosure of the 2010 (Event C) and 2011 (Event I) test results seem to have no significant effect on measures of IA at least during the short window (four day) after the results in Table 5. Since in the short horizon, the bid-ask spread data may be noisy, I lengthen the horizon to one month before and after the 2010 and 2011 test results and report the DID coefficients in Table 6. While there are still no significant effects on IA after the

2010 test result, all three measures of IA decline across the three control groups after the 2011 test result. In particular, the decline in the adverse selection component of short and long bid-ask spreads is statistically significant, when compared with the untested EU non-banks and the untested EU banks (short bond only). Relative to the EU non-banks, the short bond and long bond bid-ask spreads decline by -0.12 (11%) and -0.15 (14%), respectively. This result can also be seen in Figure 1. Hence, I find evidence in support of H1b.

Results disclosure effects on IU. The disclosure of the 2010 test results is associated with a slight decline in IU as measured using implied volatility. Across all three control groups the sign on the coefficient for Event C are negative in Table 5 (column 4), and in the comparison with EU non-banks the decline is significant at the 5% level although economically small in magnitude. Increasing the horizon to one month in Table 6 (column 4) increases the statistical significance of the decline in IU across all three comparison groups. However, the CDS1Y/CDS5Y measure in column 5 experiences an increase but only in comparison with the EU non-banks. As a result, the conclusion on IA in 2010 is mixed using these two measures. Focusing on 2011, both IU measures show a statistically significant increase across two of the three comparison groups. Over the short horizon in Table 5, the increase is an average of 0.03 standard deviations for implied volatility and 0.04 for the CDS1Y/CDS5Y ratio. The result remains significant when the length of the horizon is increased to one month in Table 6 (columns 4 and 5). Figure 2, Panel B and Figure 3, Panel A corroborate these results. Overall, consistent with hypothesis H2b, information uncertainty using my measures appears to increase after the 2011 test results.

In order to further investigate the effect of the results disclosure on IU, I use the insight provided by Duffie and Lando [2001] that uncertainty of accounting information is strongly evident in short term credit spreads. Figure 4 plots the credit term structure for the tested banks

and the three untested comparison groups for the three months prior to the 2011 test announcement (Event D) and the three months after the 2011 test result (Event I). Specifically, I calculate the average CDS spread for each group for contracts ranging from 6 months to 10 years and plot yield curve for each group. Two observations can be made. First, the tested banks have higher spreads compared to the other three groups. This is not surprising given the ongoing EU sovereign credit crisis and the significant size of the EU banks where the sovereign risk is concentrated. Second, after the results release in 2011 the curve for the tested EU banks not only shifts upward (more so than the control groups), but the short end widens significantly more than the long end. In fact, the yield curve becomes inverted after the release of results suggesting increased IU. Arora, Richardson and Tuna [2012] report a similar inverted curve for a sample of US banks with lower asset reliability (measured using Level 2 and Level 3 assets as a proportion of total assets) during the financial crisis period. Figure 4 provides hints that the effect on the credit term structure from the stress tests is greater for the tested EU banks indicating greater IU.

I also explore whether the announcement and disclosure results across the two years of the tests are correlated. Under the assumption that the 2010 and 2011 stress tests are not vastly different (an admittedly weak assumption) and that the banks have not changed significantly across the two years (an admittedly even weaker assumption), it may be helpful to examine whether the changes in the various IA and IU measures across 2010 and 2011 are related. Table 7 reports the Pearson (upper diagonal) and non-parametric Spearman (lower diagonal) correlations. For each instrument the boxes along the diagonal report the relevant correlations. The equity spread results are not correlated. The short bond bid-ask spread changes upon announcement are correlated across the two years (0.60 Spearman correlation at 10% significance level, while the Pearson correlation is insignificant). Similarly, the long bond bid-ask spread changes between 2011 test announcement and 2010 test results have a Spearman correlation of 0.53. The IU

measures are also weakly correlated across the two years, although sometimes the signs are flipped. One cannot draw strong conclusions except to say that the changes in IA and IU experienced by some banks in 2010 are somewhat correlated with the subsequent changes in 2011 (except in the equity markets).

5.2. Cross-sectional Analyses of Information Content in 2011 Test Results

Table 8 reports the results of the information content study using the cross-section of tested banks after the release of 2011 test results using the $SovRisk$ and $MacroShock$ variables discussed in Section 3.3. The dependent variables are percentage change in the adverse selection component of equity and bond bid-ask spreads, change in implied volatility, and change in CDS1Y/CDS5Y. In the set of explanatory variables, I also include two measures of the level of government support and pass/fail indicators from the two 2011 and 2010 tests. First, I examine the 4 days after the release of the 2011 test results and calculate the change in each instrument over the 4 day period. $SovRisk$ is negatively associated with changes in IA measures including equity, short bond and long bond bid-ask spreads although only the long bond bid-ask spread changes are statistically significant (columns 1, 3 and 5). The $SovRisk$ results can be interpreted as follows. An increase in $SovRisk$ from the 25th percentile to the 75th percentile of 1.8 (see Table 3, Panel B) translates into a 3.4 percent decline in the long bond bid-ask spreads.[24] Also, those banks with an announced bailout in the period prior to the release of the results experience a significant decline in bid-ask spreads (concentrated in the long bond). This suggests that the sovereign EAD disclosure in the 2011 test results had some information content even in the short horizon of four days. Increasing the horizon to one month in Table 9 and using the inter-quartile range translates into a 5.1% decline in the long bid-ask spread (column 5). The government ownership variable is only weakly significant (10% level). However, the short bond bid-ask

[24] The decline in the long bond bid-ask spreads is 1.8 x -0.019, where -0.019 is exp(-0.019)-1.

spread changes remain insignificant while the equity bid-ask spread are negatively associated and economically meaningful but only at a 15% significance level. Conversely, the $MacroShock$ variable is not significant for measures of IA in the short horizon. The binary 2011 test pass/fail indicator is positively associated with equity, short bond and long bond bid ask spreads. Given the lack of significant variation in this variable, the coefficient is likely picking up the average effect of an overall widening in bid-ask spreads across tested banks.

Next, I examine changes in implied volatilities and CDS1Y/CDS5Y. These measures of IU are negatively associated with $SovRisk$ both in the short horizon (Table 8, columns 7 and 9) and over the longer horizon (Table 9). In the longer horizon, an increase in $SovRisk$ from the 25^{th} percentile to the 75^{th} percentile of 1.8 (see Table 3, Panel B) translates into a -0.2 standard deviation decline in implied volatility, and a small but statistically significant decline in CDS1Y/CDS5Y. Columns 8 and 10 of Table 8 how a similar analysis using the $MacroShock$ variable for changes in implied volatility and CDS1Y/CDS5Y, respectively. While the association with implied volatility is insignificant, a positive change in the $MacroShock$ variable using the interquartile range of 0.5 from Table 3, Panel B is associated with a statistically significant decline in CDS1Y/CDS5Y of -0.05 (0.5 x -0.095). Increasing the horizon to one month, Table 9 reports that an inter-quartile increase in the $MacroShock$ variable of 0.5 translates into a decline of -0.04 (-0.076) although the coefficient for $MacroShock$ is only significant at the 10% level. Overall, the results suggest that the country-wise sovereign risk and macroeconomic exposure information disclosed in the 2011 test results allowed some directional predictions to be made about changes in measures of IU.

Finally, I examine the information content of the 2011 test disclosures for security prices, focusing on three month changes in the 5 year CDS spreads (CDS5Y) and three month

cumulative stock returns. I use three months since prior literature suggests that greater IU delays the flow of information into security prices (see Zhang [2006]). Three months is a reasonably long window (without being too long) to study how the market "learns" and processes the information content of the stress test results. The results are presented in Table 10. Over the three months after the release of the 2011 test results, changes in CDS spreads are strongly positively associated with $SovRisk$. The interpretation is that a change in $SovRisk$ from the 25th to 75th percentile translates into a 37.0 basis point (1.8 x 0.21 x 100) widening of CDS spreads over the 3 months after the 2011 test results. This provides some further corroborating evidence on the co-movement of bank CDS spreads and sovereign CDS spreads during this crisis-related period, and also suggests that the sovereign EAD disclosure had information content. Conversely, a positive change in $MacroShock$ over the inter-quartile range is associated with a 115.3 basis point (0.5 x -2.31 x 100) decline in CDS spreads over the three month period.

Over the three month period, $SovRisk$ is strongly negatively, and $MacroShock$ is strongly positively, associated with equity returns. Consistent with prior research, equity returns are positively related with earnings-to-price in the specifications which exclude $SovRisk$. In particular, the explanatory power of the specification with $SovRisk$ is high with an R-squared of 0.55. A change in $SovRisk$ of 1.8 using the interquartile range is associated with equity returns of -9.7 percent (1.8 x -0.054) over the three month horizon. Conversely, a positive change in $MacroShock$ over its interquartile range is associated with a directional prediction of 17.0 percent equity returns. This analysis suggests that the country-by-country credit and sovereign EAD disclosure for each bank reported in the 2011 stress test results had some explanatory power in characteristic regressions for stock returns.

6. Potential Limitations and Robustness Tests

The biggest potential limitation of this study is that it is unclear whether banks selected for the stress tests were *ex-ante* different from the firms not selected for the stress tests. While it appears that the EBA used size as a primary selection criterion, a handful of other sizeable EU banks remain that were not selected for the tests. In addition, other financial characteristics of the EU banks, non-EU banks and EU non-banks could be systematically different. Therefore, even though I have tried to control for potential selection bias and systematic differences by using propensity score matching, there may be omitted unobservable firm characteristics. I test for this possibility by using different definitions of some of the matching variables. For example, I use market leverage instead of book leverage, debt instead of total liabilities, and total capital instead of Tier 1 capital. While the composition of the matched firms varies, the results do not alter significantly especially for the bank firm control groups. While I use three different control groups and try multiple combinations of firms including the full sample, I cannot fully mitigate the potential selection issue that the tested banks were different on the basis of some unobserved parameter.

Another significant potential limitation of the study is that to the extent I am not able to accurately identify the exact timing of the EBA stress test events, the results could be spurious. While the EBA publishes press releases for each event on its website, I may have incorrectly identified the timing of the events. In order to mitigate this potential concern, I conduct detailed searches of press articles for several days around each event in order to mitigate potential concerns of confounding news that may affect IA and IU. However, other sources of market volatility may still exist given that the analysis is being conducted in the midst of a crisis, and these other sources may affect the results. For example, one day before the day of the announcement of stress test results on July 15, 2011, Standard & Poor's moved the US AAA

sovereign debt rating to credit watch. The rating was subsequently downgraded on August 5, 2011. Hence, the interpretation of results around the results date is affected. Also, contemporaneous earnings announcements, equity analyst forecast revisions and credit analyst rating changes that occur near the stress test events will bias the results.

The estimates of the adverse selection component of bid ask spreads may have substantial measurement error, especially for bonds as I do not have trading volume data. This measurement error can stem from the actual bid-ask spread trading data which may be of poor quality or the estimation model which may be mis-specified. I cannot do much about the former except to use the most liquid available quotes, but to mitigate the latter concern I try different specifications of the adverse selection estimation models. In particular, for short and long bonds, I use other proxies of trading liquidity suggested in prior literature such as bond rating, squared bond return in current month and time to maturity (instead of age). In untabulated results, these variable choices do not significantly affect the estimates.

I also alter the treatment of the dependent variables to investigate the robustness of the results reported here. Specifically, instead of using contemporaneous stock or bond price as the deflator, I use the average over the prior 6 months as an alternative deflator. Especially, during times of increased volatility, the price deflator may drive mechanical changes in the relative bid-ask spreads which can introduce further noise especially in the short window tests. The use of the alternative deflator does not significantly change the tenor of the results. In the models, I am also using the stock and bond price level as a control and this should further reduce any spurious deflator effects. Furthermore, for a subset of the main events, I use the raw bid-ask spreads instead of the relative bid-ask spreads and also do not use natural logarithms. As expected, outliers in the bid-ask spread data reduce statistical significance in these specifications especially for the short horizon tests, and makes cross-sectional comparability challenging. However, the

differences are more muted as the horizon is increased. Finally, I also use CDS5Y/CDS10Y as an alternative measure of IU and as expected find smaller coefficients relative to the shorter maturity variable (CDS1Y/CDS5Y).

In the information content analysis for CDS spreads and stock returns, I rerun the tests using one month instead of three months after the 2011 test. The results for the one month horizon are weaker for equity returns with the $SovRisk$ coefficient remaining significant at the 10% level but with much lower magnitude of 1%. This further suggests the information revealed from the tests is gradually incorporated in prices. For the CDS spreads, reducing the horizon to one month does not significantly alter the results except in magnitude. For example, using the inter-quartile range of the $MacroShock$ variable, the predicted effect on CDS spreads is a decline of -62.1 basis points (versus 115.3 basis points previously).

7. Conclusion

This paper presents empirical evidence on the capital market consequences of government stress testing of banks using a unique setting of EU bank stress tests in 2010 and 2011. I document that the stress test announcements did not have a significant effect on IA or IU, except the long bond bid-ask spreads after the 2011 test announcement. This increase may be due to illiquidity and appears to be concentrated in weaker banks. The eventual release of test results is associated with a decline in credit market measures of IA which accelerates significantly over the one month after the release of the results, while equity bid-ask spreads decline only insignificantly. The decline in IA provides some evidence of the value of the mandatory test disclosures in reducing information differences across investors. On the other hand, equity option implied volatilities and the slope of the credit term structure (CDS1Y/CDS5Y) as measures of IU exhibit a statistically significant increase around the time of results disclosure, with a stronger

and sustained increase as the horizon is lengthened. The CDS1Y/CDS5Y result corroborates recent work studying the role of imprecise accounting information on the credit term structure for firms. Finally, using information revealed by the stress tests, I develop firm specific measures of sovereign risk and macroeconomic growth exposure, and find that the disclosures had directional information content for measures of IA, IU, CDS spreads and equity returns.

While conducting the analysis in the midst of a crisis is challenging, I conduct several tests to validate robustness. The evidence presented in this paper suggests that transparent government stress tests may have a role to play in improving the information environment in capital markets during crises for potentially opaque organizations such as banks.

Appendix A: Summary of 2010 CEBS and 2011 EBA Stress Tests and Contents of Results Disclosure[25]

Year	Sample Selection Process	Hypothetical Base and Adverse Case Scenarios	Main Results and Contents of Public Disclosure Provided
2010	Banks ranked in descending order of 2009 total assets in 27 EU member states representing at least 50% of respective national banking sector. Test was conducted at consolidating bank holding company level. Therefore, for 7 EU member states no banks were selected due to testing at the parent company level. Final sample of 91 banks representing 65% of total assets in the EU banking sector in 20 EU member states were tested.	**Base case:** Annual GDP growth for Euro area of +0.7% (2010) and +1.5% (2011). **Adverse Case:** Deviations from base case assumed to be Euro area GDP growth -0.2% (2010) and -0.6% (2011). For the whole EU (27 members), a -3% deviation from the base case assumed. **Yield Curve Shift:** Each country assumed to experience a common rise of +125 bps for 3 month rates and +75 bps for 10 year rates at end-2011, resulting in haircuts applied to EU sovereign bond holdings in trading books of banks. Equity exposures in AFS portfolios subject to cumulative haircut of 19% in base and 36% in adverse case, respectively.	**Aggregate Report:** Summary of results provided under both cases. In adverse case, aggregate Tier 1 capital ratio decreases from 10.3% in 2009 to 9.2% by end of 2011; and aggregate impairment and trading losses are EUR 565.9 billion. Overall, 7 banks have Tier 1 capital ratios below the 6% benchmark threshold. Follow-up action to address identified capital shortfalls left to local supervisor. **Bank-by-bank Results:** One page summary for each of the tested banks comparing 2009 actual capital adequacy to the outcome of the stress test under the base and adverse cases at end of 2011. Total capital, risk weighted assets and Tier 1 ratio disclosed. Two year cumulative impairment losses from corporate and retail exposures as well as a sovereign shock to the trading book disclosed with capital shortfall assessed against 6% threshold (after announced government support and capital raisings announced before July 1, 2010).
2011	Similar methodology as in 2010. Tested banks represented 65% of 2010 total assets in the EU banking sector and at least 50% of respective national banking sector. Some banks from 2010 were dropped if they were acquired by a tested bank or no longer existed. Six banks were added to replace these banks (1 in Austria, 1 in Denmark, 1 In Ireland, 1 in Norway, 1 in Slovenia, and 1 in Spain). A bank in Germany (Helaba Landesbank) withdrew from the 2011 test due to disagreement over the inclusion of hybrid capital. Final sample of 90 banks in 21 EU member states.	**Base case:** GDP growth for Euro area of +1.5% (2011) and +1.8% (2012). Gradual increase in short term (1.8% in 2012) and long term interest rates (2.9% in 2012). US dollar depreciation against the Euro to 1.39 in 2011 and 2012. **Adverse Case:** Deviations from base case assumed to be Euro area GDP growth of -2.0% (2011) and -2.0% (2012), inflation of -0.5% (2011) and -1.1% (2012), and unemployment rate of +1.2% (2012). Short term interbank rates increase by 125bps. Equity prices fall by 15%. Housing prices, consumption and investment shocks also applied. **Country-specific Shocks:** Newly introduced in 2011, country-specific bond yield shocks were applied and distributed based on volatility of sovereign CDS spreads in late 2010 resulting in haircuts to trading book EU sovereign bond holdings.	**Aggregate Report:** Detailed results provided under both cases. In adverse case, aggregate Tier 1 capital ratio declines from 8.9% to 7.4% by end of 2012. Overall, 20 banks have Tier 1 capital ratios below the 5% benchmark threshold (8 banks after incorporating announced government support and capital raisings through April 2011). Aggregate capital shortfall of EUR 26.8 billion. EBA recommends remedial measures to national supervisory authorities to address shortfalls. Disclosure on loss and default rates, funding structures, cost of funding and risk measurement models used by banks. **Bank-by-bank Results:** Eleven page document for each of the tested banks along with a downloadable spreadsheet. Summary disclosure on outcome of scenarios on total capital, risk weighted assets, Tier 1 ratio, two year cumulative impairment losses and capital shortfall. Detailed disclosure of capital composition, profit and loss, mitigating measures and country-by-country disclosure of Exposure At Default (EAD) for each bank across credit and market segments (institutional, corporate, retail, real estate, sovereign, securitization and counterparties).

[25] On January 1, 2011, the EBA took over from its predecessor organization, the Committee of European Banking Supervisors (CEBS). In the announcement of the 2011 test, the EBA highlighted that the "lessons learnt" from the previous tests conducted by CEBS in 2009 and 2010 would be addressed to improve transparency and usefulness.

Appendix B: Brief Description of All Stress Test Related Events in 2009, 2010 and 2011

	Event Date	Day	Description of Event	Used in Analysis
	May 07, 2009 (5:00 p.m. EDT)	Thu	US Federal Reserve releases results of stress tests conducted on 19 of the largest US bank holding companies. Individual bank holding company level results are disclosed.	No
	May 12, 2009	Tue	CEBS (the predecessor organization to the EBA) announces the first EU-wide stress testing exercise.	No
	October 1, 2009	Thu	CEBS publishes aggregate results of the first EU-wide stress testing exercise on 22 unnamed banks.	No
A	June 18, 2010	Fri	CEBS announces second EU-wide stress test with the sample of banks to be released in the future. The sample is expected to cover 60% of the EU banking sector in terms of total assets.	Yes
B	July 7, 2010 (post-close)	Wed	CEBS releases a statement on the key features of the second EU-wide stress test, identifies the sample of banks to be tested, and announces the results release date.	Yes
C	July 23, 2010 (post-close)	Fri	CEBS publishes bank-by-bank detailed results of second EU-wide stress testing exercise on a one page template based disclosure document made available on the websites of the EBA and each bank.	Yes
D	January 13, 2011	Thu	EBA announces third round of stress tests on a *broadly similar group of banks* as was tested in 2010 with the results to be released in mid-2011 (no definite date is provided).	Yes
E	March 2, 2011	Wed	EBA announces next steps and timeline for third EU-wide stress testing exercise with the sample of tested banks to be released on March 18, 2011.	Yes
F	March 18, 2011	Fri	EBA publishes details on scenarios and methodology (banks not identified contrary to expectations)	Yes
G	April 8, 2011	Fri	EBA announces benchmark Tier 1 capital ratio (5%) and identifies sample of banks to be tested.	Yes
H	July 8, 2011	Fri	EBA announces the date of publication for the results of the third EU-wide stress test (one week hence).	Yes
I	July 15, 2011 (post-close)	Fri	EBA publishes bank-by-bank detailed results of the third EU-wide stress test on an eleven page template based disclosure document made available on the websites of the EBA and each bank.	Yes

Announcements by CEBS/EBA have been sourced from the EBA website at www.eba.europe.eu. Based on a press search on Factiva, the announcements appear to be released during market trading hours, unless indicated. This table shows the twelve events initially identified as important stress test related events in 2009, 2010 and 2011. Events A through Event I are the nine events related to the 2010 and 2011 stress tests used in the announcement and disclosure effects analyses.

Appendix C: Description of Variables

Variable Name	Short Name	Definition and Calculation of Variable
Dependent Variables		
Equity Bid-Ask Spread	*Eq_Sprd*	Relative equity bid-ask spread calculated as: (Ask – Bid) / (Ask – Bid)/2 (in basis points).
Short Credit Bid-Ask Spread	*CrS_Sprd*	Relative bid-Ask spread for short maturity bond (maturity within 36 months) calculated as: (Ask – Bid) / (Ask – Bid)/2 (in basis points).
Long Credit Bid-Ask Spread	*CrL_Sprd*	Relative bid-Ask spread for long maturity bond (maturity after 48 months) calculated as: (Ask – Bid) / (Ask – Bid)/2 (in basis points). Regressions use natural logarithm of bid-ask spreads. Adverse selection component of bid-ask spreads for equity and credit instruments is estimated using the procedure described in Section 3.2.
Implied Volatility	*IVOL*	At-The-Money equity call option implied volatility in standard deviations. Continuous series from Datastream. Market adjusted by subtracting the average implied volatility for the other firms in the sample (see Section 3.2 for details).
CDS1Y/CDS5Y	*CDS1Y/CDS5Y*	The ratio of the one year issuer CDS spread (CDS1Y) to the five year issuer CDS spread (CDS5Y).
Independent Variables		
Size	*Size*	Natural logarithm of market value of equity.
Stock Return Volatility	*Eq_Volatility*	Standard deviation of stock returns over the prior 12 months estimated daily on a rolling basis.
Short Bond Return Volatility	*CrS_Volatility*	Standard deviation of short bond returns over the prior 12 months estimated daily on a rolling basis.
Long Bond Return Volatility	*CrL_Volatility*	Standard deviation of long bond returns over the prior 12 months estimated daily on a rolling basis.
Freefloat Trading Volume	*Share_VolFF*	Daily number of shares traded / Freefloat Shares outstanding (percentage).
Value Traded	*Value_Traded*	Stock price in local currency x daily volume traded in shares. (billions of local currency). Log transformation used in adverse selection component estimation.
Short Bond Size	*Bond_SizeS*	Outstanding US dollar amount of short term credit instrument (maturity within 36 months) in millions.
Long Bond Size	*Bond_SizeL*	Outstanding US dollar amount of short term credit instrument (maturity after 48 months) in millions.
Market Volatility Index	*Volatility Index*	Euro STOXX 50 Volatility Index developed by STOXX Limited based on real-time option prices on the Euro STOXX 50 index (Datastream code: VSTOXXI)
Market Return	*Mkt Return*	Percentage change in level of STOXX Euro 600 Price Index developed by STOXX Limited (Datastream code: DJSTOXX)

Appendix C: Description of Variables (continued)

Variable Name	Short Name	Definition and Calculation of Variable
Independent Variables (cont'd)		
Beta	*Beta*	Estimated daily using a 12 month rolling regression of a market model: $R_i = \alpha_i + \beta_i R_m + \varepsilon_i$
Book-to-price	*BTP*	Book Value of Equity / Market Value of Common Equity
Earnings-to-price	*ETP*	Net Income before extraordinary items / Market Value of Common Equity
Sovereign Risk	*SovRisk*	The sum product of a bank's Sovereign Exposure At Default by country and that country's average 5 year sovereign CDS spread in percentage for the prior month. See Discussion in Section 3.3 for more details.
Macroeconomic Shock	*MacroShock*	The sum product of a bank's Total Exposure At Default by country and the 'macroeconomic shock' to that country's expected performance based on OECD Composite Leading Indicators. See Discussion in Section 3.3 for more details.
Announced Bailout	*Bailout*	Indicator variable identifying bank that received government support in the period prior to the release of 2011 test results. See discussion in Section 3.3.
Government Ownership	*GovtOwn*	Percentage of shares outstanding owned by government. See discussion in Section 3.3.
Pass 2010 Test	*Pass2010*	Indicator variable identifying banks that passed (1) or failed (0) the 2010 stress test.
Pass 2011 Test	*Pass2010*	Indicator variable identifying banks that passed (1) or failed (0) the 2011 stress test.
Market Leverage	*Mkt_Leverage*	Total Liabilities / Market Value of Equity (percentage)
Matching Variables		
Total Assets		FY2009 assets as reported on balance sheet for (US$ billions)
Market Value		Market Value of Common Equity: Number of shares outstanding x Midpoint of Bid-Ask price (US$ billions)
Tier 1 Ratio		Tier 1 Capital / Risk Weighted Assets (percentage)
Loan Loss Provisions		Balance Sheet Provisions for Loan Losses / Total Assets (percentage)
Return on Equity		Net Income Available to Common Shareholders / Book Value of common equity (percentage)
Risky Assets		Risk Weighted Assets / Total Assets (percentage)
Financial Leverage		Total Liabilities / Total Assets (percentage)
Total Assets Growth		12 month growth in assets over prior period (percentage)

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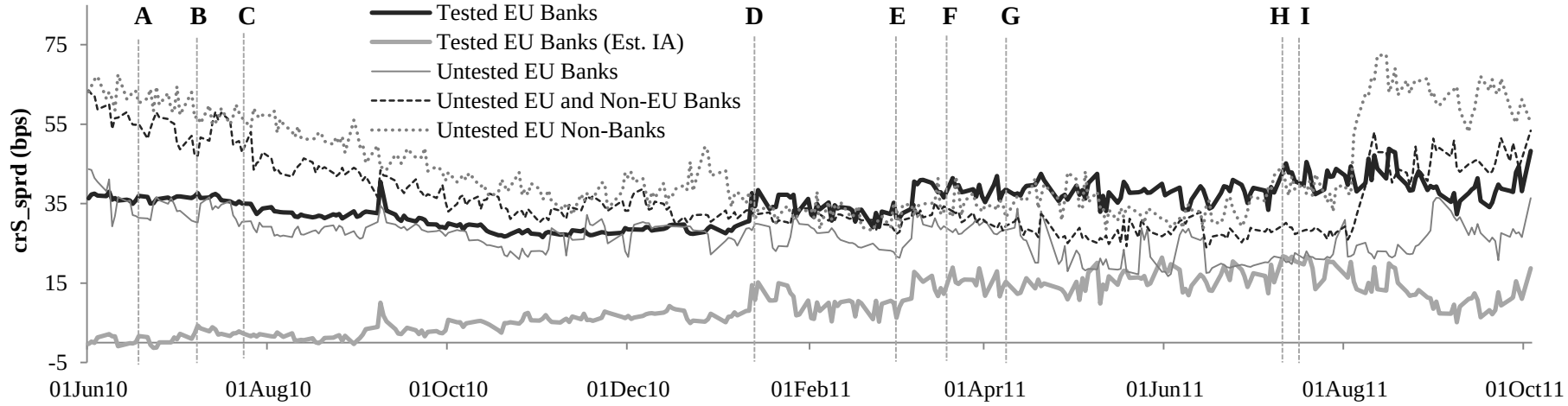
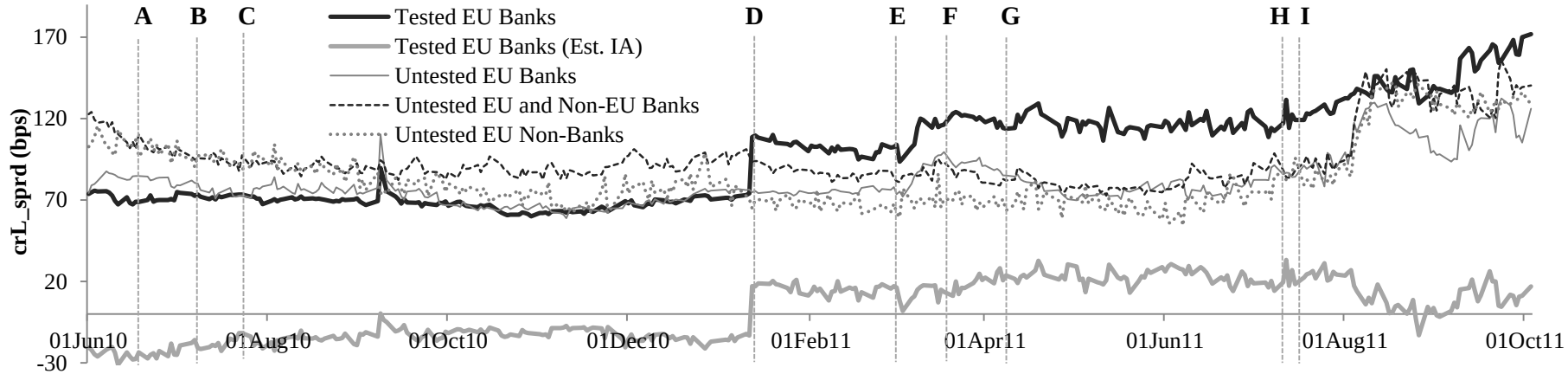
Figure 1: Plot of Short and Long Maturity Bond Bid-Ask Spreads (June 2010 – October 2011)

Panel A: Mean Short Bond Bid Ask Spreads



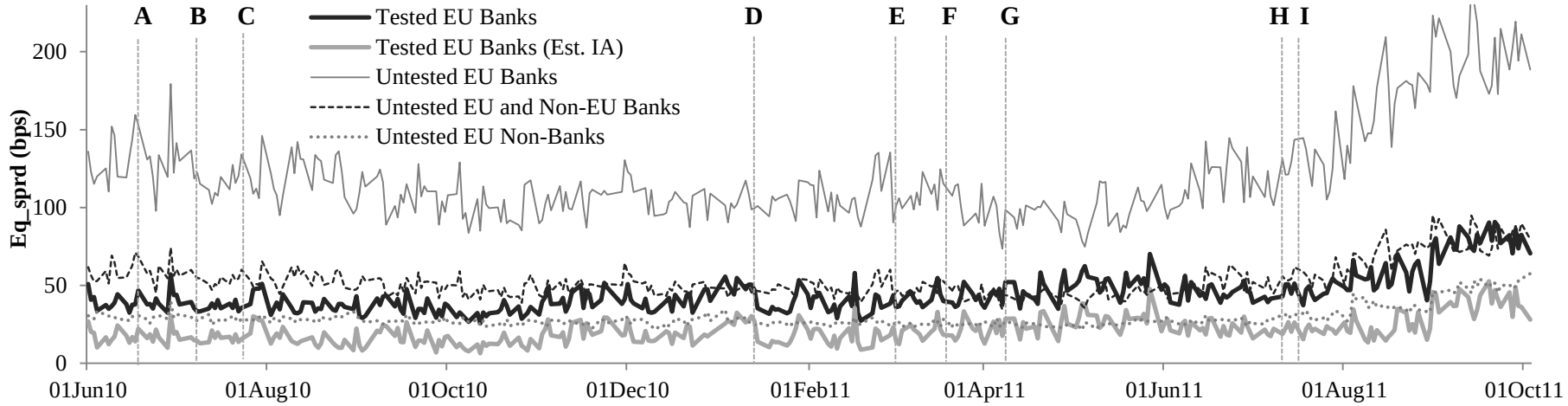
Panel B: Mean Long Bond Bid Ask Spreads



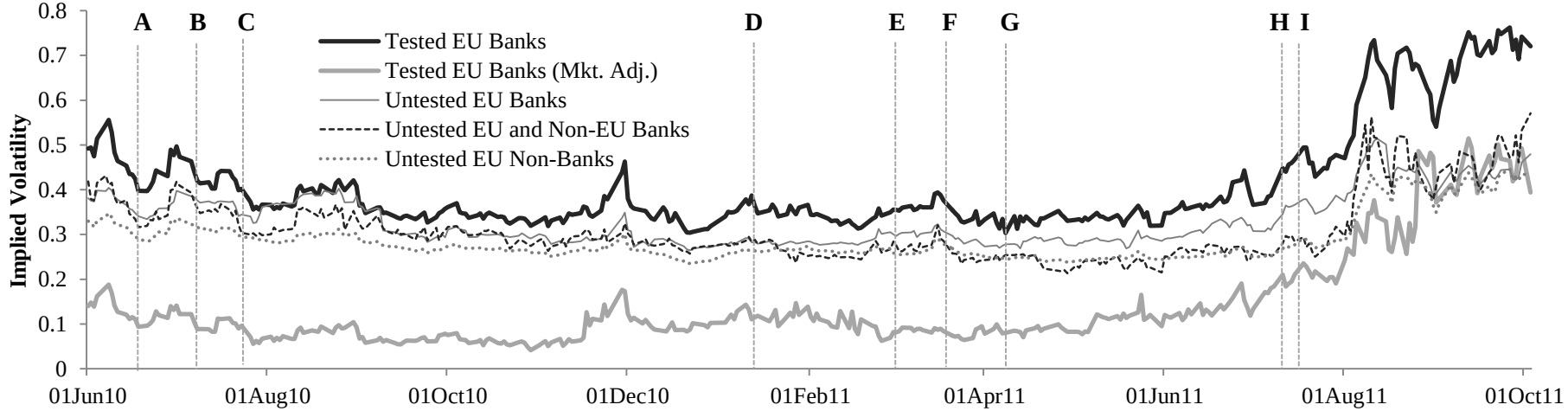
This figure depicts the mean short bond (Panel A) and long bond (Panel B) raw bid-ask spreads for the Tested EU banks and the three potential control groups. The thick gray line is the estimated adverse selection component of bid-ask spreads for the Tested EU Banks. The dotted vertical lines highlight the 9 events related to the stress tests in 2010 and 2011 (See Appendix B).

Figure 2: Plot of Equity Bid-Ask Spreads and Implied Volatility (June 2010 – October 2011)

Panel A: Mean Equity Bid Ask Spreads



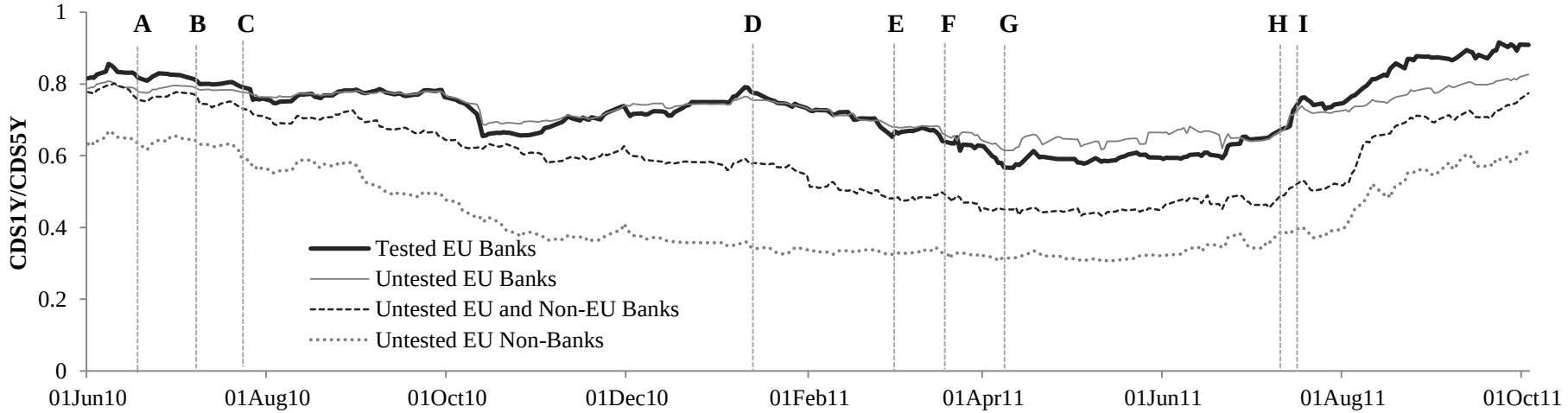
Panel B: Mean Equity Call Option Implied Volatility



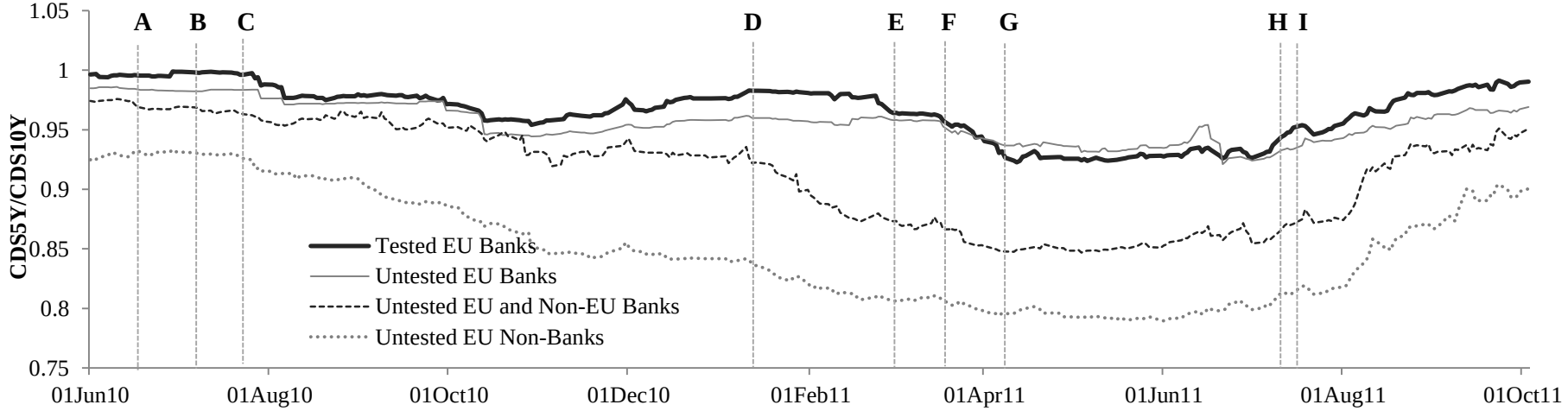
This figure depicts the mean equity raw bid ask-spreads (Panel A) and the implied volatility (Panel B) for the Tested EU banks and the three potential control groups. The thick gray lines are the estimated adverse selection component of bid-ask spreads, and market adjusted implied volatility for the Tested EU Banks, respectively. The dotted vertical lines highlight the 9 events related to the stress tests in 2010 and 2011 (See Appendix B).

Figure 3: Plot of CDS1Y/CDS5Y and CDS5Y/CDS10Y (June 2010 – October 2011)

Panel A: Mean CDS1Y/CDS5Y



Panel B: Mean CDS5Y/CDS10Y

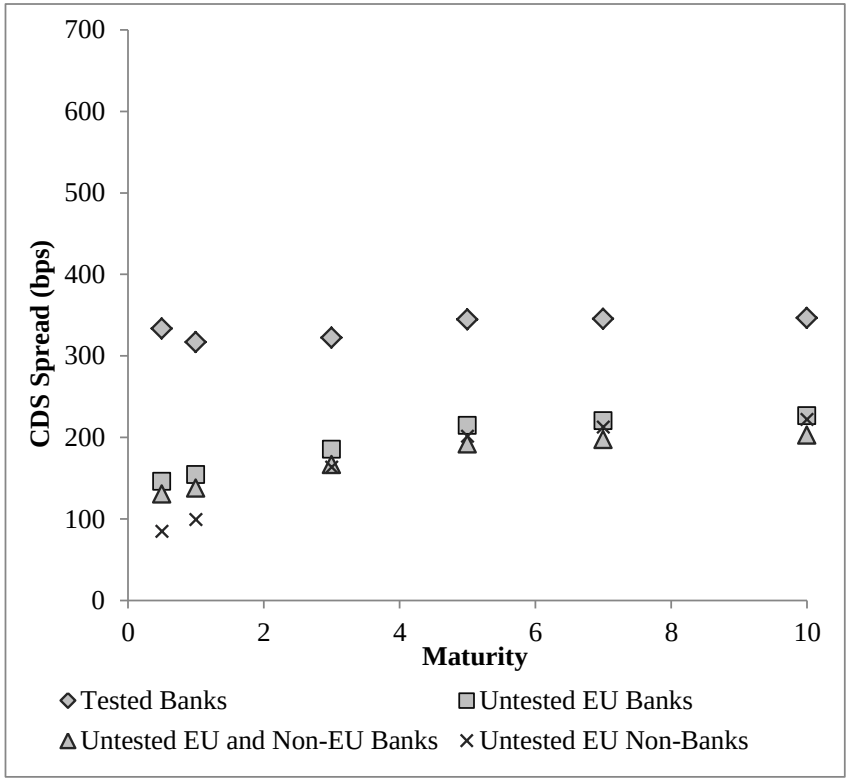


This figure depicts the mean CDS1Y/CDS5Y (Panel A) and CDS5Y/CDS10Y (Panel B) for the Tested EU banks and the three potential control groups. The dotted vertical lines highlight the 9 events related to the stress tests in 2010 and 2011 (See Appendix B).

Figure 4: Stress Test Effects on Credit Term Structure for Tested EU Banks

This figure presents the credit term structure using average CDS spreads at each maturity for the four groups of firms, i.e., the tested banks and the three control groups. The maturities are 6 months, 1 year, 3 year, 5 year, 7 year and 10 year. Figure 4A shows the credit term structure averaged over the three months *prior* to the announcement of the 2011 stress test (Event D) and Figure 4B shows the credit term structure averaged over the three months *after* the release of 2011 stress test results (Event I).

A: Average of Three Months Prior to Announcement of 2011 Test



B: Average of Three Months After 2011 Test Results

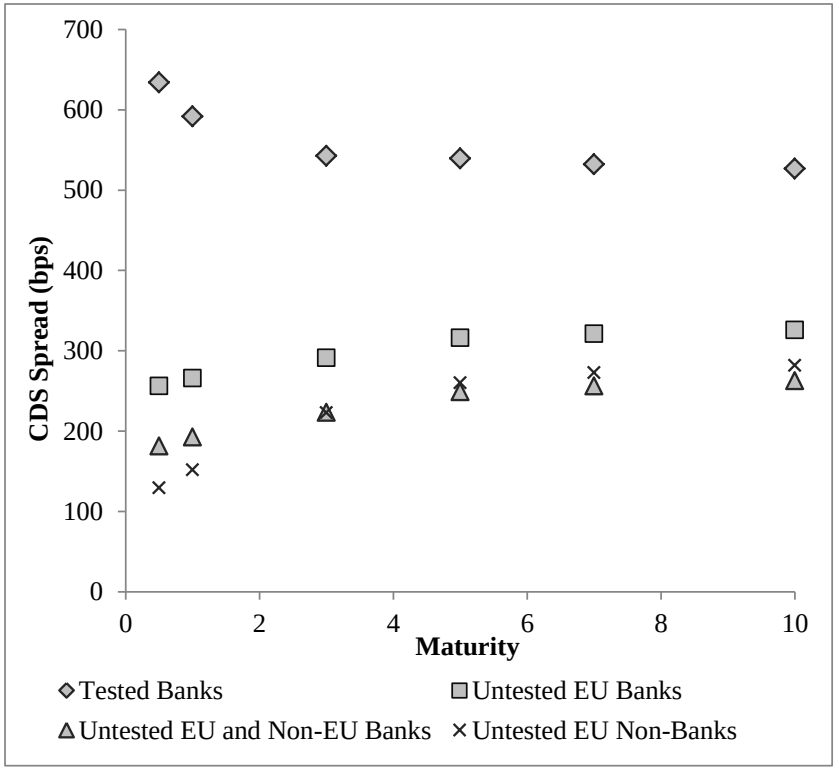


Table 1: Sample of Tested Banks and Matched Control Group Firms

Panel A: Sample Selection Criteria and Distribution by Country

	Tested Banks		Untested EU Banks		Untested Non-EU Banks		Untested EU Non-Banks	
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Identified Firms	97		107		60		840	
Exclusions:								
Less than $5bn Assets			(56)				(413)	
Not Tested in 2011	(7)							
Parent BHC Tested			(8)					
No Market Date	(9)		(1)		(2)			
Full Sample	81		42		58		427	
Removed in Matching	(11)		(3)		(27)		(364)	
Matched Sample	72		39		31		63	
Australia					5	16.1		
Austria	3	4.2	4	10.3			1	1.6
Belgium	1	1.4						
Canada					7	22.6		
Cyprus	2	2.8	1	2.6				
Denmark	4	5.6	3	7.7				
Finland	1	1.4	1	2.6				
France	4	5.6	2	5.1			14	22.2
Germany	7	9.7	3	7.7			13	20.6
Greece	6	8.3	1	2.6				
Hungary	1	1.4						
Ireland	3	4.2					1	1.6
Italy	5	6.9	11	28.2			6	9.5
Luxembourg	1	1.4						
Malta	1	1.4						
Netherlands	2	2.8	2	5.1			3	4.8
Norway	1	1.4	6	15.4				
Poland	1	1.4						
Portugal	4	5.6	1	2.6			1	1.6
Slovenia	2	2.8	1	2.6				
Spain	16	22.2					5	7.9
Sweden	4	5.6					1	1.6
Switzerland							4	6.4
UK	3	4.2	3	7.7			14	22.2
USA					19	61.3		1.6
Publicly-listed Equity	53	73.6	34	87.2	31	100.0	63	100.0
Privately held	19	26.4	5	12.8	0	0.0	0	0.0

This table reports the selection process for the four groups of firms are the exclusion criteria. The table also reports the geographic breakdown on the firms in each group as well as the proportion of firms with publicly listed equity instruments.

Table 1: Sample of Tested Banks and Matched Control Group Firms (continued)

Panel B: Top 25 Propensity Score Matched Firms in Each Sample in Descending FY2009 Assets (US$ bn)

Tested Banks:		**Untested EU Banks:**		**Untested Non-EU Banks:**		**Untested EU Non-Banks:**	
Name	**Assets**	**Name**	**Assets**	**Name**	**Assets**	**Name**	**Assets**
BNP Paribas SA	2,952	Groupe Credit Mutuel	831	Bank of America	2,225	AXA	995
Royal Bank of Scotland	2,740	Standard Chartered plc	437	JPMorgan	2,032	Allianz	815
HSBC Holdings plc	2,365	Credit Industriel Et Comm.	338	Citigroup	1,857	Generali	595
Credit Agricole	2,234	Old Mutual plc	265	Wells Fargo	1,244	Aviva	560
Lloyds Banking Group	1,659	Mediobanca	110	Goldman Sachs	849	Aegon	421
Banco Santander	1,593	Banca Pop. Emilia Romagna	85	Morgan Stanley	771	Prudential	362
Groupe BPCE	1,476	Banca Popolare Di Milano	64	Royal Bank of Canada	593	Zurich Insurance Group	349
Societe Generale	1,469	BAWAG PSK	59	National Australia Bank	584	EDF	347
Unicredit SpA	1,333	Aareal Bank AG	57	Commonwealth Bank	562	Muenchener Rückvers,	306
Intesa Sanpaolo SpA	896	Banca Carige	52	Westpac Banking Corp.	540	Volkswagen	254
RaboBank Group	872	IKB Deutsche Industriebank	51	Metlife	539	Deutsche Boerse	232
BBVA	768	Credito Emiliano	38	Toronto-Dominion Bank	504	Standard Life	225
Nordea Bank AB	728	Credito Valtellines	36	ANZ Banking Group	455	Swiss RE	222
Danske Bank	597	Banca Popolare Di Sondria	32	Bank of Nova Scotia	449	Daimler	185
Landesbank B-W	591	Van Lanschot NV	31	Bank of Montreal	351	BMW	146
Bayerische Landesbank	486	FIH Erhvervsbank A/S	25	Canadian Imperial Bank	304	RWE	134
KBC BANK NV	465	Gruppo Bancario Iccrea	25	State Street	157	Eads (Paris-SBF)	115
BFA-BANKIA	419	Oberbank AG	23	Macquarie Group	131	Fiat	96
Grupo Caixa	390	Sparebank 1 SR Bank ASA	22	National Bank of Canada	120	Peugeot	92
Norddeutsche Landesbank	342	Banif-Sgps SA	21	Keycorp	93	Carrefour	74
Banca Monte Dei Paschi	323	Banco Di Sardegna SpA	20	Northern Trust	82	National Grid	72
Skand. Enskilda Banken	320	Oldenburgische Landesbank	18	M&T Bank	69	Veolia Environnement	71
DnB NOR Bank ASA	314	Sparebanken Vest ASA	17	Huntington Bancshares	52	Baloise-Holding AG	65
Svenska Handelsbanken	294	Aktia OYJ	15	Popular Inc.	35	Unipol	64
Erste Group	289	Banca Popolare Etruria	15	Synovus Financial Corp	33	Ferrovial (BAA)	63
Remaining Banks (47)	5,177	Remaining Banks (14)	129	Remaining Banks (6)	103	Remaining Firms (38)	1,164
Total (*N* = 72)	**31,094**	**Total (*N* = 39)**	**2,812**	**Total (*N* = 31)**	**14,732**	**Total (*N* = 63)**	**8,022**

This table reports the largest 25 firms in each group of firms in terms of FY2009 total assets. The industry breakdown for the 63 Untested EU Non-banks based on the GICS schema is as follows: consumer discretionary (12); consumer staples (3); energy (1); financials (19, of which 17 are insurance firms); industrials (13); information technology (1); materials (1); utilities (13).

Table 2: Descriptive Statistics for Selected Credit Instruments

	Short Dated Bonds				Long Dated Bonds			
Variable	**Tested Banks**	**Untested EU Banks**	**EU and Non-EU Banks**	**EU Non-Banks**	**Tested Banks**	**Untested EU Banks**	**EU and Non-EU Banks**	**EU Non-Banks**
Number of Bonds	74	23	27	129	68	20	38	218
Mean Size Outstanding ($ mm)	1,918	847	1,511	905	1,083	586	1,055	946
Median Size Outstanding ($ mm)	1,623	589	1,055	750	787	362	571	834
Median Issue Year	2009	2009	2008	2008	2009	2009	2008	2009
Median Maturity Year	2012	2012	2012	2013	2019	2016	2018	2017
Mean Coupon (%)	3.5	2.8	4.8	4.9	4.5	3.2	5.0	5.7
Median Modified Duration	0.5	0.6	1.0	0.8	4.7	5.3	3.0	4.1
Bond Rating AA and Above (%)	28.4	8.7	25.9	7.8	13.2	0.0	42.1	6.0
Bond Rating A (%)	23.0	21.7	44.4	38.8	32.4	35.0	23.7	28.9
Bond Rating BBB and Below (%)	13.5	0.0	25.9	40.3	10.3	0.0	0.0	49.5
Unrated or Rating Not Avail. (%)	35.1	69.6	3.7	13.2	44.1	65.0	34.2	15.6
Floating Coupon (%)	24.3	39.1	7.4	4.7	14.7	45.0	10.5	0.9
Straight Coupon (%)	75.7	60.9	92.6	95.4	85.3	55.0	89.5	99.1
Domestic Bond (%)	47.3	30.4	59.3	17.1	47.1	35.0	44.7	11.5
International Bond (%)	52.7	69.6	40.7	83.0	52.9	65.0	55.3	88.5
Year of Issue (% of Bonds):								
Prior to 2002	6.8	4.4	0.0	6.2	2.9	0.0	0.0	3.7
2003 to 2007	29.7	43.5	29.6	41.9	30.9	45.0	34.2	22.5
2008	9.5	0.0	33.3	21.7	13.2	5.0	23.7	6.4
2009	43.2	43.5	37.0	25.6	25.0	15.0	39.5	51.8
2010	10.8	8.7	0.0	4.7	27.9	35.0	2.6	15.6
Year of Maturity (% of Bonds)								
2011	17.6	21.7		0.8				
2012	77.0	65.2	66.7	30.2				
2013	5.4	13.0	33.3	69.0				
2014 to 2017					23.5	70.0	36.8	58.3
2018 to 2020					69.1	30.0	63.2	26.6
After 2021					7.4			15.2

This table reports descriptive statistics for short and long maturity bonds for *Tested Banks* and the three potential control groups of *Untested firms*. For each firm, one bond was selected with a maturity of within 36 months of the stress tests, and another bond was selected with a maturity of 48 months after the stress tests. Credit instrument characteristic data is from Datastream while credit bid-ask spread data is from Bloomberg and Datastream. Modified Duration is as of November 15, 2011.

Table 3: Descriptive Statistics for Primary Variables

Panel A: Dependent Variables

Variable	*N*	Mean	Std. Dev.	P1	P25	Median	P75	P99
Tested Banks:								
Raw Equity Spread (bps)	24,602	52.17	77.68	1.50	7.48	22.35	61.54	392.16
Raw CrS Spread (bps)	32,051	37.33	42.78	2.78	11.81	24.30	45.49	226.71
Raw CrL Spread (bps)	27,330	109.16	97.33	18.97	43.41	82.62	135.12	488.69
Implied Volatility	12,066	0.44	0.18	0.19	0.32	0.39	0.51	1.01
CDS1Y/CDS5Y	20,363	0.76	0.22	0.31	0.60	0.75	0.89	1.35
Control Group 1: Untested EU Banks:								
Raw Equity Spread (bps)	15,787	130.65	113.31	3.11	49.38	94.12	181.14	487.80
Raw CrS Spread (bps)	10,980	27.33	30.28	1.70	11.72	19.91	32.69	184.71
Raw CrL Spread (bps)	8,713	88.98	61.07	14.89	47.35	78.82	116.59	360.44
Implied Volatility	3,710	0.34	0.12	0.20	0.27	0.31	0.38	0.84
CDS1Y/CDS5Y	4,439	0.74	0.16	0.35	0.64	0.75	0.86	1.08
Control Group 2: Untested EU Banks and non-EU Banks:								
Raw Equity Spread (bps)	31,341	73.98	97.48	1.83	10.43	33.82	94.77	458.02
Raw CrS Spread (bps)	19,827	33.07	39.88	2.18	11.89	21.36	36.51	216.48
Raw CrL Spread (bps)	18,973	83.17	64.91	12.47	36.60	73.22	112.81	351.87
Implied Volatility	15,014	0.31	0.13	0.14	0.22	0.29	0.36	0.74
CDS1Y/CDS5Y	10,960	0.65	0.20	0.22	0.50	0.66	0.77	1.11
Control Group 3: Untested EU Non-Banks:								
Raw Equity Spread (bps)	33,266	28.27	50.72	1.57	5.63	11.27	28.15	269.21
Raw CrS Spread (bps)	15,973	51.40	40.36	10.88	27.46	40.18	59.95	232.19
Raw CrL Spread (bps)	28,453	102.79	85.44	18.51	51.26	75.49	118.51	440.20
Implied Volatility	27,623	0.31	0.12	0.15	0.22	0.28	0.37	0.70
CDS1Y/CDS5Y	21,813	0.48	0.16	0.20	0.35	0.47	0.58	0.85

The table reports descriptive statistics for the dependent variables for each group of firms for the period from January 4, 2010 to February 15, 2012 (534 daily observations) observations. The sample contains 72 tested banks, 68 untested EU and non-EU banks, and 63 untested EU non-banks. For the 72 matched tested banks, the maximum available firm-day observations are 38,448. The maximum firm-day observations across all the matched firms are 109,470. For the announcement and disclosure effects analysis four days before and four days after each event are used. All spreads are expressed in terms of basis points for ease of comparison. The table reports the raw bid-ask spreads. In the regression analyses I use natural logarithm of the estimated adverse selection component of bid-ask spreads for each instrument. The implied volatility reported here is the raw (not market adjusted) data. Please see Appendix C for a description of the variables.

Table 3: Descriptive Statistics for Key Variables (continued)

Panel B: Primary Independent Variables

Variable	*N*	Mean	Std. Dev.	P1	P25	Median	P75	P99
Size (log MV)	95,879	8.32	1.81	3.25	7.08	8.47	9.66	11.73
Stock Return Volatility	95,935	0.36	0.19	0.08	0.25	0.33	0.42	1.08
Short Bond Return Vol.	71,304	0.04	0.06	0.00	0.01	0.02	0.04	0.25
Long Bond Return Vol.	78,789	0.09	0.14	0.01	0.04	0.06	0.09	0.69
Freefloat Trading Volume	96,297	0.58	1.05	0.00	0.09	0.32	0.71	4.12
Value Traded (billions)	95,879	0.60	2.36	0.00	0.00	0.02	0.16	11.20
Short Bond Size (log)	73,158	6.85	1.03	3.48	6.38	6.96	7.57	8.78
Long Bond Size (log)	83,304	6.46	1.17	2.62	6.11	6.68	7.25	8.02
Market Volatility Index	109,470	28.22	7.78	18.80	22.49	25.64	31.14	49.50
Daily Market Returns	109,470	0.00	0.01	-0.04	-0.01	0.00	0.01	0.04
Beta	55	1.13	0.50	-0.15	0.90	1.18	1.47	2.14
Book-to-price	55	1.90	2.00	0.00	0.83	1.40	2.19	10.95
Earnings-to-price	55	-0.51	4.17	-30.84	0.04	0.08	0.11	0.70
MacroShock	81	-0.95	0.45	-1.91	-1.20	-1.00	-0.68	1.02
SovRisk	81	3.64	5.01	0.30	1.03	1.96	2.82	20.63
Announced Bailout	81	0.23	0.43	0.00	0.00	0.00	0.00	1.00
Govt. Ownership	81	0.12	0.24	0.00	0.00	0.00	0.17	0.94
Pass 2010 Test	81	0.91	0.29	0.00	1.00	1.00	1.00	1.00
Pass 2011 Test	81	0.81	0.40	0.00	1.00	1.00	1.00	1.00
Market Leverage	55	4.69	5.11	0.31	2.01	3.83	5.31	34.52

The table reports descriptive statistics for the independent variables used in the adverse selection component estimations and the primary regression specifications. The upper half of the table reports the descriptive statistics for all available firm-day observations for all 205 matched firms (72 tested banks, 39 untested EU banks, 31 untested Non-EU banks, and 63 untested EU non-banks) for the period from January 4, 2010 to February 15, 2012 (534 daily observations). The maximum firm-day observations are 109,470 and the number of observations varies based on data availability. The second half of the table reports descriptive statistics for the dependent variables used in the cross-sectional regressions for the 81 stress tested banks (see Table 1, Panel A for bank selection criteria). Public equity data is available for 55 banks. See Appendix C for a description of variables.

Table 3: Descriptive Statistics for Key Variables (continued)

Panel C: Variables Used in Propensity Score Matching

Variable	*N*	Mean	Std. Dev.	P1	P25	Median	P75	P99	*t-stat*
Tested Banks:									
Total Assets (US$ bn)	68	337.66	469.91	8.30	62.07	168.14	332.35	2,365.47	
Market Value (US$ bn)	47	19.40	36.24	0.41	2.51	6.47	15.76	199.26	
Tier 1 Ratio (%)	68	10.63	2.50	7.20	9.04	9.90	11.75	19.70	
Loan Loss Provisions (%)	68	2.00	1.54	0.02	0.87	1.77	2.54	7.19	
Return on Equity (%)	68	1.25	17.63	-81.60	1.25	5.42	9.72	27.94	
Risky Assets (%)	68	50.30	17.67	3.35	38.61	52.73	61.78	83.35	
Financial Leverage (%)	68	94.03	2.49	86.27	92.82	94.37	95.77	98.18	
Total Assets Growth (%)	68	1.48	8.00	-19.61	-2.09	1.42	5.92	20.52	
Control Group 1: Untested EU Banks:									
Total Assets (US$ bn)	39	72.11	154.56	5.72	11.08	20.72	52.08	830.77	*(-0.89)*
Market Value (US$ bn)	35	3.28	8.65	0.04	0.55	0.84	2.57	51.05	*(-1.06)*
Tier 1 Ratio (%)	39	10.51	2.62	6.62	8.68	10.25	11.50	21.00	*(-0.61)*
Loan Loss Provisions (%)	39	2.37	2.18	0.16	0.60	1.55	3.33	9.10	*(-0.35)*
Return on Equity (%)	39	5.88	12.19	-55.49	2.90	5.89	11.60	33.11	*(-0.16)*
Risky Assets (%)	39	60.73	16.34	11.17	50.94	64.69	72.12	85.58	*(1.08)*
Financial Leverage (%)	39	93.30	2.01	88.40	92.26	93.48	94.83	97.40	*(0.02)*
Total Assets Growth (%)	39	3.88	9.51	-20.08	-1.68	2.92	12.16	23.54	*(-0.43)*
Control Group 2: Untested EU Banks and non-EU Banks:									
Total Assets (US$ bn)	68	257.77	465.71	5.72	17.21	44.60	344.73	2,224.54	*(-1.14)*
Market Value (US$ bn)	64	20.71	36.46	0.04	0.80	2.42	24.53	164.26	*(0.78)*
Tier 1 Ratio (%)	68	10.89	2.47	6.62	9.33	10.59	11.99	21.00	*(0.27)*
Loan Loss Provisions (%)	68	1.83	1.85	0.00	0.52	1.25	2.77	9.10	*(-0.80)*
Return on Equity (%)	68	3.68	15.14	-57.99	2.71	7.09	10.72	33.11	*(0.86)*
Risky Assets (%)	68	59.77	16.65	11.17	46.31	60.19	72.25	93.18	***(3.04)***
Financial Leverage (%)	68	93.01	1.97	88.29	91.74	93.28	94.21	97.40	***(-2.64)***
Total Assets Growth (%)	68	3.34	10.94	-20.08	-4.48	0.87	10.46	26.84	*(1.13)*
Control Group 3: Untested EU Non-Banks:									
Total Assets (US$ bn)	63	127.34	194.19	6.16	28.31	49.78	134.06	994.60	***(-2.91)***
Market Value (US$ bn)	63	16.98	18.63	0.71	4.16	11.33	20.56	110.24	*(-0.41)*
Return on Equity (%)	63	5.07	13.64	-24.85	-5.39	8.22	13.90	38.88	*(-0.28)*
Financial Leverage (%)	63	84.20	6.58	75.29	78.52	82.09	89.93	97.93	***(-10.88)***
Total Assets Growth (%)	63	4.36	8.61	-20.27	-0.36	3.41	9.42	30.06	*(1.41)*

This table reports descriptive statistics for the variables used in propensity score matching for the four groups of firms. Accounting data and financial ratios are collected or calculated using fiscal year end 2009 data. See Appendix C for a description of the variables. The last column on the right reports the *t*-statistic for the difference in means between the matched groups of firms and the appropriate set of matched tested EU banks. This table only reports the 68 tested EU banks matched with the EU and Non-EU banks control group (i.e., control group 2). For the *t*-statistics reported for the other control groups, an equivalent number of tested banks are matched before conducting the mean difference tests. Statistically significant differences at the 5% level are shown in bold.

Table 4: Pearson and Spearman Correlations between Dependent and Independent Variables

This table reports correlations for the dependent and independent variables used in the analyses. Pearson correlations are presented in the upper diagonal and Spearman correlations are presented in the lower diagonal. Significance at the 5% level is indicated with an asterisk. See Appendix C for description of variables.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1)	*Eq_Sprd*		0.00	0.04*	0.21*	0.13*	0.15*	-0.01*	-0.23*	0.14*	-0.02	0.10*	-0.38*	-0.05*	-0.09*	-0.01	0.01	0.05*	0.00
(2)	*CrS_Sprd*	-0.08*		0.20*	0.06*	0.13*	0.27*	-0.01*	-0.08*	0.19*	0.29*	0.17*	-0.12*	-0.20*	-0.02*	-0.32*	0.51*	0.08*	0.00
(3)	*CrL_Sprd*	-0.06*	0.18*		0.31*	0.32*	0.41*	-0.01*	-0.25*	0.20*	0.03*	0.21*	-0.02*	-0.04*	-0.15*	-0.14*	0.16*	0.24*	0.00
(4)	*Implied Vol*	0.14*	0.16*	0.36*		0.57*	0.58*	-0.07*	-0.17*	0.62*	0.16*	0.26*	-0.09*	0.00	0.32*	-0.11*	0.36*	0.50*	-0.04*
(5)	*CDS1Y/CDS5Y*	0.17*	0.33*	0.38*	0.65*		0.60*	-0.02*	-0.39*	0.49*	0.29*	0.37*	-0.19*	0.13*	-0.12*	-0.38*	0.62*	0.30*	0.01*
(6)	*CDS5Y*	0.14*	0.29*	0.57*	0.65*	0.82*		-0.03*	-0.49*	0.54*	0.44*	0.35*	-0.27*	-0.02*	-0.13*	-0.28*	0.67*	0.21*	0.00
(7)	*Stock Return*	0.00	-0.01	0.00	-0.06*	0.00	-0.02*		0.03*	-0.01*	-0.01*	0.00	0.02*	0.00	0.00	0.01*	-0.03*	-0.09*	0.46*
(8)	*Size*	-0.39*	-0.15*	-0.14*	-0.22*	-0.39*	-0.48*	0.03*		-0.12*	-0.20*	-0.26*	0.66*	0.38*	0.56*	0.29*	-0.34*	-0.06*	0.00
(9)	*Eq Return Vol.*	0.16*	0.09*	0.06*	0.50*	0.30*	0.23*	0.03*	.0.03*		0.31*	0.33*	-0.07*	0.11*	0.04*	-0.01	0.41*	0.05*	0.02*
(10)	*CrS Return Vol.*	0.12*	0.32*	-0.02	0.11*	0.19*	0.03*	-0.00	-0.33*	0.31*		0.28*	-0.12*	-0.13*	-0.04*	-0.21*	0.56*	-0.01*	0.00
(11)	*CrL Return Vol.*	0.24*	0.21*	0.30*	0.20*	0.24*	0.32*	0.00	-0.30*	0.25*	0.23*		-0.12*	-0.08*	-0.15*	-0.16*	0.36*	0.02*	0.01
(12)	*Trading Volume*	-0.28*	-0.34*	-0.09*	-0.20*	-0.39*	-0.44	0.03*	0.79*	-0.12*	-0.41*	-0.28*		0.25*	0.30*	0.28*	-0.38*	0.02*	-0.01*
(13)	*Bond SizeS*	-0.21*	-0.26*	-0.02*	-0.15*	-0.19*	-0.19	0.02	0.38*	-0.10*	-0.54*	-0.23*	0.53*		0.45*	0.22*	-0.01	0.00	0.00
(14)	*Bond SizeL*	-0.07*	-0.01	-0.17*	0.17*	-0.04*	-0.11	0.00	0.45*	0.24*	-0.13*	-0.26*	0.34*	-0.04		-0.09*	0.05*	0.00	0.00
(15)	*MacroShock*	-0.14*	-0.40*	-0.20*	-0.23*	-0.51*	0.55*	0.02	0.30*	-0.04*	-0.14*	-0.34*	0.53*	0.33*	0.13*		-0.55*	0.00	0.00
(16)	*SovRisk*	-0.03*	0.48*	0.36*	0.26*	0.53*	0.57*	-0.02*	-0.14*	0.06*	0.20*	0.36*	-0.42*	-0.28*	-0.12	-0.84*		0.00	0.00
(17)	*Volatility Index*	0.11*	0.04*	0.23*	0.62*	0.47*	0.36*	0.40*	-0.13*	0.07*	-0.06*	0.02*	-0.02*	-0.01	-0.01	-0.02*	0.00		-0.15*
(18)	*Market Return*	0.01	0.00	-0.00	-0.03*	0.02	-0.00	0.68*	0.01	0.04*	0.01	0.01	-0.01	-0.00	0.00	0.00	-0.00	-0.12*	

Table 5: Difference-in-Differences Event Study of Stress Test Events – Matched Sample

This table reports the coefficients for the difference-in-differences (DID) estimator for the *matched* sample of firms using the four days before and after each event of interest. The coefficient β_3 is the DID estimator.

$$y_{it} = \alpha_0 + \beta_1 EventX_t + \beta_2 Tested_i + \beta_3 EventX_t * Tested_i + X\beta + \varepsilon_{it} \quad (1)$$

where *X* is a matrix of controls including Stock Price when the regressed dependent variable is *Eq_Sprd*, Bond Price when regressing *CrX_Sprd*, Stock Return Volatility when regressing *IVOL* and Market Leverage when regressing *CDS1Y/5Y*. The Volatility Index and Market Return are used as controls in all specifications. See Appendix C for description of variables. Bootstrapped *p*-values are calculated using the methodology described in Section 3.2. The asterisks *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. The average number of observations and R-squared are reported across all events for each group.

		(1)	(2)	(3)	(4)	(5)
Event	*Control Group*	*Eq_Sprd*	*CrS_Sprd*	*CrL_Sprd*	*IVOL*	*CDS1Y/5Y*
Event A	EU Banks	0.1272	-0.0278	-0.0298	-0.0056	0.0067
	EU & Non-EU Banks	0.1094	0.0123	-0.0592	-0.0120	0.0043
	EU Non-Banks	0.0358	0.0490	0.0626	-0.0180	0.0069
Event B	EU Banks	-0.0864	0.0726	-0.0478	-0.0216	0.0093
	EU & Non-EU Banks	-0.1902	0.0727	0.0201	-0.0055	0.0077
	EU Non-Banks	-0.0355	0.1261***	0.0599	-0.0325**	0.0052
Event C	EU Banks	0.0183	0.0315	0.0032	-0.0369	0.0111
	EU & Non-EU Banks	0.1480	0.0802	-0.0067	-0.0169	0.0046
	EU Non-Banks	0.0139	0.0330	-0.0226	-0.0365**	0.0331**
Event D	EU Banks	-0.1884	0.0572	0.2519***	0.0156**	0.0092
	EU & Non-EU Banks	-0.1472	0.0583*	0.2672***	-0.0047	0.0059
	EU Non-Banks	-0.1619	0.0146	0.2405***	-0.0134	0.0182
Event E	EU Banks	-0.0773	0.1604*	-0.0131	0.0099	-0.0013
	EU & Non-EU Banks	0.0216	0.0681	-0.0189	0.0060	0.0001
	EU Non-Banks	-0.1180	0.0978	-0.0448	0.0115	0.0030
Event F	EU Banks	-0.0902	0.0498	0.0718	0.0167	0.0226*
	EU & Non-EU Banks	-0.0743	0.0298	0.0049	0.0118	0.0038
	EU Non-Banks	-0.0968	-0.0233	-0.0388	-0.0024	-0.0103
Event G	EU Banks	0.0841	-0.0254	0.0263	-0.0078	-0.0066
	EU & Non-EU Banks	0.0706	-0.0004	-0.0817	-0.0177***	-0.0120
	EU Non-Banks	0.0633	0.0155	-0.0476	-0.0088**	-0.0135
Event H	EU Banks	0.1672	-0.2051***	0.0120	-0.0656**	-0.0138
	EU & Non-EU Banks	0.0589	-0.0578	0.0686	0.0000	-0.0105
	EU Non-Banks	0.0778	-0.1739***	-0.0780	0.0281**	-0.0210
Event I	EU Banks	0.0174	-0.0186	-0.0316	0.0256**	0.0138
	EU & Non-EU Banks	0.0208	0.0300	-0.0617	0.0336**	0.0372***
	EU Non-Banks	0.0608	0.0687	-0.0414	0.0189	0.0552***
N / R-sq.	EU Banks	*413* / 0.074	*302* / 0.142	*230* / 0.072	*98* / 0.618	*162* / 0.768
	EU & Non-EU Banks	*786* / 0.040	*587* / 0.035	*533* / 0.070	*393* / 0.730	*396* / 0.790
	EU Non-Banks	*831* / 0.038	*546* / 0.055	*702* / 0.206	*589* / 0.715	*562* / 0.642

Table 6: Difference-in-Differences Event Study of 2010 and 2011 Test Results Release

This table reports the coefficient for the difference-in-differences (DID) estimator for the *matched* sample of firms using the one month *before* and after the release of the 2010 test results (Event C) in Panel A, and 2011 test results (Event I) in Panel B. The coefficient β_3 in the following model is the DID estimator.

$$y_{it} = \alpha_0 + \beta_1 EventX_t + \beta_2 Tested_i + \beta_3 EventX_t * Tested_i + X\beta + \varepsilon_{it} \quad (1)$$

where *X* is a matrix of controls including Stock Price when the regressed dependent variable is *Eq_Sprd*, Bond Price when regressing *CrX_Sprd*, Stock Return Volatility when regressing *IVOL* and Market Leverage when regressing *CDS1Y/5Y*. The Volatility Index and Market Return are used as controls in all specifications. The asterisks *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. See Appendix C for description of variables

Panel A: 2010 Test Results (Event C)

	(1)	(2)	(3)	(4)	(5)
Control Group	*Eq_Sprd*	*CrS_Sprd*	*CrL_Sprd*	*IVOL*	*CDS1Y/5Y*
EU Banks	-0.0286	-0.0405	0.0684	-0.0699*	0.0176
	(0.698)	(0.683)	(0.522)	(0.051)	(0.301)
EU & Non-EU Banks	0.0184	0.0870	0.0078	-0.0231*	0.0186
	(0.723)	(0.213)	(0.916)	(0.051)	(0.176)
EU Non-Banks	-0.0760	-0.0678	0.0127	-0.0355***	0.0397**
	(0.173)	(0.342)	(0.777)	(0.000)	(0.013)
Observations / Adjusted R-squared					
EU Banks	*2,169* / 0.082	*1,557* / 0.085	*1,090* / 0.015	*516* / 0.314	*860* / 0.607
EU & Non-EU Banks	*4,213* / 0.024	*3,087* / 0.006	*2,717* / 0.012	*2,064* / 0.613	*2,107* / 0.638
EU Non-Banks	*4,458* / 0.047	*2,881* / 0.064	*3,681* / 0.343	*3,139* / 0.741	*3,138* / 0.426

Panel B: 2011 Test Results (Event I)

	(1)	(2)	(3)	(4)	(5)
Control Group	*Eq_Sprd*	*CrS_Sprd*	*CrL_Sprd*	*IVOL*	*CDS1Y/5Y*
EU Banks	-0.0387	-0.1858**	-0.0445	0.0484	0.0083
	(0.684)	(0.044)	(0.615)	(0.279)	(0.787)
EU & Non-EU Banks	-0.0839	-0.0211	-0.0427	0.0665**	0.0227
	(0.188)	(0.764)	(0.456)	(0.024)	(0.329)
EU Non-Banks	-0.0519	-0.1229**	-0.1462***	0.0884***	0.0502**
	(0.409)	(0.030)	(0.000)	(0.003)	(0.013)
Observations / Adjusted R-squared					
EU Banks	*2,246* / 0.090	*1,713* / 0.117	*1,381* / 0.225	*572* / 0.691	*920* / 0.860
EU & Non-EU Banks	*4,309* / 0.062	*3,312* / 0.060	*3,027* / 0.165	*2,244* / 0.727	*2,251* / 0.835
EU Non-Banks	*4,593* / 0.025	*3,085* / 0.107	*3,930* / 0.210	*3,256* / 0.677	3,232 / 0.776

Table 7: Pearson and Spearman Correlations between Average Changes in IA and IU Measures across 2010 and 2011 Tests

This table reports pair-wise correlations for the average of the four day changes in measures of IA and IU across the two test years for stress test announcement dates (2010A; 2011A) and test result release dates (2010R; 2011R). Pearson correlations are presented in the upper diagonal and Spearman correlations are in the lower diagonal. Significance at the 10% level is indicated in bold italics. See Appendix C for description of variables.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1)	*Eq_SprdΔ 2010A*		0.09	0.09	0.26	-0.02	0.04	0.02	-0.03	0.15	***0.43***	0.00	0.10	-0.14	0.16	-0.13	0.08	0.17	0.07	-0.28	-0.14
(2)	*Eq_SprdΔ 2010R*	0.06		-0.10	-0.09	0.06	-0.09	0.17	-0.07	0.28	0.15	-0.16	***0.43***	-0.21	0.11	***-0.62***	0.07	-0.07	0.30	0.17	-0.03
(3)	*Eq_SprdΔ 2011A*	-0.37	0.21		-0.12	0.07	-0.23	0.18	-0.12	0.01	-0.10	0.03	-0.30	-0.17	0.03	-0.17	0.03	-0.23	-0.22	-0.23	0.03
(4)	*Eq_SprdΔ 2011R*	-0.02	-0.01	-0.16		-0.03	-0.03	-0.03	0.04	-0.10	0.08	-0.15	0.15	0.31	-0.06	0.08	0.35	-0.03	0.02	-0.01	-0.04
(5)	*CrS_SprdΔ 2010A*	-0.05	0.31	***0.62***	-0.10		-0.06	-0.14	-0.14	-0.13	-0.19	***0.43***	0.10	-0.09	0.05	***-0.39***	0.17	0.31	***0.32***	-0.01	0.11
(6)	*CrS_SprdΔ 2010R*	0.15	0.48	0.06	0.19	0.15		0.07	0.04	0.10	-0.10	0.01	-0.08	-0.23	-0.16	0.09	0.21	0.13	0.11	***0.34***	-0.24
(7)	*CrS_SprdΔ 2011A*	-0.24	0.03	0.40	0.01	***0.60***	-0.02		0.24	0.04	0.08	***0.39***	-0.17	-0.33	-0.06	-0.13	-0.06	0.07	-0.11	0.07	0.20
(8)	*CrS_SprdΔ 2011R*	0.17	-0.35	-0.22	0.06	-0.13	0.16	0.27		-0.22	-0.04	0.15	-0.01	0.07	0.17	0.23	0.32	0.05	0.12	0.22	-0.12
(9)	*CrL_SprdΔ 2010A*	-0.45	0.04	0.35	***-0.53***	0.25	-0.33	0.23	-0.20		-0.06	0.19	0.20	-0.10	0.04	-0.15	-0.10	***-0.37***	-0.06	-0.01	0.17
(10)	*CrL_SprdΔ 2010R*	0.21	-0.25	-0.06	-0.11	-0.30	-0.08	0.41	0.34	-0.11		-0.07	0.12	0.18	0.27	-0.27	-0.35	0.24	0.02	***-0.29***	0.13
(11)	*CrL_SprdΔ 2011A*	***0.55***	***-0.51***	-0.23	0.05	-0.09	-0.12	0.18	0.43	-0.06	***0.53***		0.06	-0.32	-0.04	-0.19	-0.14	***0.38***	***0.36***	-0.07	0.27
(12)	*CrL_SprdΔ 2011R*	-0.01	-0.50	-0.41	0.08	0.04	-0.01	0.34	0.24	-0.15	0.20	0.46		-0.02	-0.08	0.32	0.21	-0.07	0.25	0.12	***-0.34***
(13)	*IVOLΔ 2010A*	-0.38	-0.35	-0.31	***0.52***	-0.45	-0.43	-0.21	-0.08	-0.13	-0.10	-0.27	-0.08		-0.01	***0.41***	**-0.39**	-0.16	-0.01	-0.10	0.00
(14)	*IVOLΔ 2010R*	-0.31	0.17	0.14	-0.09	0.08	-0.43	0.07	-0.02	0.17	-0.27	-0.24	-0.09	-0.03		***-0.49***	0.17	0.06	0.17	-0.17	-0.09
(15)	*IVOLΔ 2011A*	0.25	***-0.67***	***-0.52***	0.14	***-0.51***	0.10	-0.48	0.33	-0.34	0.02	0.34	0.32	0.27	***-0.57***		-0.15	-0.09	-0.23	0.20	***-0.40***
(16)	*IVOLΔ 2011R*	-0.06	0.02	-0.05	0.14	0.43	0.38	0.15	0.10	-0.21	-0.38	0.04	***0.58***	-0.31	0.15	0.00		0.02	***0.37***	0.09	-0.33
(17)	*CDS1Y/5YΔ 2010A*	***0.70***	0.13	-0.33	-0.02	0.02	***0.56***	-0.19	0.23	***-0.50***	0.10	0.41	0.29	**-0.56**	-0.26	0.23	***0.54***		***0.55***	0.20	-0.21
(18)	*CDS1Y/5YΔ 2010R*	0.24	-0.06	-0.43	0.07	0.10	0.20	0.27	0.09	-0.14	0.24	0.45	***0.74***	-0.23	-0.18	0.04	***0.62***	***0.62***		0.21	-0.19
(19)	*CDS1Y/5YΔ 2011A*	-0.03	-0.38	-0.17	0.28	-0.02	0.40	0.26	0.20	-0.22	0.31	0.29	***0.58***	0.11	***-0.78***	***0.56***	0.20	0.17	0.43		***-0.46***
(20)	*CDS1Y/5YΔ 2011R*	0.05	0.15	0.01	0.01	-0.42	-0.28	-0.15	-0.26	-0.06	0.41	-0.24	***-0.59***	0.42	-0.19	-0.12	***-0.88***	-0.42	-0.47	-0.15	

Table 8: Information Content of 2011 Test Results (Short Horizon)

This table reports results for *four-day* changes in the dependent variables. The analysis includes only *Tested* banks for the four days after the release of the 2011 Test results. The model with $SovRisk_i$ is used for columns (1), (3), (5), (7) and (9), and with $MacroShock_i$ is used for columns (2), (4), (6), (8) and (10).

$$\Delta y_i = \alpha_0 + \beta_1 SovRisk_i + \beta_2 Bailout_i + \beta_3 GovtOwn_i + \beta_4 Pass2010_i + \beta_5 Pass2011_i + X\beta + \varepsilon_i \quad (4)$$

where *X* is a matrix of controls including *Size* (for *Eq_SprdΔ*), *Market Leverage* (*CrX_SprdΔ* and *CDS1Y/5YΔ*), and *Stock Return Volatility* for *IVOLΔ*.
See Appendix C for description of variables. The asterisks *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	*Eq_SprdΔ*	*Eq_SprdΔ*	*CrS_SprdΔ*	*CrS_SprdΔ*	*CrL_SprdΔ*	*CrL_SprdΔ*	*IVOLΔ*	*IVOLΔ*	*CDS1Y/5YΔ*	*CDS1Y/5YΔ*
SovRisk	-0.017		0.012		-0.019**		-0.007		-0.003	
	(0.488)		(0.223)		(0.013)		(0.718)		(0.414)	
MacroShock		-0.235		0.005		0.093		0.012		-0.095**
		(0.275)		(0.972)		(0.206)		(0.722)		(0.019)
Announced Bailout	-0.026	0.048	-0.204	-0.236	-0.334***	-0.304***	-0.041	-0.040	0.017	0.026
	(0.956)	(0.918)	(0.325)	(0.247)	(0.000)	(0.000)	(0.386)	(0.343)	(0.711)	(0.573)
Govt. Ownership	0.000	0.000	0.005*	0.006*	0.001	-0.000	0.003*	0.002*	-0.002*	-0.001
	(0.976)	(0.995)	(0.082)	(0.094)	(0.354)	(0.988)	(0.070)	(0.065)	(0.069)	(0.332)
Pass 2010 Test	-0.402	-0.482*	0.170	0.220	0.367***	0.357**	0.084	0.084	-0.008	-0.044
	(0.164)	(0.068)	(0.358)	(0.278)	(0.009)	(0.015)	(0.175)	(0.244)	(0.894)	(0.537)
Pass 2011 Test	0.657**	0.703**	0.238*	0.207	0.216**	0.233**	0.027	0.036	-0.034	-0.036
	(0.027)	(0.027)	(0.053)	(0.141)	(0.028)	(0.021)	(0.589)	(0.516)	(0.339)	(0.374)
Size	-0.079	-0.003	0.002	-0.016	-0.010	-0.006	-0.021*	-0.021*	0.014	0.030**
	(0.556)	(0.980)	(0.955)	(0.623)	(0.716)	(0.848)	(0.091)	(0.066)	(0.390)	(0.031)
Market Leverage			0.014	0.014	0.026***	0.027***			-0.000	0.000
			(0.296)	(0.320)	(0.001)	(0.001)			(0.910)	(0.176)
Stock Return Volatility							0.087*	0.071		
							(0.053)	(0.120)		
Constant	0.800	-0.126	-0.475*	-0.290	-0.413	-0.424	0.443**	0.367***	-0.015	-0.225*
	(0.409)	(0.898)	(0.076)	(0.355)	(0.115)	(0.139)	(0.040)	(0.008)	(0.909)	(0.074)
Observations	51	51	47	47	42	42	30	30	40	40
Adjusted R-squared	0.0724	0.0759	0.142	0.1138	0.229	0.192	0.387	0.384	0.1347	0.2451

Table 9: Information Content of 2011 Test Results (Long Horizon)

This table reports results for *one-month* changes in the dependent variables. The analysis includes only *Tested* banks for the four days after the release of the 2011 Test results. The model with $SovRisk_i$ is used for columns (1), (3), (5), (7) and (9), and with $MacroShock_i$ is used for columns (2), (4), (6), (8) and (10).

$$\Delta y_i = \alpha_0 + \beta_1 SovRisk_i + \beta_2 Bailout_i + \beta_3 GovtOwn_i + \beta_4 Pass2010_i + \beta_5 Pass2011_i + X\beta + \varepsilon_i \quad (4)$$

where *X* is a matrix of controls including *Size* (for *Eq_SprdΔ*), *Market Leverage* (*CrX_SprdΔ* and *CDS1Y/5YΔ*), and *Stock Return Volatility* for *IVOLΔ*.
See Appendix C for description of variables. The asterisks *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	*Eq_SprdΔ*	*Eq_SprdΔ*	*CrS_SprdΔ*	*CrS_SprdΔ*	*CrL_SprdΔ*	*CrL_SprdΔ*	*IVOLΔ*	*IVOLΔ*	*CDS1Y/5YΔ*	*CDS1Y/5YΔ*
SovRisk	-0.159		0.007		-0.029***		-0.108*		-0.007***	
	(0.107)		(0.460)		(0.002)		(0.059)		(0.008)	
MacroShock		-0.036		-0.201		-0.126		-0.087		-0.076*
		(0.953)		(0.246)		(0.417)		(0.382)		(0.084)
Announced Bailout	0.750	0.875	0.870***	0.900***	-0.202	-0.207	-0.137	-0.075	0.042	0.066
	(0.220)	(0.134)	(0.000)	(0.000)	(0.532)	(0.535)	(0.262)	(0.597)	(0.537)	(0.324)
Govt. Ownership	-0.004	-0.006	-0.007	-0.006	0.005	0.007	0.003	0.003	-0.001	-0.001
	(0.688)	(0.524)	(0.127)	(0.170)	(0.312)	(0.296)	(0.296)	(0.228)	(0.569)	(0.549)
Pass 2010 Test	-0.311	-0.724	-0.613***	-0.689***	0.292	0.210	0.235	0.048	-0.041	-0.097
	(0.689)	(0.310)	(0.009)	(0.007)	(0.234)	(0.362)	(0.134)	(0.783)	(0.710)	(0.325)
Pass 2011 Test	-0.970*	-0.442	0.208	0.182	-0.114	-0.054	-0.152	-0.077	-0.033	-0.032
	(0.093)	(0.333)	(0.109)	(0.147)	(0.277)	(0.685)	(0.254)	(0.688)	(0.514)	(0.522)
Size	0.072	0.134	-0.074	-0.055	-0.041	-0.011	0.073**	0.083**	0.022	0.045**
	(0.642)	(0.536)	(0.204)	(0.260)	(0.594)	(0.895)	(0.047)	(0.025)	(0.326)	(0.022)
Market Leverage			-0.051***	-0.054***	0.007	0.008			0.000	0.000
			(0.006)	(0.007)	(0.786)	(0.739)			(0.811)	(0.187)
Stock Return Volatility							0.579***	0.307*		
							(0.002)	(0.054)		
Constant	0.758	-0.264	1.131*	0.899*	0.209	-0.225	1.727***	0.438	-0.013	-0.260
	(0.611)	(0.895)	(0.074)	(0.099)	(0.814)	(0.821)	(0.010)	(0.211)	(0.949)	(0.131)
Observations	35	35	44	44	41	41	30	30	40	40
Adjusted R-squared	0.058	0.003	0.097	0.111	0.0687	0.0492	0.438	0.302	0.1837	0.1703

Table 10: Characteristic Regressions for Sovereign Risk and Macroeconomic Shock

This table reports the results of characteristics regressions for the 55 publicly listed Tested banks with the dependent variable as either the three month change in CDS spreads (44 banks with available date) or the three month cumulative equity returns after the release of the 2011 test results (July 15, 2011 to October 15, 2011). The following basic model is estimated

$$\Delta y_i = \alpha_0 + \beta_1 SovRisk_i + \beta_2 Bailout_i + \beta_3 GovtOwn_i + \beta_4 Pass2010_i + \beta_5 Pass2011_i + X\beta + \varepsilon_i \qquad (4)$$

A first version of the model with $SovRisk_i$ is used for column (1) and (3) where the dependent variable is $3M\Delta CDS5Y_i$ (column 1) and $3MRet_i$, respectively. A second version of the model with $MacroShock_i$ is used for column (2) and (4) where the dependent variable is $3M\Delta CDS5Y_i$ (column 1) and $3MRet_i$, respectively.

Depending on the model used, the control variables vary. With $3M\Delta CDS5Y_i$ as the dependent variable, the matrix of controls *X* includes *Size* and *Market Leverage*; with $3MRet_i$.as the dependent variable, the controls including *Size*, *Beta*, *Earnings-to-price* and *Book-to-price*.

See discussion in Section 3.3 for details on $SovRisk$ and $Shock$ and Appendix C for variables description. The asterisks *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

	(1)	(2)	(3)	(4)
	3 Month	*3 Month*	*3 Month*	*3 Month*
VARIABLES	*ΔCDS5Y*	*ΔCDS5Y*	*Returns*	*Returns*
SovRisk	0.207***		-0.054***	
	(0.004)		(0.000)	
MacroShock		-2.305***		0.340***
		(0.001)		(0.002)
Announced Bailout	-0.348	-0.692	-0.143	0.017
	(0.585)	(0.248)	(0.409)	(0.927)
Govt. Ownership	0.000	0.021*	0.000	-0.006
	(0.999)	(0.068)	(0.910)	(0.197)
Pass 2010 Test	0.574	0.257	0.290	0.116
	(0.390)	(0.721)	(0.166)	(0.583)
Pass 2011 Test	-0.066	0.259	-0.106	0.069
	(0.936)	(0.765)	(0.477)	(0.729)
Size	-0.647***	-0.580**	-0.001	0.043
	(0.008)	(0.025)	(0.981)	(0.391)
Market Leverage	0.010***	0.014***		
	(0.000)	(0.000)		
Beta			-0.153	-0.150
			(0.192)	(0.303)
Earnings-to-price			0.002	0.002*
			(0.434)	(0.095)
Book-to-price			0.012*	0.010**
			0.082	0.027
Constant	6.617***	4.427*	-0.129	-0.372
	(0.001)	(0.064)	(0.578)	(0.225)
Observations	40	40	55	55
Adjusted R-squared	0.807	0.802	0.546	0.239