On Becoming an O-SII

("Other Systemically Important Institution")

Alin Marius Andrieș
Alexandru Ioan Cuza University of Iasi, Faculty of Economics and Business Administration
22 Carol I Boulevard, Iasi 700505, Romania
Telephone: +40 232 201435
E-mail: alin.andries@uaic.ro

Simona Nistor
Babeş-Bolyai University of Cluj-Napoca, Faculty of Economics and Business Administration
Teodor Mihali Street, Nr. 58-60, Cluj-Napoca 400591, Romania
Telephone: +40 264 418652
E-mail: simona.mutu@econ.ubbcluj.ro

Steven Ongena *
University of Zürich, Swiss Finance Institute, KU Leuven and *CEPR*
Plattenstrasse 14, 8032 Zürich, Switzerland
Telephone: +41 44 6342951
E-mail: steven.ongena@bf.uzh.ch

Nicu Sprincean
Alexandru Ioan Cuza University of Iasi, Faculty of Economics and Business Administration
22 Carol I Boulevard, Iasi 700505, Romania
Telephone: +40 232 201435
E-mail: sprincean.nicu@uaic.ro

January, 2019

***** Corresponding author. We thank Raffaele Giuliana and participants at the 2017 Wolpertinger Conference (Santander), 2018 Financial Management Association Annual Meeting (San Diego), 2018 IBEFA Summer Conference (Vancouver) EEFS 2018 17th Annual Conference (London) and 2019 ASSA Annual Meeting (Atlanta) for valuable comments. Andries, Nistor and Sprincean acknowledge financial support from the Romanian National Authority for Scientific Research and Innovation, *CNCS – UEFISCDI - Project PN-III-P1-1.1-TE-2016-1855*. Ongena acknowledges financial support from the European Research Council *ERC ADG 2016 - GA 740272 lending*. Pronounce "O-SII" as "Ossi", but do not confuse with the nickname given to former residents of East Germany.

On Becoming an O-SII

("Other Systemically Important Institution")

Abstract

How do financial markets react to the disclosure of the list of Other Systemically Important Institutions by the European Banking Authority? With an event study of bank stock prices, we document that the immediate reaction of the stock market is negative. However, within a few days investors change their perception, both in the case of euro zone and non-euro zone banks. CDS spreads react similarly, increasing first before decreasing almost immediately thereafter. Abnormal returns are more negative for large, traditionally-focused or state-owned banks, and in countries with less competitive banking markets or lower fiscal capacity. In addition, the quantitative or qualitative approach by which O-SIIs are selected, as well as the existence and level of the capital buffers imposed on them, have a significant impact on both the short and long run market reaction. (133 words)

Key words: Other Systemically Important Institutions, bank stock prices, CDS spreads, event study, abnormal returns

JEL classification: G21, G32, G34

1. Introduction

In October 2012 the Basel Committee on Bank Supervision (BCBS) published its framework for dealing with domestic systemically important banks. The Basel framework proposed to apply additional buffer requirements to such institutions in order to account for the externalities that they could exert on the domestic economy in the case of failure or distress. In this context, on April 25th, 2016, the European Banking Authority (EBA) disclosed the first official list of Other Systemically Important Institutions (O-SIIs).[1] These are financial institutions that are systemically important at the national level, a part of them being included on the list of 29 Global Systemically Important Banks (G-SIBs). The latter are banks picked by the Financial Stability Board (FSB) in consultation with the Basel Committee on Banking Supervision from all Systemically Important Financial Institutions (SIFIs).[2]

The annual O-SII buffer assessment process comprises two main steps: first, identifying the O-SIIs within each jurisdiction and, second, assigning bank-specific O-SII buffer requirements to the institutions identified in the first step. Selection of the O-SIIs follows guidelines established by the EBA after consultation with the European Systemic Risk Board (ESRB) and reflects the 12 principles of Basel Committee (BCBS, 2012) to deal with Domestic Systemically Important Banks (D-SIBs). The objective is to identify institutions within the European Union with a significant contribution to systemic risk and negative externalities exerted at the national level. Such contribution can be based on size (e.g., total assets), interconnectedness with the financial system (e.g., intra-financial system assets and liabilities), relevance for the economy (e.g., the amount of payments carried-out at the national level), and/or complexity (e.g., cross-border assets and liabilities) (EBA, 2014). While G-SIBs were required to hold additional capital of 1 to 2.5% Common Equity Tier 1 (CET1) in order to improve their loss absorption capacity (FSB, 2011), being also subject of a tighter and more effective supervision, O-SIIs must maintain a CET1 capital buffer of up to 2% of their total risk exposure.

[1] All European G-SIBs are by default O-SIIs, but not all O-SIIs are also G-SIBs: being relevant at the global level from the standpoint of systemic importance and negative externalities created, the institution is also relevant at the national level; however, being relevant at the national level does not mean that the institution is also important at the global level.

[2] Besides financial intermediaries (banks), SIFIs include insurance companies (non-bank financial intermediaries), and other financial institutions. According to Zhou et al. (2012) SIFIs may jeopardize financial stability through counterparty, liquidity, and contagion risk.

Considering the importance of the publication of the official list for both banks and policy makers alike, first we examine whether the regulatory change regarding O-SIIs *per se* had any effect on the market, then we assess how market participants reacted to the actual designation list. In particular, we investigate how the publication of the O-SII list impacted banks' stock returns and CDS spreads. From the shareholders point of view, we aim to establish if the new regulatory framework had a *stigma* effect, i.e., the included financial institutions are perceived to be less profitable because they must maintain a capital buffer and are subject to tighter supervision which is costly for the bank,[3] *no effect*, i.e., the event does not bring any new information to the market, or a *positive* effect due to the association of O-SIIs with the too-big-to-fail (TBTF) status which increase the probability of future bailouts in case of collapse and may help them to obtain lower funding costs thus increasing the profitability (e.g., Morgan et al., 2014; Gorton and Ordoñez, 2016).

From the bondholders' perspective, who seek protection via CDS, a *negative* reaction of the market can be linked with the fact that being designated as O-SII, and therefore carrying an implicit classification as TBTF a bank might take on more risk and succumb to moral hazard (Acharya and Yorulmazer, 2007; Farhi and Tirole, 2012). On the other hand, by revealing the list of O-SIIs policymakers may help reducing the information asymmetry surrounding the banks and strengthen their capital buffers and compliance with specific regulatory measures. This can result in a safe effect for bondholders and can be associated with a *positive* reaction of the bond market.

Determining which effect dominates is relevant both for shareholders and for bondholders. To answer these research questions, we assess in a first stage the reaction of banks' stock prices and CDS spreads to the O-SII list announcement, employing an event study methodology. First, we study the day when the EBA published the O-SII list, i.e., April 25th, 2016. This day will be henceforth labeled as "the official event". Additionally, we examine whether there was a reaction on the days when the national regulatory authorities submitted the O-SII list to the EBA, henceforth "the national events".[4] Finally, for a comparison with other

[3] Not all the banks are required to build-up additional capital buffers after the designation as O-SSI. In some jurisdictions there is no capital requirement, while in others it varies from 0.5% to 2%.

[4] Each central bank or supervisory authority identified quantitative assessment or through supervisory judgement based on uniform criteria provided by the EBA the national list of O-SIIs. Subsequently, the national authorities notified the ESRB, the ECB and the EBA on these lists that were afterwards published on the ESRB website. The first country that identified its O-SIIs was Denmark on June 25th, 2014 whereas the National Bank of Poland and the National Bank of Bulgaria submitted these lists after the official publication of the O-SIIs by the EBA, i.e., on

designation events, we investigate the financial markets` reaction to the publication of the G-SIBs list by BCBS, the stress tests conducted by the EBA, and the inclusion of financial institutions in the Single Supervisory Mechanism (SSM) by the European Central Bank (ECB). In a second stage, we assess the main drivers of bank stock cumulative abnormal returns, considering bank fundamentals like risk strategies and business models, as well as market characteristics and macro controls.

The empirical findings show that overall the immediate reaction of the stock market is negative, i.e., there seems to be a *stigma* effect of being designated an O-SII. However, in the days surrounding the event, the investors change their perception, resulting in an increase in shareholders' wealth and thus consistent with a *positive* effect and holding for both euro zone and non-euro zone banks. Results for the CDS spreads confirm the outcome obtained using stock returns: we find an increase in CDS spreads and thus a higher cost for the banks initially. However, on the first day after the event, the CDS spreads decrease. Further evidence suggests that the cumulative abnormal returns are not only driven by the events *per se*, being also related to other relevant factors like the existence of a capital buffer imposed to O-SIIs and its level, the approach through which supervisors select banks that present systemic importance, their size, liquidity, noninterest income and ownership structure, the banking market competition, and the countries' fiscal capacity.

Our results are related to a broad literature on intervention mechanisms, regulation and market reaction. As the global financial crisis unfolded, public authorities (both national and supranational) took action making use of different intervention measures and instruments in order to alleviate the consequences and negative externalities (see Goodhart, 2008; Praet and Nguyen, 2008; Panetta et al., 2009). Among the intervention schemes, the most frequently used were deposit guarantees, capital injections, and the setting up of new asset management companies, also known as "bad banks" (Hryckiewicz, 2014). The immediate objective of all these measures was to maintain financial stability that was put at risk especially by the TBTF institutions and to

---

October 21st, 2016, in the case of Poland and December 12th, 2016, in the case of Bulgaria. In the end, the banks identified as O-SIIs by the national authorities were in fact on the official list disclosed by the EBA on April 25th, 2016. Therefore, we consider worth investigating whether there was a reaction of the investors after these "national events" on an aggregated basis, besides the single "official event". Although the EBA guidelines in identifying the O-SIIs were public and the investors could consult the national lists, there still was uncertainty in the market because nobody knew how the final designation list will look like and whether there will be included all the institutions deemed O-SIIs by the national authorities.

restore the confidence in financial markets. However, the efficiency of these intervention policies that used public money is highly debated by academics. An extensive literature examines the impact of regulations and interventions on systemic risk (López-Espinosa et al., 2012; Londono and Tian, 2014; Berger et al., 2016; Nistor and Ongena, 2018), bank stability (Demirgüç-Kunt and Detragiache, 2011; Klomp and de Haan, 2012), bank risk-taking (Agoraki et al., 2011; Anginer et al., 2014) or liquidity risk (Brunetti et al., 2011; Aït-Sahalia et al., 2012). At first glance, these interventions should have positive effects on banks because they provide liquidity and increase confidence from market participants and costumers. However, the empirical findings are inconclusive, either advocating or refuting the overall efficiency of the measures implemented and rescue packages that were provided to the banks. These aspects are of a primordial importance due to the fact that taxpayers' money is usually used for saving the banks and thus judicious actions are expected from governments to reduce the risk posed by the TBTF institutions.

To address the systemically important financial institutions issue, a series of regulatory measures have been proposed. The majority of academics have agreed that imposing capital and/or liquidity surcharges based on institution's contribution to systemic risk in order to absorb future losses may be an appropriate tool to reduce negative externalities (e.g., Elliott and Litan, 2011; Ötker-Robe et al., 2011; Adrian and Brunnermeier, 2016; Acharya et al., 2017). Besides capital surcharges, Elliott and Litan (2011) suggest to limit SIFIs' exposure to individual counterparties, to request additional information to be disclosed and to limit or eliminate certain types of proprietary trading and investment activity. Zhou et al. (2012) consider that the shareholders and creditors should bear the losses (bail-in) and this action should be enforced together with other resolution tools. Ötker-Robe et al. (2011) propose an intensive supervision based on SIFIs' risk and resolution regimes at the national and global level. However, Iwanicz-Drozdowska and Schab (2014) found that there are considerable differences among G-SIBs identified by the FSB and BCBS and that a uniform approach based on capital surcharges may not be appropriate. Also, Elliott and Litan (2011) point out that charging additional capital for SIFIs may not result in less risk-taking.

To assess the impact of regulatory changes on financial institutions using an event study methodology, several studies have been conducted over time, including those of Schwert (1981) and MacKinlay (1997). The most recent papers focus on regulation of systemically important

financial institutions across different regions, such as Europe (Petrella and Resti, 2013; Sahin and de Haan, 2016; Schäfer et al., 2016) and the US (Brewer and Klingenhagen, 2010; Abreu and Gulamhussen, 2013; Morgan et al., 2014; Schäfer et al., 2016). Additionally, there are studies that examine market reaction of SIFIs designation (Bongini et al., 2015; Moenninghoff et al., 2015).

Petrella and Resti (2013) analyze 97 European banks that participated in the 2011 EBA test stress exercise. Their findings suggest no relevant impact on the market concluding that the banks are opaque. Schäfer et al. (2016) assess the reaction of the stock returns and CDS spreads of banks from Europe and the USA to regulatory reforms, after the crisis (i.e., Dodd-Frank Act in the USA, Vickers Report in the UK, Restructuring Law in Germany, and TBTF Regulation in Switzerland). With a sample of the 10 biggest banks in terms of market capitalization from the UK, the US, Germany, and Switzerland, the authors argue that the regulatory announcements led to a decrease in banks' stock prices and an increase in CDS spreads. Sahin and de Haan (2016) found limited market effects in terms of stock returns and CDS spreads to the ECB's Comprehensive Assessment for 14 banks from the euro area.

For the US market, Brewer and Klingenhagen (2010) show that the largest TBTF banks experienced positive abnormal returns following the Troubled Asset Relief Program (TARP) comparing with their smaller peers, whilst Abreu and Gulamhussen (2013) find no evidence of abnormal performance for the TBTF institutions following the FSB designation list. However, Morgan et al. (2014)'s analysis for the 19 largest US banks holding companies reveal the importance of stress testing, suggesting that stress tests can reduce banks' opacity. The findings of Moenninghoff et al. (2015) empirically show that the government ownership influences the abnormal performance of banks. Furthermore, the analysis of Bongini et al. (2015) conducted for 70 of the world's largest banks, including G-SIBs, highlights the importance of banks' capital adequacy ratios. They provide evidence that banks with high capital adequacy ratios have positive abnormal performance whilst their peers (i.e., banks with low capital adequacy ratios) experience negative abnormal performance.

Our work contributes to the literature in at least two ways. First, we provide estimates on the appropriateness and the necessity of disclosing financial institutions that are systemically important. To our knowledge, no other studies have assessed the reaction of banks' stock prices and CDS spreads to the O-SII list publication. Second, we contribute to the literature on O-SII

determinants by identifying the main drivers of the cumulative abnormal returns. In our analysis, we focus on a large spectrum of (theoretically motivated) bank-specific characteristics such as size, leverage, credit risk, non-interest income, liquidity, distance to default, ownership structure, international activity, as well as macro attributes like competition in the banking market, fiscal capacity, bailouts provided by government, banking crisis in the home country, and regulatory framework.

The empirical specifications also include the level of CET1 capital buffer that some of the O-SIIs must hold and the way banks were identified as O-SIIs (i.e., using a quantitative approach or through supervisory judgement). We find that, on the event day, abnormal returns are more negative for banks with large size, with less non-interest income, and in countries with lower requirements regarding the level of CET1 capital buffer for O-SII-s (or their absence) and where the identification of O-SIIs is assessed through supervisory judgement. These are the banks that may have less leeway to mitigate the immediate negative impact of inclusion (in the local shadow banking sector for example), especially in countries where O-SIIs buffer restrictions are relaxed. In a longer period after the event, investors are additionally influenced by the liquidity of banks and their ownership structure, the abnormal returns being more negative for financial institutions with a good liquidity situation or where the state is shareholder. From a macro perspective, more negative abnormal returns are associated with a reduced competition in the banking market and for countries where the government has lower fiscal capacity to absorb the consequences of a bank failure.

The remainder of our paper is structured as follows: In Section 2 we describe the sample, event dates and the methodology we employ, in Section 3 we discuss the empirical findings, and in Section 4 we conclude.

2. Data and methodology

2.1 Sample

Our sample consists of a number of banks included in various lists on systemically important financial institutions published by supervisory authorities. First of all, we consider the official list of other systemically important institutions published by the European Banking Authority (April 25th, 2016). Second, an event study is carried out for the globally systemically important banks as

defined by the Financial Stability Board and the Basel Committee on Banking Supervision (the list was first published on November 4th, 2011 and is renewed each year).[5] Third, we focus our attention towards the banks that had been included on the list for the stress test exercises conducted by the EBA. Finally, we analyze the effect of being included in the SSM list of the ECB (the list of supervised banks was first released on September 4th, 2014 and is also renewed each year).

For all these lists, we select the banks with available data on stock prices and CDS spreads on Thomson Reuters Datastream and Bloomberg databases. To have a more representative sample and to eliminate the survivorship bias, we also pick the stocks that are currently not traded anymore (appear as "dead" on Datastream) but have prices and CDS spreads for the event day, event window, and estimation window. A detailed list of all these banks is provided in Table 1.

INSERT TABLE 1

Starting from the O-SII list published by the EBA (2016) that consists of 173 financial institutions, we include in our initial sample just the banks with data on stock prices available for the event window and an estimation period of 250 trading days prior to it. From the initial set of banks, 72 are subsidiaries of other banks or financial holdings, and 116 are not public at the time of the designation. From the list of 57 publicly traded banks, two of them are subsidiaries of Nordea from Finland and Denmark,[6] and one of them is ABN AMRO for which we did not have enough observations to compute the expected return (it was relisted in November 2015). We arrive at a sample consisting of 54 banks for conducting the event study on the EBA official event, and 64 banks for investigating the market behavior for the national events date. These data represent 24 countries, 15 euro area and 9 non-euro area countries. The number of banks per country ranges from 1 to 8, countries with the largest number of banks are Poland (8 banks),

[5] Because the Financial Times twice leaked a list with the supposed G-SIBs before the publication of the official list, we also undertake an analysis of G-SIBs with the event day being 30 November 2009 (Financial Times). 20 out of 24 banks disclosed by the newspaper proved out to be on the official list G-SIBs list when it was first published.

[6] Nordea relocated its headquarter in Finland in 2017, so at the time of the publication of the O-SIIs list it was considered a Swedish bank and was placed outside the euro zone.

Spain (6 banks), and the UK (5 banks). For the official event we do not include the banks from Poland and Bulgaria, as they do not appear on the official list disclosed by the EBA. Therefore, we have 54 for the official event, and 64 banks for the national events. Table 1 presents the sample of the O-SIIs included in our analysis and information regarding their size as of December 31st, 2015 (previous to the publication of the list). Our sample represents 65.55% of the total assets of the EU credit institutions and 92.06% of the total assets of the credit institutions within the euro area at the end of 2015.[7] The largest banks are those from the UK, representing 27.33% of our sample's size while the weight of the total assets of the euro area O-SIIs in the sample is 62.08%.

The list of the O-SIIs used for the event study on CDS spreads is also shown in Table 1. As it includes only banks with data on CDS spreads available in Datastream and Bloomberg, for the event window and an estimation period of 250 trading days prior to it, the composition differs from the previous sample and it includes 40 banks for the official event analysis, and 41 banks for the national events analysis. They represent 14 countries and the number of banks per country ranges from 1 to 6, Germany, the UK, Spain, and Sweden being the countries represented by the largest number of banks.

2.2 Event dates

For an in-depth analysis and in order to capture all the relevant abnormal returns, we take into consideration several event dates for each list of banks. Hence, for the O-SIIs the official date when EBA published the list is used along with the very first time (not considering the subsequent days) when the national banks of each country where the banks' headquarters are located sent the notification with the O-SIIs to the European Systemic Risk Board (the unofficial date). In this way we can assess whether there is a difference in terms of effects between these two event dates and how the market reacted to these two announcements that can be considered international and domestic, respectively.

[7] According to ECB (2016), the total assets of credit institutions in 2015 headquartered in the EU amounted €33,798 billion whilst the total assets of credit institutions within the euro area amounted €24,067 billion. The sum of total assets for our sample of 54 banks is €22,156.11 billion.

For the G-SIBs, the relevant dates are the official date when the FSB published the official list (November 4th, 2011) and the first date when the *Financial Times* publication leaked the supposed list (November 30th, 2009).[8] As for the banks subject to stress testing, we take as the event date the first time when that particular bank was on the list published by EBA, starting from 2010 when for the first time the sample of banks was made public. The same procedure is applied for the banks included in the Single Supervisory Mechanism. For all these sub-samples we consider as event date the day when the banks were first included in any of these lists. By conducting such an analysis, our main purpose is to assess which of these events were the most significant (and did bring new information in the market) in terms of abnormal returns. A timeline with all the events is represented in Figure 1.

INSERT FIGURE 1

2.3 Methodology

2.3.1 Abnormal return computation

In our analysis, in order to determine the impact of the designations to certain categories by specific regulatory bodies (i.e., O-SIIs, G-SIBs, EBA stress test, and SSM), we closely follow the standard event study techniques used in the literature, such as Schwert (1981), MacKinlay (1997), and Lamdin (2001). Schwert (1981) and Lamdin (2001) implement and assess the usefulness of event studies in the case of regulatory changes, while MacKinlay (1997) discusses the structure and the framework of event studies in general. It is worth mentioning that the pioneers in this field are Fama et al. (1969).

In the literature, the most used models for computing the abnormal return (AR) are the market model, the Capital Asset Pricing Model (CAPM) and the Fama and French factor models. A concern related to these models is that they ignore the complexity of globalized markets in which the markets may not be perfectly integrated, but rather segmented (Bekaert and Harvey, 1995; Bekaert et al., 2009). Integration is assumed when the company's stockholders hold

[8] We do not analyze the second date of publication in the *Financial Times* (one year later) because it contains the same banks (24) as the first publication.

globally diversified portfolios whereas segmentation describes the situation when the stockholders are located and invest mostly in the home country (Bodnar et al., 2003).

To overcome these drawbacks, we follow the approach proposed by Bekaert et al. (2009), simultaneously allowing a regional and a global benchmark (i.e., a hybrid CAPM), besides the single global, regional or local benchmark indices used in the aforementioned models. Their model allows for the exposure to global and regional factors at the same time and has the potential to capture the international or regional integration. We apply their approach with small modifications in the sense that we use the global and regional indices already computed by relevant providers and do not construct them from our sample because it contains only European banks and therefore we cannot construct a global index. Brooks and Del Negro (2005) find that region effects are relevant in explaining the return variation accounted for by within-region country effects. Therefore, we use a global benchmark – the MSCI World Index - and two regional benchmarks – the Eurostoxx 50 for euro zone banks and the STOXX Europe 600 excluding euro zone for non-euro zone banks, within the following equation:

$$R_{it} - r_f = \alpha_i + \beta_i(R_{mt1} - r_f) + \delta_i(R_{mt2} - r_f) + \varepsilon_{it} \quad (1)$$

where α_i is the intercept, $R_{it} - r_f$ is the excess log return of bank *i* at time *t*, $R_{mt1} - r_f$ is the excess log return of MSCI World index at time *t* (the global index), $R_{mt2} - r_f$ is the excess log-return of either Euro Stoxx 50 or STOXX Europe 600 excluding euro area indices (the regional indices), r_f is the risk-free rate and ε_{it} is the disturbance term, which is assumed to be independent and identically distributed (*iid*) with a mean of zero and a constant variance. In order to compute the excess return we use as a free-risk rate the one-month Treasury-Bill rate, alongside with the log-returns computed for stock prices denominated in US dollars. Because the global and regional benchmarks are highly correlated, we orthogonalize the returns of Euro Stoxx 50 and STOXX Europe 600 excluding euro area with respect to the returns of MSCI World Index employing an OLS regression and using the errors in the Eq. (1) as the regional indices. The abnormal return for each bank *i* at time *t* is determined from the Eq. (1) as below:

$$AR_{it} = R_{it} - r_f - [(\alpha_i + \beta_i(R_{mt1} - r_f) + \delta_i(R_{mt2} - r_f)] \quad (2)$$

A positive value of AR implies that the actual return is greater than the predicted one (i.e., the market value of banks increases following the event; market participants consider the event to be beneficial), while a negative value of AR denotes a smaller normal return comparing to the expected one (i.e., the market value of banks decreases following the event as market participants consider the event harmful).

Besides the modified CAPM of Bekaert et al. (2009), we employ other methods in robustness exercises in order to compute the expected return, including the modified market model (with MSCI World index, Eurostoxx 50 and STOXX 600 excluding euro area as benchmark indices) and a simple CAPM with MSCI World index as the market index and one-month Treasury-Bill rate as the risk-free rate. A detailed description of the variables is provided in Table 2.

INSERT TABLE 2

As a robustness check, we use the simple market model for the event study on mid-rate CDS spreads reaction. Firstly, we could not identify a global CDS index and secondly, the sample of CDS spreads would have been much smaller if we had used the CDS spreads denominated in US dollars instead of CDS spreads denominated in EUR. Therefore, we adopted the market model, having the following form:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt} \qquad (3)$$

where R_{jt} is the log-return of bank *j*'s CDS spread at time *t*,α_j is the constant term, β_j is the slope, R_{mt} is the market portfolio log-return at time *t* and ε_{jt} is the *iid* error term. The main market index to compute the abnormal performance and betas for all the events is *iTraxx Europe 5 years CDS index* collected from Bloomberg. We account for thin trading on a trade-to-trade basis as suggested by Maynes and Rumsey (1993).

Next, following Brown and Warner (1985) we compute the average abnormal return (AAR) across all banks from our sample:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (4)$$

where *N* is the number of banks.

Further, to assess the stock reaction over a longer period of time we sum all the abnormal returns obtained using Eq. (1) over any interval in the event window ($[t_1; t_2]$) around the event date to obtain the cumulative abnormal return (CAR) as in Morgan et al. (2014):

$$CAR\ [t_1;\ t_2] = \sum_{t=t_1}^{t_2} AR_{it} \quad (5)$$

Using the same approach as in Eq. (2) we aggregate the average abnormal returns over the interval $[t_1; t_2]$ to get the cumulative average abnormal return (CAAR) as specified by MacKinlay (1997):

$$CAAR\ [t_1;\ t_2] = \sum_{t=t_1}^{t_2} AAR_t \quad (6)$$

The global systemically important banks sample includes several banks with headquarters outside the Europe (the United States and Asia). If an event is taking place in Europe the news will reach Asian markets only in the following day because the stock market would be already closed. Thus, we adjust this issue by setting the non-weekend events to the following day and the weekend events to the next Monday.

The event study is performed over an estimation window of 250 trading days prior to each event window, as in MacKinlay (1997). In order to check the robustness of our results, we run all the specifications using an alternative estimation window of 150 trading days.

Finally, regarding the event window length, in order to measure the abnormal performance we consider four sets of event windows: [0; 0], [-1; 1], [-3; 3], and [1; 5]. Firstly, similar to Moenninghoff et al. (2015), we use a one-day sampling interval as the event dates are precisely defined and we attempt to mitigate the effect of confounding events and to exclude additional noise from other events occurring during the financial crisis. Secondly, following Bongini et al. (2015), we aim to account for both the risk of a news leak before the event date (we use [-1; 1], [-3; 3]) and the possibility that investors will react slowly to the implications of the news (we use [1; 5]).

2.3.2 Significance tests

For more conclusive results, we test the significance of cumulative average abnormal returns using both parametric and non-parametric tests. As parametric tests, we employ *the classic t-test*, and *standardized residual test* of Boehmer et al.'s (1991). As non-parametric tests, we apply *the generalized sign test* (Cowan, 1992) and the *Corrado and Zivney rank test* (Corrado and Zivney, 1992).

The parametric tests are based on the assumption that the abnormal returns are normally distributed. However, this is not the case as the empirical observations have shown that the daily returns display fat tails due to time-varying volatility, skewness resulting from mean non-stationarity, non-linearity dependence, and volatility clustering as pointed out by Pagan (1996). The widely used *t-test* has a strong predictive power (Brown and Warner, 1985) but is based upon the underlying assumption that the residuals are not correlated across securities (are cross-sectional independent).

To overcome this drawback several tests have been developed in the last years. Boehmer et al. (1991) proposed *a test of standardized residuals* corrected for event-induced changes in volatility. The test is based on the standardization procedure proposed by Patell (1976), taking into account the heteroskedasticity of event-window abnormal returns. *The generalized sign test* has the great advantage of being robust for skewed returns. Corrado and Zivney (1992) introduced the Corrado and Zivney rank test corrected for event-induced volatility of rankings, also being well specified to skewed returns. All the tests have the null hypothesis that the cumulative average abnormal returns are equal to zero whilst the alternative hypothesis specifies that the cumulative average abnormal returns are different from zero. A methodological description of the tests employed to assess the statistical significance of the CAARs is given in the Appendix I.

2.4 Identifying the determinants of cumulative abnormal returns

Even though the abnormal returns are mainly influenced by the event *per se*, it is of interest to study other relevant factors that may have a significant influence over the abnormal performance of the financial institutions. For this purpose, we run a cross-sectional regression model for the O-

SIIs sample using the *OLS method* and the cumulative abnormal return (CAR) as dependent variable, similar with MacKinlay (1997). The model takes the following form:

$$CAR_{ij}\,[t1;\,t2] = \alpha + \beta_1 \times O\text{-}SIIs\ Characteristics_{ij} + \beta_2 \times Bank\ Characteristics_{ij} + \beta_3 \times Macroeconomic\ Characteristics_j + \varepsilon_{ij} \quad (7)$$

where $CAR_{ij}\ [t1;\ t2]$ represents the cumulative abnormal return of bank i from country j during the event window, α is the constant term, $O\text{-}SIIs\ Characteristics_{ij}$ is a vector of bank-level specific variables related to the capital requirements and identification of O-SIIs, $Bank\ Characteristics_{ij}$ is a vector of bank-level specific controls, $Macroeconomic\ Characteristics_j$ is a vector of country level indicators reflecting banking market conditions and macroeconomic fundamentals, and ε_{ij} is the error term. The standard errors are clustered at the country level. The variables have an annual frequency and we consider their values as of December 31st of the year before the event took place. A detailed description of them is provided in Table 2.

Because the market reaction to the publication of O-SIIs list is different during the event day in comparison with the subsequent days, we assess the determinants of the cumulative abnormal returns considering two intervals: the event day, corresponding to the [0;0] window, and a longer-term period following the event, corresponding to the [1;5] window.

First, we investigate the impact of O-SIIs attributes on the market reaction following the official release of the O-SIIs list by EBA. One of the most important challenge for these institutions is the additional capital requirements they must hold after the designation. In some jurisdictions there is no capital requirement, while in others it varies from 0.5% to 2%. We construct a variable *Buffer* that reflects the level of CET1 capital that the O-SIIs must increase up to 2% of the total risk exposure. Investors can expect more positive abnormal returns for banks that must hold additional capital buffers, as this will increase their loss-absorbing capacity and will strengthen their resilience. Also, this might reduce the moral hazard behavior in terms of risk-taking. Besides, a negative reaction might be also expected, if the increase in capital regulation will affect the profitability of banks. Next, we differentiate among institutions that were identified as O-SIIs through supervisory judgment and those that were chosen based on quantitative criteria. We use a dummy variable *Supervisory judgment* from EBA, that takes the value one when the banks are selected based on qualitative criteria like national characteristics or

individual functions, and zero when a quantitative set of indicators (based on banks' size, importance, complexity and interconnectedness) is used to choose the institutions with systemic importance at the national level. Using the qualitative procedure, the authorities may depict small institutions as being systemically relevant, which otherwise have not been designated as O-SIIs through the quantitative approach. On one side, the effects of this assessment might generate positive expectations on the market if national specificities are captured appropriately when a bank is designated as O-SII. On the other side, the qualitative approach might generate negative abnormal returns as it may be subjective and it may not be implemented in a harmonized manner across countries. Further, we exploit the cross-border spillovers by focusing on the role that the parent banks have in the transmission of shocks to their subsidiaries. In this line, we construct a dummy variable that takes the value of 1 if the bank is a subsidiary of other O-SII and 0 otherwise (*Dummy O-SII subsidiary*). Being part of a group where the parent is also selected on the O-SIIs list implies greater control of the cross-border spillovers due to stricter supervisory requirements and/or the fulfilment of additional capital requirements for the parent bank, which might generate positive expectations on the market.

Second, we examine whether differences in terms of risk and business models across banks influenced market reactions to the assessment of O-SIIs. To account for heterogeneity among bank fundamentals, the following characteristics are included in our analysis: size, leverage, credit risk, and liquidity risk. *Size*, measured by the natural logarithm of total assets, might be linked with negative cumulative abnormal returns if large financial institutions are engaged in risky operations or if they undertake complex projects that are too difficult to supervise (Laeven et al., 2016). Also, they might experience positive abnormal returns following the designation as large banks have the capacity to increase their profitability and diversify better their risk (Diamond, 1984). *Leverage*, defined as the percentage of the total debt in common equity, could also affect the abnormal returns. We expect lower stock returns for institutions with higher leverage as they have a greater contribution to systemic risk (Brunnermeier et al., 2012). As a proxy for *Credit risk ratio* we use the non-performing loans over total loans. A bank with a high credit risk ratio is expected to be riskier due to the fact that it could have a great amount of uncollectable or trouble loans, affecting negatively the abnormal performance. In contrast, banks can experience positive expectations from investors if they maintain an adequate liquidity situation, reflected by a high ratio of Cash and due from banks and Investments to Total deposits.

To reflect the diversity across business models of banks we account for the investment activity reflected by the non-interest income. Banks focused on investments have a larger share of non-interest income in total revenues, while traditional banks present a higher share of lending in total assets. Being on the O-SII list, investment banks may obtain lower funding costs due to a more stringent regulation which may be viewed as positive by investors. But non-traditional banking activities may also generate an increased contribution to systemic risk (Brunnermeier et al., 2012).

Also, we distinguish among the ownership structure by including a dummy variable that takes the value of 1 if the state is a shareholder, regardless its participation, and 0 otherwise. Government owned banks are more likely to receive public funds in case of collapse (Faccio et al., 2016). This may increase lending, but it may also generate an aggressive risk-taking behavior (Demirgüç-Kunt and Detragiache, 2002). Moreover, state-owned banks may be less efficient than the private ones (Berger et al., 2005). In an alternative exercise, we include a foreign ownership dummy that takes the value one if 50% or more of banks' shares are owned by foreigners and 0 otherwise (Dummy foreign ownership). Foreign banks can increase financial stability by providing better access to financial services and stimulate the domestic competition (Claessens, 2001). Yet they also may enhance the transmission of cross-border shocks.

Besides the bank characteristics, variables reflecting the regulatory changes and other designation lists can affect banks' cumulative abnormal returns. First, we consider the designation list of ECB regarding the SSM that comprises significant and less significant financial institutions from Europe. A dummy variable takes the value 1 for banks included on this list and the value 0 otherwise (Dummy SSM). The aim of this framework is to maintain financial stability in the European banking markets. The euro area countries are by default part of this mechanism, but other EU countries could voluntary join the SSM.[9] Being on this list could result in positive abnormal returns following the designation of the O-SIIs, but at the same time the market could anticipate this move and consequently have no reaction. Next, our analysis accounts for the stress testing exercise of EBA used to assess the soundness of the financial institutions in the EU. A dummy variable takes the value 1 for banks included in this stress testing exercise and

[9] We have initially included in the model a dummy variable for the euro zone countries, but it is highly correlated with the Dummy SSM, thus we have eliminated it.

the value 0 otherwise (Dummy EBA). As in the case of the SSM list, there could be either a positive abnormal performance or no market reaction.

As some of the banks from our sample are engaged in international activities, we include a dummy variable that takes the value of 1 if the bank is present in other countries and 0 if it only has a domestic presence. Operating in other countries increase the exposure of banks to cross-border spillovers which can have negative effects and reduce the confidence of investors (Ongena et al., 2015).

In order to measure the overall risk of banks we use banks' *distance to default* (DTD_{ij}) of Duan and Wang (2012). The risk measure is a metric based on options valuation and it is expressed in standard deviations of banks' distance to default. The institutions' equity is approached as a call option on the underlying asset. The higher the distance to default, the safer the institution is and a positive reaction of investors is anticipated.

Third, to control for the macroeconomic environment across countries we start by including the *Boone indicator*, a measure that reflects degree of the banking competition, computed as the elasticity of profits to marginal costs. Lower values of the Boone indicator are associated with higher levels of the banking sector competition. There is an intensive debate in the theoretical and empirical literature regarding the relationship between competition and financial stability. In more competitive banking markets banks chose riskier lending and investment strategies, especially in the presence of an insurance back-up scheme, which exacerbates the system's fragility (Besanko and Thakor, 1993). On the other hand, when competition is increased banks can better diversify credit risk (Boyd and Prescott, 1986), hold more capital (Berger et al., 2009) and attain economies of scale and scope from the cross-border activities (Meon and Weill, 2005). We then add the central government fiscal deficit (revenues minus expenses) divided by GDP from IMF that reflects the fiscal capacity of the countries (*Fiscal balance*). Demirgüç-Kunt and Huizinga (2013) found a positive association between countries' fiscal position and banks' stock valuation. In countries with a lower fiscal deficit, authorities have more fiscal potential to save troubled banks if unexpected financial crisis will occur. The models also contain a dummy variable that takes the value 1 if the bank's home country experienced a bank crisis during 2008-2012 and 0 otherwise (*Dummy crisis*). In an alternative specification we replace this variable with the share of bailouts in total banking system assets received by financial institutions (*Bailouts*). Data on financial aid received by the

banking sector is provided by the European Commission and take the form of recapitalizations, impaired asset measures, guarantees or other liquidity measures.[10] We expect that institutions from countries with high propensity to save troubled banks may have positive abnormal returns, while banks which home country experienced banking crisis may be associated with negative abnormal returns. Finally, we consider the stringency of regulatory framework expressed by the *Capital regulatory index* and the *Overall restrictions index* of Barth et al. (2013). The first variable is a composite index that measures the amount of capital banks must hold and the stringency of regulations related to the nature and source of regulatory capital, taking values from 0 to 10 (higher values indicating tight regulations). The second index assess the degree to which banks should comply with regulatory restrictions on their activities in securities, insurance or real estate markets, and on the ownership of shares in nonfinancial firms. Its values are from 0 to 16, higher scores indicating stringent restrictions. Tighter capital requirements and activity restrictions can reduce the default risk of banks (Agoraki et al., 2011), as well as their systemic importance (Karolyi et al., 2018). Thus, a stringent regulatory environment is expected to generate an optimistic perception among bondholders. Yet the impact on shareholders might be negative, as tighter capital requirements generate costs for banks which reduce their profitability.

3. Empirical results

3.1 Descriptive statistics

Table 3 presents the descriptive statistics for the cumulative effective (actual) returns (CER) and cumulative abnormal returns (CAR) for short-term (the event day [0; 0]) and for a longer time horizon (the [1; 5] window), including both stock returns and CDS spreads. In Panel A the data refers to the official event, corresponding to the date when EBA published the O-SII list. The cumulative average effective returns in the event day is larger for the non-euro zone countries than for the euro zone ones and there is a significant difference (at 5%) of the means for these two sub-samples. Also, larger banks have significant greater cumulative average effective returns during the event day in comparison with smaller banks, a result that also holds in the case of abnormal returns.

[10] When adding the crisis dummy we drop the variable reflecting the bailouts in total banking system assets received by financial institutions as they are highly correlated.

Panel B exhibits the descriptive statistics for the national event dates, corresponding to the days when the national regulatory authorities submitted the list of domestic systemically important institutions to the EBA. Data show a significant difference in means among euro zone and non-euro zone banks just for the [1; 5] window both for effective and abnormal cumulative abnormal returns.

Regarding the CDS spreads, the difference in means for both effective and cumulative abnormal returns over the [0; 0] and [1; 5] intervals is significant. Returns and CARs are higher in case of the official event date over the [0; 0] interval, but also on long term over the [1; 5] interval.

INSERT TABLE 3

To describe the investors' behavior more in detail, Figure 2 illustrates the evolution of cumulative average actual return and cumulative average abnormal return from 30 days before to 30 days after the official O-SIIs event. Panel A reports the mean values for stock prices across the full sample of 54 banks, but also across a restricted sample of 35 banks that eliminates the largest bank by total assets within each country as there may be no uncertainty among investors with respect to the position of these banks. Both figures show an immediate negative reaction of cumulative actual returns and cumulative abnormal returns (less sharp than the actual stock returns), followed by a positive evolution within a few days. Panel B depicts the cumulative average actual return and cumulative average abnormal return for CDS spreads across a sample of 40 banks and across a restricted sample of 27 banks that remain after the elimination of the largest bank within each country. Similarly, we see an immediate pessimistic perception of investors linked to a rise in CDS spreads returns (CAR being lower than the actual return), followed by an optimistic effect when CDS spreads returns start to decrease.[11]

INSERT FIGURE 2

[11] As an alternative check we also drop the banks ranked on the 2nd position by total assets within each country from our sample. Results remain similar both for stock prices returns and for CDS spreads returns.

For an in-depth analysis we also computed several risk indicators across the full sample of 54 banks.[12] Figure 3 presents the mean systemic risk and individual risk across O-SIIs from 30 days before to 30 days after the EBA official event date. Panel A shows the systemic risk indicator computed using the *Marginal Expected Shortfall* methodology of Acharya et al. (2017). The index reflects the probability of a bank to be undercapitalized when the whole system is undercapitalized (i.e., the bank/system experienced their 5% worst market capitalization returns).[13] To express the individual risk taking of banks (Panel B) we quantify the maximum possible drop in market capitalization that a bank could register for a given confidence level (95%), using the *Value at Risk* methodology as in Jorion (1997). Both systemic risk and individual risk-taking experience an increase in the day following the official EBA release of O-SIIs list, followed by a reduction in the next five days.

INSERT FIGURE 3

3.2 Cumulative average abnormal return (CAAR) corresponding to the EBA official event

The CAARs are useful in studying the aggregate effect of the abnormal returns over the entire sample or sub-samples respectively, which is of our interest. Tables 4 and 5 show the cumulative average abnormal returns of stock prices, and CDS spreads respectively, together with the statistic tests and the associated p-values used to assess the significance for the full sample, and for the two sub-sets of euro zone and non-euro zone banks (only for the stock prices) over the official event date.[14] The CAARs are presented for the four intervals for which we assess the abnormal performance: [0; 0], [1; 1], [-3; 3], and [1; 5]. The [0; 0] CAAR is in fact the abnormal return on the event day. To analyze the statistical significance of the CAARs we employ two parametric tests, the *t-test* and the *Boehmer test*, and two non-parametric tests, the *Corrado and Zivney rank test* and the *generalized sign test*. As suggested by Campbell et al. (2010), the non-

[12] For the restricted sample defined above we found similar patterns.

[13] The indicator is estimated using the DCC-GJR GARCH framework, and as proxy for the system the STOXX 600 Financial index is used.

[14] We do not split the sample into euro zone and non-euro zone banks in the case of CDS spreads because it will result in a small number of non-euro zone banks and thus the non-representativeness of the sample might occur.

parametric tests are more powerful than the parametric ones and hence we decided to present the results considering both approaches.

INSERT TABLE 4
INSERT TABLE 5

We can assume that market participants value the institutions designated as O-SIIs and therefore as SIFIs more highly than the other institutions because the designation reduces investors' insolvency risk (Kleinow et al., 2014). Investors' reaction and conclusions derived from this type of events depend on the efficiency of the markets and whether security prices fully reflect all public available information (Fama, 1970). During the official date (April 25th, 2016) when the European Banking Authority disclosed the O-SII list, the financial market reacted negatively (i.e., pessimistic behavior of investors), as we have a negative sign associated with stock returns (Table 4), and a positive sign for CDS spreads (Table 5). In the event day, the negative abnormal performance of stock returns is significant according to all four test and the positive abnormal performance of CDS spreads is significant for three tests. Across the remaining intervals, the sign of stock returns CAARs changes to a positive one, reflecting a confident reaction of shareholders, especially for the [-3; 3] window when the increase of stock returns is about 2%. The effect does not differ for the euro zone and non-euro zone banks, having the same trend in both cases. In case of CDS spreads the perception of investors improves for the [-3; 3] window (i.e., a decrease in CDS spreads with 361.71 basis points). All four tests show a statistical significance (p-value is less than 10%). For the interval [1; 5] the CAARs of banks' CDS spreads is positive like in the event day, but three tests out of four indicate that the result is not statistical significant. However, we can note a reduction in the CDS spread by 20.69 basis points in the first day following the event, although, as in the case of [1; 5] interval, only generalized sign test shows statistical significance.

The empirical findings show that making the list public generated a *stigma* effect on the event day (market participants perceived the designation event as being harmful for the banks), and subsequently shareholders' wealth decreased. However, our results indicate that following it an *optimistic* reaction came as the CAARs turn positive up to five post-event days resulting in an

increase in shareholder's wealth. Hence, on the event day, the investors are worried about this regulatory framework and they did not anticipate it. Nevertheless, in the following days the perception of the investors changed, leading to an increase in the abnormal returns. This might be due to the association of O-SIIs with the too-big-to-fail status which increase the probability of future bailouts in case of collapse and may help them to obtain lower funding costs. However, looking at Appendix F, Panel C one can note that the reaction of investors to the publication of the official list of O-SIIs is more pronounced in the case of the full sample (54 banks) than in the case of restricted list, without G-SIBs (39 banks): CAAR for the full list is -1.11% and all tests show statistical significance and CAAR for the restricted sample is only -0.85%, and only two tests out of four reject the null hypothesis of a CAAR indistinguishable from zero. Even when including the previous experience with G-SIBs, investors still reacted negatively, meaning that this event conveyed new information in the market. However, in the first post event day and on longer timeframes, the effect in reversed with an increase in CAAR. This means that there was a two-step reaction and not an immediate adjustment in stock prices and CDS spreads. One possible explanation is that some markets are more liquid than others, the level of uncertainty can be very high on those illiquid markets because of information asymmetry, and hence the reaction is either reduced or exacerbated, the efficient market hypothesis being thus violated.

3.3 Determinants of cumulative abnormal return

In order to identify factors that might influence cumulative abnormal returns this section presents the results of the empirical model described in section 2.4. considering O-SII attributes, bank fundamentals as well as market and macroeconomic characteristics. Table 6 provides a multivariate analysis of banks' stock prices CARs during the official EBA event day, corresponding to the window [0;0]. The analysis starts by considering the effects of bank and macro characteristics in model (1), the benchmark specification, and further accounts for different controls in models (2) to (9).

INSERT TABLE 6

Looking first at the O-SIIs attributes, results show that higher additional capital buffers held by this type of banks are associated with more positive CARs. The sign of the corresponding

coefficient is highly significant and positive across all models for the event day. The economic impact is also noteworthy, implying a semi-elasticity of 50 percent. This finding has important policy implications as not all banks are required by the supervisory authority to add on capital for being designated as O-SIIs. The optimistic reaction of investors reflects an increased resilience of banks to systemic events when they are required to fulfil additional capital buffers and a greater loss-absorbing capacity. On the other hand, designating banks as O-SII through supervisory judgment significantly lower the cumulative abnormal returns. Even though the qualitative assessment specific to this approach accounts for the national and individual specificities of banks, investors may perceive it as being subjective in comparison with the alternative approach based on quantitative indicators, and thus consider that might lead to poor decisions. Another explanation of the pessimistic expectation of investors for banks selected through supervisory judgment might be linked with the fact that this approach is not harmonized across all European Union member state. Yet not significant, being a subsidiary of a group that is also designated as O-SIIs leads to lower aggregated abnormal return, which reflect a lack of confidence due to cross-border effects that can be transmitted from parent banks to their subsidiary.

Assessing the banks fundamentals, results show that large banks present negative CARs during the official regulatory announcement day. Large banks are more prone to engage in risky lending and investments operations, thus increasing their risk-taking but also the contribution to systemic risk. Being more difficult to supervise, this behavior is perceived as harmful by the market in case of potentially systemic important banks at the national level. Regarding the business model we document more pronounced CARs for banks oriented towards investment activity. The optimistic reaction of investors for these institutions may be explained by the possibility of banks to better diversify their risk through the non-traditional services and to obtain lower funding costs due to a more stringent regulation on O-SIIs.

Next, we re-asses in Tabel 7 the relationship between the bank and market fundamentals and the cumulative abnormal returns considering the EBA official designation over a longer period following the event, corresponding to the window [1;5]. The empirical output that examines cross-sectionally the determinants of banks' stock prices present some particularities in comparison with the short-term multivariate analysis.

INSERT TABLE 7

We observe that the additional capital buffer that O-SIIs must fulfil in some jurisdiction is no longer significant. In turn, results depict a highly significant impact of the selection approach for these banks that is robust. Across all models the coefficient associated with the dummy variable Supervisory judgement is positive, reflecting more positive cumulative abnormal returns in case of banks selected through qualitative criteria. In comparison with the short-term impact, in the days following the event, investors pound more on the benefits associated with using optional indicators to choose the banks with potential systemic importance at the national level. As this approach emphasize the role of banks' individual characteristics as well as the specificities of the macroeconomic environment, the identification of O-SIIs can be made more adequately, especially when small or interconnected institutions present systemic relevance and are not designated as O-SIIs through the quantitative criteria.

State ownership has a significant and negative impact on cumulative abnormal returns in the days following the official regulatory announcement. This means that investors do not rely on their potential to receive public funds in case of collapse, which is also demonstrated by model (5) when we introduce the bailouts provided by governments at the country level. It is more likely that the market focuses on their capacity to generate profitability, and because state banks may be less efficient than the private ones, investors penalize the O-SIIs with a majority government shareholder. The dummy variable associated with the Single Supervisory Mechanism is positive and significant, suggesting that the inclusion of other relevant banks in the SSM list generates confidence among the market. In fact, the aim of SSM is to assure financial stability and to offer a harmonized supervisory framework across European banks which increase investors' expectations. Size is no longer significant in the long run, while non-interest income share in total revenues maintain its positive and significant impact. Results also show a highly significant impact for the liquidity position which is negative. Indeed, investors are less confident in case of banks with a high cash to deposit ratio, which can be associated with a lower efficiency of the institutions that prefer to maintain high liquid reserves instead of investing in projects that generate future cash-flows.

Among the banking market characteristics, competition is an important determinant of investors' expectations. CARs are higher in countries where the banking market competition is

enhanced as shown by the negative and significant coefficient linked with the Boone indicator.[15] This implies that investors associate competition with a greater financial stability, which can be explained by better risk diversification, increased capital holdings and economies of scale and scope obtained in competitive banking markets. We also found a highly significant impact for fiscal capacity during the event day. Cumulative abnormal returns are more pronounced for banks from countries with a greater share of central government finances in GDP as indicated by the positive coefficients. This result can be linked with the fact that investors perceive as safe and stable the countries where governments have high fiscal potential to maneuver potential future financial crisis and provide assistance funds to troubled banks, thus valuing more the O-SIIs from these jurisdictions.

In unreported results we re-run the empirical specifications using as dependent variable the CARs computed for the CDS spreads. During the event day, bank characteristics like size and international activity, the selection of O-SIIs through supervisory judgment, and being on the EBA list significantly influence the investors' expectation. At the macro level, the competition and fiscal capacity have a strong influence. In the days following the official EBA designation, the market behavior is shaped by the capital buffer that some of the O-SIIs must add on, the credit risk, the ownership structure and the involvement in international activities.

3.4 Further analysis - the national events

In Appendix A are presented the findings for the national event dates when the national regulatory bodies acknowledged the EBA on the O-SII identification. In this case, we deal with multiple event dates.[16] The findings are the same as in the case of EBA official date, i.e., there is a *stigma effect*, but the effect is more pronounced when banks were designated officially as O-SIIs (average CARs of -1.11% for the official date and four tests out of four show statistical significance, comparing to average CARs of -0.82% and two tests out of four show statistical significance in the case of unofficial events, respectively). However, on average basis, there are no significant differences between the CARs of these two events (Table 3, Panel C). On longer post-event time horizon, like [1; 5] interval, the average CARs are still negative, but slightly

[15] Lower values of the Boone indicator are associated with higher levels of the banking sector competition.

[16] The first national O-SIIs event of our sample took place in Denmark prior to the EBA official date (June 25th, 2014), while the last O-SIIs list publication event took place in Bulgaria after the EBA official date (December 12th, 2016).

significant (only one test out of four proves that the CAAR is statistically significant. This means that the market still perceived the events harmful for the banks on an aggregated basis, but waited for the EBA to make an official announcement, as we can note from our strongly negative and statistically significant results showcased in Table 4. With regard to the subsamples, the national events had the same influence for the euro zone banks as in the full sample (negative CAARs, but the statistically significance is achieved only for the [-3; 3] window), and slightly different for the non-euro zone banks, with positive CAARs over the [1; 5] window and statistically distinguishable from zero according to three tests out of four. Hence, for [0; 0] event window, the negative and strongly relevant results for official announcement of EBA are mainly due to euro-zone banks, which is different for national events, where the market reacted more pronounced (as we can note from the test statistics) in the case of banks which are not part of the euro zone. However, for [1; 5] post-event interval, the positive effect for the official event on euro zone banks still dominates the negative one on non-euro zone banks, which is the other way around for national events – here the negative effect on euro zone banks dominates the positive effect on non-euro zone banks. However, the mean CARs for euro zone and non-euro zone banks do not differ significantly on average basis, as we can note from Table 3, Panels A and B.

As for the CDS spread, unreported results how that the CAARs are positive in the event day (although lacking statistical significance), but negative and statistically distinguishable from zero thereafter. Thus, for the subsequent CAARs windows, the cost of the default protection decreases for the banks designated as O-SII. This is true especially over the [1; 1] and [1; 5] windows (with a decrease in CDS spreads with 65.39 and 191.26 basis points, respectively), the results being strongly significant. It appears that these national regulatory events, overall, bring little information to the market participants.

3.5 Robustness checks

To assess the robustness of our findings, we re-run our analysis using different methodologies and estimation windows which are appended in order to conserve space.

Appendix B presents the results corresponding to the robustness assessment where we employ as methodology a hybrid market model. Similar with the hybrid CAPM model used for the main results, the specification allows simultaneously for a global index (the *MSCI World index*) and two regional indices depending on the locations of the banks (the *Eurostoxx 50 index*

for the euro zone banks and the *STOXX 600* excluding euro zone for the Non-euro zone banks). The results are consistent with our baseline analysis in terms of sign, for both official and national events, with small differences regarding the magnitude of the coefficients. Thus, when the EBA disclosed the domestic systemically important institutions list, we have negative and significant CAARs (for the full sample) in the event day and positive thereafter. Furthermore, we find no relevant differences for the euro zone and non-euro zone banks, having the same trend and sign as in the full sample. This means that the event has conveyed new information to the market , and this information has been perceived as being harmful for the banks (a *stigma* effect); the positive and significant one-day CAAR, however, shows a turnaround, i.e., an *optimistic* reaction – the investors have taken this event (information) as positive, probably due to new information they have acquired in the following days, regarding the too-big-to fail status of these banks. As for the national announcements, there is an *opacity* effect in the event day and the following day, with differences in size across the full sample, the euro zone, and the non-euro zone banks. An exception is the positive evolution of CAARs for the non-euro zone banks on the [1; 1] interval, but the result is not validated by the significance tests. For the subsequent intervals, we observe a *stigma* effect for the euro zone countries, yet validated just by the parametric tests, and a *positive* reaction of the non-euro zone banks for the longer [1; 5] interval that is statistically significant.

We also assessed the robustness of the results computing the abnormal stock returns through a simple CAPM model for both events, the EBA date and national events date. The main market index is *MSCI World index* and the risk-free rate is the *one-month Treasury-Bill rate*. The estimates are similar with the baseline analysis for most of the intervals assessed in terms of trend and size, with the exceptions discussed in the previous paragraph (Appendix C).

Robust results are obtained for CDS spreads too. Appendix D presents the output corresponding to the robustness assessment where we employ as market portfolio the *Datastream Europe Banks 5 years CDS index* for the official EBA event date . Panel A shows that there is an increase in CDS spreads for the official event across the event day and on the longer-term interval [1; 5], and a decrease in CDS spreads for the [1; 1] and [-3; 3] windows. The CAAR in the event day is highly significant (three tests out of four show statistical significance), suggesting that the financial market did not anticipate the event and attributed a *stigma* effect. The results are in line with those on stock returns. For a longer timeframe (three pre-event days,

the event day, and three post-event days), the CDS cumulative average abnormal returns are negative and highly significant, indicating an *optimistic* reaction.

Next, we re-run the analysis using an estimation window of 150 days. Results concerning both stock returns and CDS spreads (Appendix E) are consistent with the baseline empirical specifications.

Finally, we re-estimate the empirical specifications from Eq. (1) for the official EBA event constructing several sub-samples (Appendix F). First, we compute the cumulative average abnormal returns of banks' stock prices for a sub-set of large banks (with the value of total assets at the end of 2015 greater than the median of the sample), and, respectively, for a sub-set of small banks (with the value of total assets at the end of 2015 smaller than the median of the sample). Results show that CAARs of large banks (Panel A) follow a trend similar with the full sample, a negative evolution during the event day, followed by positive abnormal returns in the following intervals. The estimates associated with the small banks (Panel B) show similar evolutions of the CAARs, excepting the [1; 1] interval during which the average abnormal return is still negative as in the event day. The coefficients also are smaller in comparison with the large banks sample, but this appears in the context that the significance of the results is not validated by the empirical tests for the small banks sub-set. Thus, there was no reaction in the case of small O-SIIs, and therefore markets are concerned only about large institutions, regardless of the previous experience with other similar events. The overall conclusion is that the regulatory designation events matter in the case of large institutions, regardless of their previous status acquired from other similar events. Second, we eliminate from the initial sample the G-SIBs in Panel C. results reveal a trend similar with the main specification from Table 4, but the significance is achieved just for the event day and [1; 1] interval. Third, we eliminate the top one banks within each country (according to their size at the end of 2015). Panel D depicts significant results with a trend similar with the main findings for the first three intervals. The exception is the longer [1; 5] window that presents a negative average abnormal return. However, its significance is statistically undistinguishable from zero.

3.6 Comparison with other events related to systemically important financial institutions

In this section we discuss and compare the impact of specific regulatory changes on financial markets. This approach is very useful as it may help us to reveal whether there are differences in

market participants' behavior when relevant events regarding the systemically important financial institutions occur, and whether the information they convey is significant or not. All the results concerning these events for stock returns are displayed in the Appendix G.

We begin with the global systemically important banks (G-SIBs), as defined by the FSB and the BCBS. Before the publication of the official list, the *Financial Times* twice leaked a list with the supposed G-SIBs. 20 out of 24 banks disclosed by the newspaper proved out to be on the official list (consisting of 29 G-SIBs when it was first published). Thus, we undertake an analysis of 28 G-SIBs (excluding BPCE, which is non-listed) with the event day being November 30th, 2009 (*Financial Times*). Additionally, we investigate the market reaction to the official designation event (November 4th, 2011). Banks from our sample included in the G-SIBs list are presented in Appendix H. Hence, the publication of the list by the *Financial Times* did not bring any new information to the market in the event day in terms of returns as shown in Panel A1. However, for the [1; 1], [-3; 3] and [1; 5] intervals the associated CAARs were negative and significant. As regarding the official disclosure of the G-SIBs list, results from Panel A2 document that the CAARs were negative for all the windows and highly significant for the post-event intervals which denote a clear *stigma* effect (the banks' status as systemically important obviously worried the investors).

Regarding the EBA stress test exercises, results show that the markets had a positive reaction towards the banks that were subject to our analysis in the event day (Panel B1). In contrast, for the longer-term interval [1; 5] results point to negative abnormal stock returns. Banks from our sample included in the EBA stress test exercise are presented in Appendix H.

Not surprisingly, the euro zone banks included in the Single Supervisory Mechanism (Appendix H) registered positive abnormal returns (Panel B2). These are statistically significant for the day following the event. The common supervisory framework set out by the ECB has induced a safe sentiment for the investors deeming this event as benefic for the banks, as they were subject to a tighter macro-prudential supervision by the European regulatory authorities.

Overall, one can note the similarities between O-SIIs and G-SIBs in the event day, i.e., the official designation event: a *stigma effect*. Investors perceived these events as harmful for the banks. However, in the case of O-SIIs, in a post-event interval the information they have accumulated (greater transparency that these institutions must show) and the past experience with G-SIBs induced a *positive* expectation. This is not the case for G-SIBs where the *stigma effect*

continued even five days after the event. A possible explanation is that the investors did not have previous experience with such an event and they needed more time in order to clarify what the status of globally systemic important bank means.

4. Conclusion

The literature concerning the impact of the regulatory changes on systemically important financial institutions is inconclusive. In the present paper we carried out an analysis regarding the influence of the disclosure of the list of other systemically important institutions (as an official event), and the identification of these institutions by national regulatory authorities followed by the submission of these lists to the European Banking Authority (as national multiple events). These banks correspond to the domestic systemically important institutions at the European level, implying close monitoring by the financial supervisors, and the raise of additional capital by some of them. We assessed how financial market reacted to these regulatory changes through an event study of bank stock prices and CDS spreads using a sample of these institutions. Our findings bring into focus some interesting features regarding the introduction of the O-SII regulation.

Overall, when the EBA published the O-SII list, the immediate reaction of the market on stock returns was negative, i.e., a *stigma* effect. But, in the days surrounding the event, the investors have changed their perception, resulting in an increase in shareholders' wealth and thus in a *positive* effect. This effect holds for both euro zone and non-euro zone banks (based on their headquarter location). When considering the CDS spreads, we found a similar effect, that is, an increase in CDS spreads and thus a higher cost for the banks (the perceived risk of default rose following the designation of the institutions as systemically relevant). However, in the first day after the event the CDS spreads decreased. As for the national events, the CAARs are negative across all windows, but slightly statistically different from zero. We can relate the results to the same *stigma effect* as in the case of official event, but investors waited for an official designation, as we have seen from more negative and strongly significant CAAR on April 25th, 2016. Comparing with other similar events, the findings support those relating to the G-SIBs designation for the day when FSB published the official list. However, being included in a broad

supervisory framework (the Single Supervisory Mechanism of ECB) and being subject of the stress test exercises of EBA seem to have a *positive* effect due to the too-big-to-fail status.

Our additional evidence suggests that the cumulative abnormal returns are not only driven by the event *per se*, but are also related to other relevant factors. On the event day, abnormal returns are more negative for banks with large size, with less non-interest income, and in countries with lower requirements regarding the level of CET1 capital buffer for O-SII-s (or their absence) and where the identification of O-SIIs is assessed through supervisory judgement. Following the event, CARs are lower for liquid financial institutions or those where the state is a shareholder, where the banking market competition is reduced, and in countries where the government has less fiscal capacity to absorb the consequences of a bank failure.

References

Abreu, J.F., Gulamhussen, M.A., 2013. The stock market reaction to the public announcement of a supranational list of too-big-to-fail banks during the financial crisis. Journal of International Financial Markets, Institutions and Money 25(1), 49–72.

Acharya, V. V., Pedersen, L. H., Philippon, T., Richardson, M., 2017. Measuring systemic risk. The Review of Financial Studies 30(1), 2-47.

Acharya, V.V., Yorulmazer, T., 2007. Too many to fail – an analysis of time inconsistency in bank closure policies. Journal of Financial Intermediation 16(1), 1–31.

Adrian, T., Brunnermeier, M.K., 2016. CoVaR. The American Economic Review 106(7), 1705–1741.

Agoraki, M.-E.K., Delis, M.D., Pasiouras, F., 2011. Regulations, competition and bank risk-taking in transition countries. Journal of Financial Stability 7(1), 38–48.

Aït-Sahalia, Y., Andritzky, J., Jobst, A., Nowak, S., Tamirisa, N., 2012. Market response to policy initiatives during the global financial crisis. Journal of International Economics 87(1), 162–177.

Anginer, D., Demirgüç-Kunt, A., Zhu, M., 2014. How does deposit insurance affect bank risk? Evidence from the recent crisis. Journal of Banking & Finance 48, 312–321.

Basel Committee on Banking Supervision (BCBS), 2010. Basel III: A global regulatory framework for more resilient banks and banking systems. Bank for International Settlements. Available online at: http://www.bis.org/publ/bcbs189.pdf.

Basel Committee on Banking Supervision (BCBS), 2012. A framework for dealing with domestic systemically important banks. Bank for International Settlements. Available online at: http://www.bis.org/publ/bcbs233.pdf.

Bekaert, G., Harvey, C.R., 1995. Time-varying world market integration. The Journal of Finance 50, 403–444.

Bekaert, G., Hodrick, R.J., Zhang, X., 2009. International stock return comovements. The Journal of Finance 64, 2591–2626.

Berger, A.N., Clarke, G.R.G., Cull, R., Klapper, L., Udell, G.F., 2005. Corporate governance and bank performance: A joint analysis of the static, selection, and dynamic effects of domestic, foreign, and state ownership. Journal of Banking and Finance 29, 2179–2221.

Berger, A.N., Klapper, L.F., Turk-Ariss, R., 2009. Bank competition and financial stability. Journal of Financial Services Ressearch 35, 99–118.

Berger, A.N., Roman, R.A., Sedunov, J., 2016. Do bank bailouts reduce or increase systemic risk? The effects of TARP on financial system stability. Federal Reserve Bank of Kansas City, Working Paper no. 16-08.

Besanko, D., Thakor, A.V., 1993. Relationship banking, deposit insurance and bank portfolio. In C. Mayer and X. Vives (eds), Capital Markets and Financial Intermediation, Cambridge, UK: Cambridge University Press, 292-318.

Bodnar, G. M., Dumas, B., Marston, R. C., 2003. Cross-border valuation: the international cost of equity capital. NBER Working Paper 10115.

Boehmer, E., Masumeci, J., Poulsen, A.B., 1991. Event-study methodology under conditions of event-induced variance. Journal of Financial Economics 30(2), 253–272.

Bongini, P., Nieri, L., Pelagatti, M., 2015. The importance of being systemically important financial institutions. Journal of Banking & Finance 50, 562–574.

Boyd, J.H., Prescott, E.C., 1986. Financial intermediary-coalitions. Journal of Economic Theory 38(2), 211-232.

Brewer, E., Klingenhagen, A.M., 2010. Be careful what you wish for: The stock market reactions to bailing out large financial institutions: Evidence from the USA. Journal of Financial Regulation and Compliance 18, 56–69.

Brooks, R., Del Negro, M., 2005. A latent factor model with global, country, and industry shocks for international stock returns, IMF Working Paper 05/52.

Brown, S.J., Warner, J.B., 1985. Using daily stock returns: The case of event studies. Journal of Financial Economics 14, 3–31.

Brunetti, C., di Filippo, M., Harris, J.H., 2011. Effects of central bank intervention on the interbank market during the subprime crisis. Review of Financial Studies 24(6), 2053–2083.

Brunnermeier, M., 2009. Deciphering the liquidity and credit crunch of 2008–2008. Journal of Economic Perspectives 23, 77–100.

Campbell, C.J., Cowan, A.R., Salotti, V., 2010. Multi-country event-study methods. Journal of Banking & Finance 34(12), 3078–3090.

Claessens, S., Demirgüç-Kunt, A., Huizinga, H., 2001. How does foreign entry affect domestic banking markets? Journal of Banking & Finance 25, 891–911.

Corrado, C.J., Zivney, T.L., 1992. The specification and power of the sign test in event study hypothesis tests using daily stock returns. Journal of Financial and Quantitative Analysis 27(3), 465.

Cowan, A.R., 1992. Nonparametric event study tests. Review of Quantitative Finance and Accounting 2(4), 343–358.

Demirgüç-Kunt, A., Detragiache, E., 2002. Does deposit insurance increase banking system stability? An empirical investigation. Journal of Monetary Economics 49(7), 1373–1406.

Demirgüç-Kunt, A., Detragiache, E., 2011. Basel Core Principles and bank soundness: Does compliance matter? Journal of Financial Stability 7(4), 179–190.

Demirgüç-Kunt, A., Huizinga, H., 2013. Are banks too big to fail or too big to save? International evidence from equity prices and CDS spreads. Journal of Banking and Finance 37, 875–94.

Diamond, D.W., 1984. Financial intermediation and delegated monitoring. Review of Economic Studies 51, 393–414.

Duan, J.-C., Wang, T., 2012. Measuring distance-to-default for financial and non-financial firms. Global Credit Review 2, 95–108.

Elliott, D.J., Litan, R.E., 2011. Identifying and regulating systemically important financial institutions: The risks of under and over identification and regulation. Brookings Working Paper.

European Banking Authority (EBA), 2014. Guidelines on the criteria to determine the conditions of application of Article 131(3) of Directive 2013/36/EU (CRD) in relation to the assessment of other systemically important institutions (O-SIIs). Available online at: https://www.eba.europa.eu/documents/10180/930752/EBA-GL-2014-10+(Guidelines+on+O-SIIs+Assessment).pdf.

European Banking Authority (EBA), 2016. List of Other Systemically Important Institutions (O-SIIs) notified to the EBA. Available online at: https://www.eba.europa.eu/risk-analysis-and-data/other-systemically-important-institutions-o-siis-/2015.

European Commission (EC), 2013. Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012. Official Journal of the European Union.

European Stability Mechanism, 2013. Annual report. Available online at: http://www.esm.europa.eu/publications/index.htm.
Faccio, M., Masulis, R.W., McConnell, J.J., 2006. Political connections and corporate bailouts. Journal of Finance 61, 2597-2635.
Fama, E.F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. The Journal of Finance 25, 383–417.
Fama, E.F., Fisher, L., Jensen, M.C., Roll, R., 1969. The adjustment of stock prices to new information. International Economic Review 10(1), 1-21.
Farhi, E., Tirole, J., 2012. Collective moral hazard, maturity mismatch and systemic bailouts. American Economic Review 102(1), 60-93.
Financial Stability Board, 2011. Policy measures to address systemically important financial institutions. Financial Stability Board. Available at: http://www.fsb.org/wp-content/uploads/Policy-Measures-to-Address-Systemically-Important-Financial-Institutions.pdf.
Goodhart, C.A.E., 2008. The regulatory response to the financial crisis. Journal of Financial Stability 4(4), 351–358.
Gorton, G., Ordoñez, G., 2016. Fighting crises. National Bureau of Economic Research Working Paper No. 22787.
Hryckiewicz, A., 2014. What do we know about the impact of government interventions in the banking sector? An assessment of various bailout programs on bank behavior, Journal of Banking & Finance, 46: 246-265.
Iwanicz-Drozdowska, M., Schab, I., 2014. Regulation of G-SIBs. Does one size fit all? Available at SSRN: https://ssrn.com/abstract=2450529 or http://dx.doi.org/10.2139/ssrn.2450529.
Jorion, P., 1997. Value-at-Risk: The new benchmark for controlling market risk. Irwin, Chicago, Ill.
Karolyi, G. A., Sedunov, J., Taboada, A. G., 2018. Cross-border bank flows and systemic risk. Working paper. Available at SSRN: https://ssrn.com/abstract=2938544 or http://dx.doi.org/10.2139/ssrn.2938544.
Kleinow, J., Nell, T., Rogler, S., Horsch, A., 2014. The value of being systemically important: event study on regulatory announcements for banks. Applied Financial Economics 24, 1585–1604.
Klomp, J., de Haan, J., 2012. Banking risk and regulation: Does one size fit all? Journal of Banking & Finance 36(12), 3197–3212.
Laeven, L., Ratnovski, R., Tong, H., 2016. Bank size and systemic risk: Some international evidence. Journal of Banking and Finance 69(1), S25–S34.
Lamdin, D.J., 2001. Implementing and interpreting event studies of regulatory changes. Journal of Economics and Business 53, 171–183.
Londono, J.M., Tian, M., 2014. Bank interventions and options-based systemic risk: Evidence from the global and euro-area crisis. Board of Governors of the Federal Reserve System International Finance Discussion Papers Number 1117.
López-Espinosa, G., Moreno, A., Rubia, A., Valderrama L., 2012. Short-term wholesale funding and systemic risk: A global CoVaR approach. Journal of Banking and Finance 36(12), 3150–3162.
MacKinlay, A.C., 1997. Event studies in Economics and Finance. Journal of Economic Literature 35, 13–39.

Maynes, E., Rumsey, J. 1993. Conducting event studies with thinly traded stocks. Journal of Banking & Finance 17(1), 145-157.

Meon, P.G., Weill, L., 2005. Can mergers in Europe help banks hedge against macroeconomic risk? Applied Financial Economics 15(5), 315-326.

Moenninghoff, S.C., Ongena, S., Wieandt, A., 2015. The perennial challenge to counter Too-Big-to-Fail in banking: Empirical evidence from the new international regulation dealing with Global Systemically Important Banks. Journal of Banking & Finance 61(C), 221–236.

Morgan, D.P., Peristiani, S., Savino, V., 2014. The information value of the stress test and bank opacity. Journal of Money, Credit and Banking, 46(7), 1479-1500.

Nistor, S., Ongena, S., 2018. The impact of policy interventions on systemic risk across banks. Working paper.

Ongena, S., Peydró, J. L, van Horen, N., 2015. Shocks abroad, pain at home? Bank-firm level evidence on financial contagion during the recent financial crisis. IMF Economic Review 63 (4), 698-750.

Ötker-Robe, I., Narain, A., Ilyina, A., Surti, J., 2011. The Too-Important-to-Fail conundrum: Impossible to ignore and difficult to resolve. International Monetary Fund Staff Discussion Note SDN/11/12.

Panetta, F., Faeh, T., Grande, G., Ho, C., King, M., Levy, A., Signoretti, F., Taboga, M., Zaghini, A., 2009. An assessment of financial sector rescue programmes. Bank for International Settlements, BIS papers no. 48.

Patell, J.M., 1976. Corporate forecasts of earnings per share and stock price behavior: Empirical test. Journal of Accounting Research 14(2), 246.

Petrella, G., Resti, A., 2013. Supervisors as information producers: Do stress tests reduce bank opaqueness? Journal of Banking & Finance 37(12), 5406–5420.

Praet, P., Nguyen, G., 2008. Overview of recent policy initiatives in response to the crisis. Journal of Financial Stability 4(4), 368–375.

Sahin, C., de Haan, J., 2016. Market reactions to the ECB's Comprehensive Assessment. Economics Letters 140, 1–5.

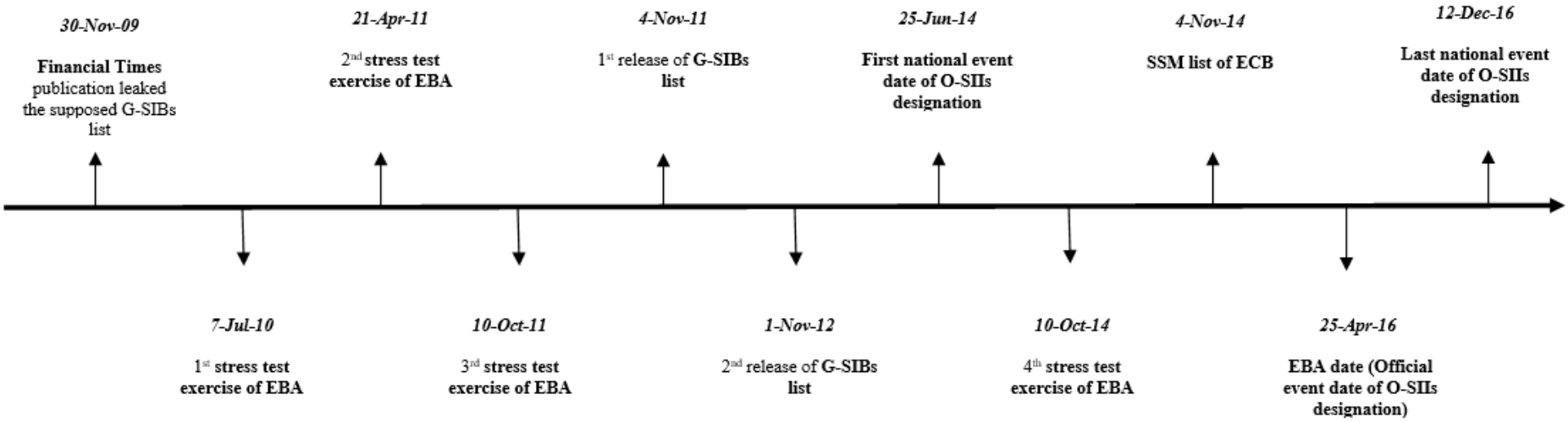
Schäfer, A., Schnabel, I., Weder di Mauro, B., 2016. Financial sector reform after the crisis: Has anything happened? Review of Finance 20(1), 77-125.

Schwert, G.W., 1981. Using financial data to measure effects of regulation. Journal of Law and Economics 24(1), 121–158.

Zhou, J., Rutledge, V., Bossu, W., Dobler, M., Jassaud, N., Moore, M., 2012. From bail-out to bail-in: Mandatory debt restructuring of systemic financial institutions. International Monetary Fund Staff Discussion Note SDN/12/03.

Figures and Tables

Figure 1. Timeline of O-SII and other designation events

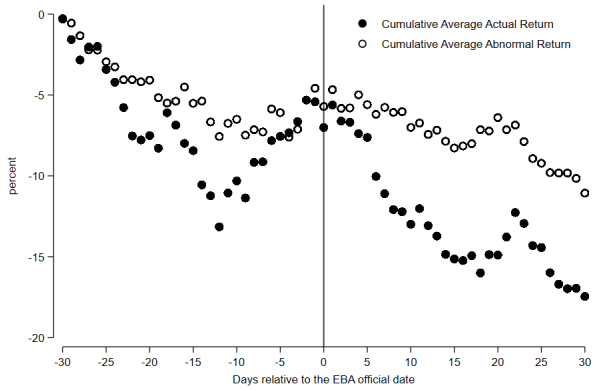


Note: This figure represents a timeline with the publication of different SIFIs lists and stress-testing exercises including the official O-SII event (corresponding to the date when the EBA published the O-SII list) and national O-SII events (corresponding to the dates when the national regulatory authorities submitted the O-SII list to the EBA). The first national O-SII event of our sample took place in Denmark (June 25th, 2014), while the last O-SII list publication event took place in Bulgaria (December 12th, 2016). The first actual stress exercise of EBA (i.e., publication of the results) took place on October 1st, 2009 but EBA did not disclose the list of the banks. Thus, we considered the second stress test exercise to be our first stress test.

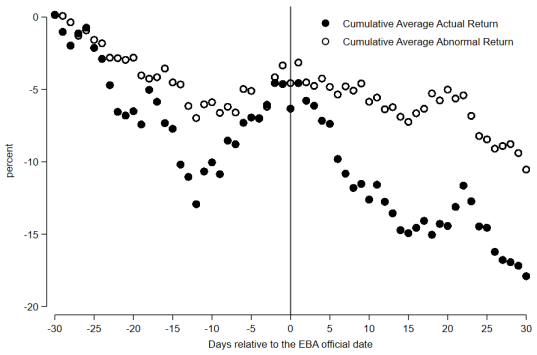
Figure 2. Cumulative abnormal return before and after the official EBA event date

Panel A. CAR for stock prices

(1) Full sample

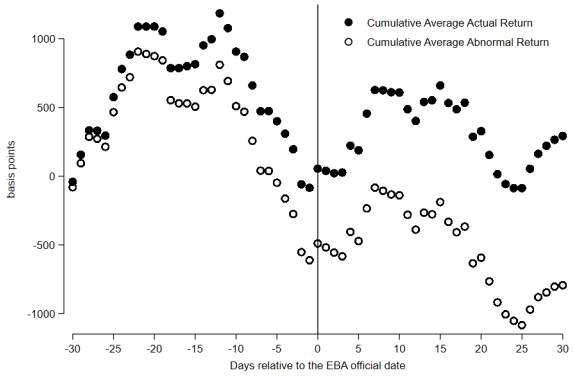


(2) Sample without top banks

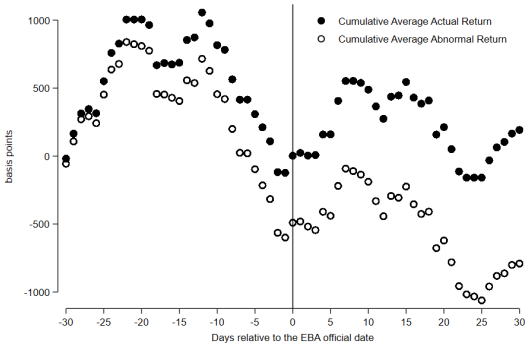


Panel B. CAAR for CDS spreads

(1) Full sample



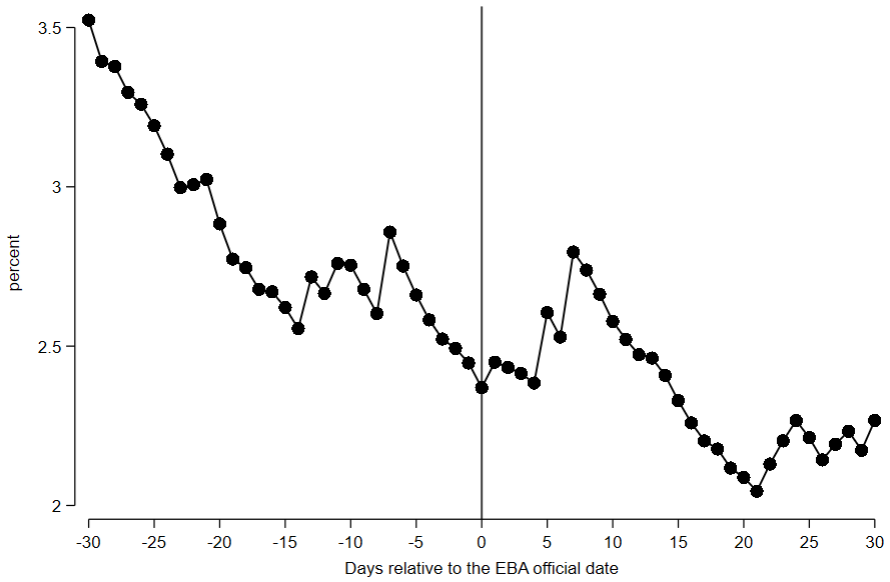
(2) Sample without top banks



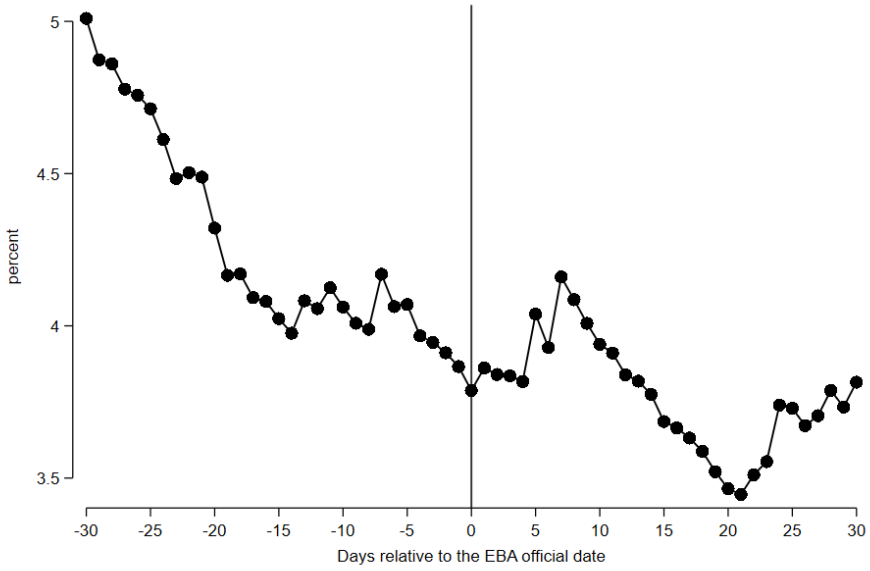
Note: This figure presents the cumulative average actual return and the cumulative average abnormal return from 30 days before to 30 days after the official O-SII event (corresponding to the date when the EBA published the O-SII list). Panel A shows the mean CAR for stock prices across the Full sample of 54 banks (1) and across a restricted sample of 35 banks that remain after the elimination of the largest bank within each country (2). Panel B depicts the mean CAR for CDS spreads across a sample of 40 banks (1) and across a restricted sample of 27 banks that remain after the elimination of the largest bank within each country (2).

Figure 3. Systemic risk and individual risk before and after the EBA official event date

Panel A. Systemic risk (Marginal Expected Shortfall)



Panel B. Individual risk (Value at Risk)



Note: This figure presents the mean systemic risk and individual risk across O-SIIs from 30 days before to 30 days after the EBA official event date. The risk indicators are computed across a sample of 54 banks. Panel A shows the mean systemic risk indicator computed using the *Marginal Expected Shortfall* methodology based on banks' stock prices and the *STOXX Financial index* as proxy for the system. Panel B presents the mean individual risk indicator computed using the *Value at Risk* methodology based on banks' stock prices.

Table 1. O-SII list and event dates for the event studies on stock returns and CDS spreads

Number	Bank	Country of origin	Total Assets as of 31 Dec. 2015 (billionmillion EUR)	EBA date (Official event date)	National events date (Unofficial events date)	Stock prices		CDS spreads	
						Banks subject to EBA event date	Banks subject to national events date	Banks subject to EBA event date	Banks subject to national events date
1	BAWAG P.S.K.	Austria	35.71	4/25/2016	4/19/2016			YES	YES
2	Erste Group Bank	Austria	199.43	4/25/2016	4/19/2016	YES	YES	YES	YES
3	Raiffeisen Bank International	Austria	114.16	4/25/2016	4/19/2016	YES	YES	YES	YES
4	Raiffeisen Zentralbank	Austria	138.43	4/25/2016	4/19/2016			YES	YES
5	KBC Group NV	Belgium	250.13	4/25/2016	10/26/2015	YES	YES	YES	YES
6	CB Central Cooperative Bank	Bulgaria	2.48	4/25/2016	12/12/2016		YES		
7	CB First Investment Bank	Bulgaria	4.54	4/25/2016	12/12/2016		YES		
8	HPB d.d.	Croatia	2.36	4/25/2016	2/26/2016	YES	YES		
9	Privredna banka Zagreb d.d	Croatia	10.25	4/25/2016	2/26/2016	YES	YES		
10	Zagrebačka Banka d.d.	Croatia	16.7	4/25/2016	2/26/2016	YES	YES		
11	Bank of Cyprus Plc	Cyprus	22.81	4/25/2016	12/31/2015	YES	YES		
12	Hellenic Bank Plc	Cyprus	7.34	4/25/2016	12/31/2015	YES	YES		
13	Komerční banka, a.s.	Czech Republic	32.99	4/25/2016	12/18/2015	YES	YES		
14	Danske Bank A/S	Denmark	441.31	4/25/2016	6/25/2014	YES	YES	YES	YES
15	Jyske Bank A/S	Denmark	72.84	4/25/2016	6/25/2014	YES	YES		
16	Sydbank A/S	Denmark	19.12	4/25/2016	6/25/2014	YES	YES		
17	BNP Paribas	France	1987.82	4/25/2016	11/30/2015	YES	YES	YES	YES
18	Groupe Credit Agricole	France	1526.75	4/25/2016	11/30/2015	YES	YES	YES	YES
19	Societe Generale	France	1328.46	4/25/2016	11/30/2015	YES	YES	YES	YES
20	Bayerische Landesbank	Germany	218.87	4/25/2016	7/15/2016			YES	YES
21	Commerzbank AG	Germany	529.81	4/25/2016	7/15/2016	YES	YES	YES	YES
22	Deutsche Bank AG	Germany	1621.37	4/25/2016	7/15/2016	YES	YES	YES	YES
23	Landesbank Baden-Württemberg	Germany	234.46	4/25/2016	7/15/2016			YES	YES
24	Landesbank Hessen-Thüringen Girozentrale	Germany	145,02	4/25/2016	7/15/2016			YES	YES
25	Norddeutsche Landesbank Girozentrale	Germany	181.34	4/25/2016	7/15/2016			YES	YES
26	Alpha Bank	Greece	64.9	4/25/2016	3/12/2015	YES	YES	YES	YES
27	Eurobank	Greece	68.69	4/25/2016	3/12/2015	YES	YES	YES	YES
28	National Bank of Greece	Greece	106.14	4/25/2016	3/12/2015	YES	YES	YES	YES
29	Piraeus Bank	Greece	82.45	4/25/2016	3/12/2015	YES	YES		
30	FHB Jelzálogbank Nyrt	Hungary	2.36	4/25/2016	10/29/2015	YES	YES		
31	OTP Bank Nyrt	Hungary	34.34	4/25/2016	10/29/2015	YES	YES		
32	Allied Irish Banks plc	Ireland	100.23	4/25/2016	9/11/2015	YES	YES	YES	YES
33	The Governor and Company of the Bank of Ireland	Ireland	129.51	4/25/2016	9/11/2015	YES	YES	YES	YES
34	Gruppo Monte dei Paschi di Siena	Italy	165.7	4/25/2016	12/14/2015	YES	YES	YES	YES
35	San Paolo	Italy	665.1	4/25/2016	12/14/2015	YES	YES	YES	YES
36	Unicredit Group S.p.A.	Italy	846.06	4/25/2016	12/14/2015	YES	YES	YES	YES
37	AB Šiaulių Bankas	Lithuania	1.69	4/25/2016	11/25/2015	YES	YES		

38	Bank of Valletta Group	Malta	9.82	4/25/2016	11/30/2015	YES	YES		
39	HSBC Bank Malta plc	Malta	7.22	4/25/2016	11/30/2015	YES	YES		
40	Coöperatieve Centrale Raiffeisen-Boerenleenbank	Netherlands	671.64	4/25/2016	11/26/2015			NO	YES
41	ING Bank N.V.	Netherlands	840.96	4/25/2016	11/26/2015	YES	YES	YES	YES
42	SNS Bank N.V.	Netherlands	62.69	4/25/2016	11/26/2015			YES	YES
43	DNB ASA	Norway	276.48	4/25/2016	12/5/2014	YES	YES	YES	YES
44	Bank BGZ BNP Paribas	Poland	15.04	4/25/2016	10/21/2016		YES		
45	Bank Handlowy	Poland	11.44	4/25/2016	10/21/2016		YES		
46	Bank Polska Kasa Opieki	Poland	38.9	4/25/2016	10/21/2016		YES		
47	Bank Zachodni WBK	Poland	32.09	4/25/2016	10/21/2016		YES		
48	Getin Noble Bank	Poland	16.32	4/25/2016	10/21/2016		YES		
49	ING Bank Śląski	Poland	25.22	4/25/2016	10/21/2016		YES		
50	mBank	Poland	28.54	4/25/2016	10/21/2016		YES		
51	PKO Bank Polski	Poland	61.65	4/25/2016	10/21/2016		YES		
52	Banco BPI	Portugal	40.26	4/25/2016	12/29/2015	YES	YES		
53	Banco Comercial Português	Portugal	72.32	4/25/2016	12/29/2015	YES	YES	YES	YES
54	Banca Transilvania S.A.	Romania	10.59	4/25/2016	11/27/2015	YES	YES		
55	BRD - Groupe Société Générale S.A.	Romania	11.19	4/25/2016	11/27/2015	YES	YES		
56	Tatra banka a.s.	Slovakia	11.19	4/25/2016	4/6/2015	YES	YES		
57	Všeobecná úverová banka a.s.	Slovakia	12.57	4/25/2016	4/6/2015	YES	YES		
58	Bankia	Spain	198.89	4/25/2016	1/13/2016	YES	YES		
59	BBVA	Spain	734.2	4/25/2016	1/13/2016	YES	YES	YES	YES
60	CaixaBank	Spain	334.16	4/25/2016	1/13/2016	YES	YES		
61	Banco Popular	Spain	155.21	4/25/2016	1/13/2016	YES	YES	YES	YES
62	Banco Sabadell	Spain	202.05	4/25/2016	1/13/2016	YES	YES	YES	YES
63	Banco Santander	Spain	1318.22	4/25/2016	1/13/2016	YES	YES	YES	YES
64	Nordea Bank AB	Sweden	640.8	4/25/2016	10/14/2015	YES	YES	YES	YES
65	Skandinaviska Enskilda Banken AB	Sweden	269.42	4/25/2016	10/14/2015	YES	YES	YES	YES
66	Svenska Handelsbanken AB	Sweden	272.25	4/25/2016	10/14/2015	YES	YES	YES	YES
67	Swedbank AB	Sweden	232.07	4/25/2016	10/14/2015	YES	YES	YES	YES
68	Barclays Plc	UK	1548.65	4/25/2016	8/4/2016	YES	YES	YES	YES
69	HSBC Holdings Plc	UK	2263.24	4/25/2016	8/4/2016	YES	YES	YES	YES
70	Lloyds Banking Group Plc	UK	1114.75	4/25/2016	8/4/2016	YES	YES	YES	YES
71	Royal Bank of Scotland Group Plc	UK	1128.78	4/25/2016	8/4/2016	YES	YES	YES	YES
72	Standard Chartered Plc	UK	602.08	4/25/2016	8/4/2016	YES	YES	YES	YES
					Total number of events	*54*	*64*	*40*	*41*

Note: The table presents the sample of O-SIIs, with available data on stock prices and CDS spreads from Datastream for the following events: the official event (corresponding to the date when the EBA published the O-SII list) and the national events (corresponding to the dates when the national regulatory authorities submitted the O-SII list to the EBA). Bulgarian and Polish banks are not included on the EBA list, but their national regulatory authorities have notified the ESRB on their O-SIIs and we consider this as the national event day for them.

Table 2. Description of variables

Variable name	Description	Source
Market variables		
Stock Return	Log return of banks' stock prices	Own computation, Datastream
CDS Return	Log return of banks' CDS spreads	Own computation, Datastream, Bloomberg
AR	Abnormal returns of banks' stock prices or CDS spreads	Own computation
AAR	Average abnormal returns of banks' stock prices or CDS spreads	Own computation
CAR	Cumulative abnormal returns of banks' stock prices or CDS spreads over the event window	Own computation
CER	Cumulative effective returns of banks' stock prices or CDS spreads over the event window	Own computation
MSCI World Index	Log return of the MSCI World Index	Datastream
Eurostoxx 50 index	Log return of the Eurostoxx 50 index	Datastream
STOXX 600 excluding euro zone index	Log return of the STOXX 600 excluding euro zone index	Datastream
MSCI Europe index	Log return of the MSCI Europe index	Datastream
MSCI USA index	Log return of the MSCI USA index	Datastream
MSCI Pacific index	Log return of the MSCI Pacific index	Datastream
One-month T-bill rate	The level of the one-month T-bill rate	Bloomberg
iTraxx Europe 5 years CDS index	The log return of the iTraxx Europe 5 years CDS index	Bloomberg
Datastream Europe Banks 5 years CDS index	The log return of the Datastream Europe Banks 5 years CDS index	Datastream
O-SII characteristics		
Buffer	The CET1 capital buffer of up to 2% of the total risk exposure amount that the O-SIIs must hold	European Banking Authority
Supervisory judgment	Dummy variable which takes the value of 1 if the O-SII is identified through supervisory judgment and 0 otherwise	European Banking Authority
Dummy O-SII subsidiary	Dummy variable which takes the value of 1 if the bank is a subsidiary of other O-SII and 0 otherwise	European Banking Authority
Bank characteristics		
Size	Natural logarithm of Total assets	Worldscope
Leverage	Total debt/Common equity	Worldscope
Credit risk	Non-performing loans/Total loans	Worldscope
Non-interest income	Non-interest income/Total revenues	Worldscope
Liquidity ratio	(Cash and due from banks + Total investments)/Total deposits	Worldscope
State ownership	Dummy variable that takes the value of 1 if the state is a shareholder, regardless its participation, and 0 otherwise	Orbis Banks; banks' annual reports
Dummy foreign ownership	Dummy variable that takes the value 1 if 50% or more of banks' shares are owned by foreigners and 0 otherwise	Orbis Banks; banks' annual reports
Dummy SSM	Dummy variable that takes the value of 1 if the bank is included in the SSM list of ECB and 0 otherwise	European Central Bank
Dummy EBA	Dummy variable that takes the value 1 if the bank was included in the list for stress tests of EBA and 0 otherwise	European Banking Authority
Dummy international activity	Dummy variable which takes the value of 1 if the bank is present in other countries and 0 if it only has a domestic presence	Orbis Banks; banks' annual reports
DTD	Distance to Default risk measure of Duan and Wang (2016) expressed in standard deviations of banks' distance to default. Higher values are associated with reduced banks' individual risk.	Credit Research Initiative of Risk Management Institute
Macro/banking system characteristics		
Boone indicator	A measure of degree of the banking competition, computed as the elasticity of profits to marginal costs. The more negative the Boone indicator, the higher the level of the banking sector competition	Global Financial Development Database
Fiscal balance	Central government revenues minus expenses divided by country's GDP	International Monetary Fund
Dummy crisis	Dummy variable equal to 1 if the bank's home country experienced a bank crisis during 2008-2012 and 0 otherwise.	World Bank
Bailouts	The share of bailouts in total banking system assets received by financial institutions in the form of recapitalizations, impaired asset measures, guarantees and other liquidity measures	European Commission Financial Aid reports; Nistor Mutu and Ongena (2018)
Capital regulatory index	A composite index that measures the amount of capital banks must hold and the stringency of regulations related to the nature and source of regulatory capital. The index takes values from 0 to 10, higher values indicating tight regulations.	Barth et al. (2013)
Overall restrictions index	The degree to which banks face regulatory restrictions on their activities in securities markets, insurance, real estate, and ownership of shares in nonfinancial firms. The index takes values from 0 to 16 (higher values indicate tight restrictions)	Barth et al. (2013)

Table 3. Descriptive statistics

Panel A: EBA official event

Cumulative average returns	Obs.	Mean	Std. Dev.	Min	Max	Non-euro zone (mean)	Euro zone (mean)	Difference in means (Non-euro zone vs. euro zone)	Small banks (mean)	Large banks (mean)	Difference in means (Small vs. Large)
CER [0; 0]	54	-1.59	1.93	-8.02	2.00	-0.82	-2.08	1.26 **	-0.97	-2.20	1.22 **
CAR [0; 0]	54	-1.11	1.80	-7.50	2.55	-0.73	-1.35	0.61	-0.50	-1.72	1.22 **
CER [1; 5]	54	-0.61	3.86	-10.86	6.27	0.22	-1.14	1.36	-0.73	-0.50	-0.23
CAR [1; 5]	54	0.25	3.54	-7.53	12.45	-0.31	0.60	-0.91	0.48	0.02	0.46
CDS CER [0; 0]	40	139.60	182.96	-103.56	667.64						
CDS CAR [0; 0]	40	130.46	180.92	-104.88	668.06						
CDS CER [1; 5]	40	133.56	313.28	-1310.23	603.39						
CDS CAR [1; 5]	40	58.21	305.71	-1396.54	517.26						

Panel B: National events

Cumulative average returns	Obs.	Mean	Std. Dev.	Min	Max	Non-euro zone (mean)	Euro zone (mean)	Difference in means (Non-euro zone vs. euro zone)	Small banks (mean)	Large banks (mean)	Difference in means (Small vs. Large)
CER [0; 0]	64	-1.01	4.50	-33.20	3.08	-0.58	-1.40	0.82	-1.01	-1.01	0.00
CAR [0; 0]	64	-0.82	4.03	-29.53	6.77	-0.63	-1.00	0.37	-0.58	-1.06	0.49
CER [1; 5]	64	-3.88	18.77	-109.83	15.58	1.64	-9.06	10.69 **	-3.13	-4.62	1.49
CAR [1; 5]	64	-2.51	16.92	-97.51	13.50	1.23	-6.03	7.27 *	-1.59	-3.44	1.85
CDS CER [0; 0]	41	7.14	202.62	-428.21	783.05						
CDS CAR [0; 0]	41	1.83	213.81	-429.71	793.77						
CDS CER [1; 5]	41	-152.68	551.43	-1130.76	1534.34						
CDS CAR [1; 5]	41	-191.26	543.12	-1193.29	1375.43						

Panel C: EBA official event and national events. Difference in means analysis

Cumulative average returns	Official event (mean)	National events (mean)	Difference in means (Official vs. National events
CER [0; 0]	-1.59	-1.01	-0.58
CAR [0; 0]	-1.11	-0.82	-0.29
CER [1; 5]	-0.61	-3.88	3.26
CAR [1; 5]	0.25	-2.51	2.76
CDS CER [0; 0]	139.60	7.14	132.47 **
CDS CAR [0; 0]	130.46	1.83	126.63 ***
CDS CER [1; 5]	133.56	-152.68	286.24 ***
CDS CAR [1; 5]	58.21	-191.26	249.47 **

Note: The table presents the descriptive statistics for the cumulative effective returns (CER) and cumulative abnormal return (CAR) for [0; 0] and [1; 5] event windows, including both stock prices returns (%) and CDS spreads returns (basis points). In Panel A the data refers to the official event, corresponding to the date when the EBA published the O-SII list, the statistics being averaged across a sample of 54 banks in case of stock returns and 40 banks in case of CDS returns. In Panel B the data correspond to the national events (when the national regulatory authorities submitted the O-SII list to the EBA), the statistics being averaged across a sample of 64 banks in case of stock returns and 41 banks in case of CDS spreads. Panel C provides the difference in means analysis between the official event and the national events. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Table 4. Market reaction to the official O-SII list disclosure by EBA. Event study on stock returns

	Stock CAARs EBA date (%)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	-1.11	1.07	2.01	0.25
Euro zone banks	-1.35	1.08	3.18	0.60
Non-Eurozone banks	-0.73	1.07	0.18	-0.31
Significance tests: Full sample				
t-test	**-2.55**	**2.47**	**1.75**	0.25
(p-value)	(0.01)	(0.01)	(0.08)	(0.80)
Boehmer test	**-5.81**	**3.88**	**2.48**	**1.68**
(p-value)	(0.00)	(0.00)	(0.01)	(0.09)
Corrado and Zivney rank test	**-1.71**	1.50	0.78	0.26
(p-value)	(0.09)	(0.13)	(0.44)	(0.79)
Generalized sign test	**-3.37**	**4.53**	**2.08**	1.53
(p-value)	(0.00)	(0.00)	(0.04)	(0.66)
Significance tests: Euro zone banks				
t-test	**-1.98**	1.59	**1.77**	0.39
(p-value)	(0.05)	(0.11)	(0.08)	(0.69)
Boehmer test	**-4.93**	**2.90**	**2.49**	**2.31**
(p-value)	(0.09)	(0.00)	(0.01)	(0.02)
Corrado and Zivney rank test	**-1.70**	1.32	1.11	0.47
(p-value)	(0.09)	(0.19)	(0.27)	(0.64)
Generalized sign test	**-3.04**	**3.23**	**2.18**	**1.83**
(p-value)	(0.00)	(0.00)	(0.03)	(0.07)
Significance tests: Non-Euro zone banks				
t-test	**-2.07**	**3.02**	0.19	-0.39
(p-value)	(0.04)	(0.00)	(0.85)	(0.70)
Boehmer test	**-3.09**	**2.53**	0.80	0.25
(p-value)	(0.00)	(0.01)	(0.42)	(0.80)
Corrado and Zivney rank test	-1.36	1.47	-0.04	-0.05
(p-value)	(0.18)	(0.14)	(0.97)	(0.96)
Generalized sign test	-1.59	**3.22**	0.60	0.16
(p-value)	(0.11)	(0.00)	(0.55)	(0.87)

Note: This table shows the cumulative average abnormal returns (CAARs) of banks' stock prices for the Full sample, the euro zone subsample and non-euro zone subsample, considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. Data refers to the official event, corresponding to the date when the EBA published the O-SII list. The estimation window is 250 days and the model employed to compute the expected returns is a hybrid CAMP model that allows for global and regional factors as described in Eq. (1). The number of observations is as follows: Full sample – 54, Euro zone banks – 33, Non-Euro zone banks – 21. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the official event date of EBA. The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Table 5. Market reaction to the official O-SII list disclosure by EBA. Event study on CDS spreads

	CDS CAARs EBA date (b. p.)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	130.46	-20.69	-361.71	58.21
Significance tests				
t-test	**2.10**	-0.33	**-2.20**	0.42
(p-value)	(0.04)	(0.74)	(0.03)	(0.68)
Boehmer test	**4.25**	-0.66	**-4.44**	0.00
(p-value)	(0.00)	(0.51)	(0.00)	(1.00)
Corrado and Zivney rank test	0.72	-0.04	**-2.03**	-1.03
(p-value)	(0.47)	(0.97)	(0.04)	(0.30)
Generalized sign test	**3.08**	**2.76**	**-3.31**	**2.12**
(p-value)	(0.00)	(0.01)	(0.00)	(0.03)

Note: This table illustrates the cumulative average abnormal returns (CAARs) of banks' CDS spreads for the Full sample, considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. Data refers to the official event, corresponding to the date when the EBA published the O-SII list. The estimation window is 250 days and the model employed to compute the expected returns is a market model that uses as market portfolio the iTraxx Europe 5 years CDS index as described in Eq. (3). The number of observations is 40. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the official event date of EBA. The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Table 6. Determinants of stock prices CAR for the official EBA event. Short-term analysis

Dependent variable	Stock CAAR [0; 0]								
Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
O-SII characteristics									
Buffer	**0.006****	**0.005****	**0.005****	**0.005****	**0.005***	**0.005****	**0.005****	**0.005***	**0.006***
	(0.002)	**(0.002)**	**(0.002)**	**(0.003)**	**(0.003)**	**(0.002)**	**(0.002)**	**(0.003)**	**(0.003)**
Supervisory judgment	**-0.012***	**-0.012****	**-0.013****	-0.009	-0.007	**-0.013****	**-0.013****	**-0.012***	**-0.012***
	(0.006)	**(0.006)**	**(0.006)**	(0.006)	(0.006)	**(0.006)**	**(0.006)**	**(0.006)**	**(0.007)**
Dummy O-SII subsidiary	-0.007	-0.009	-0.006	-0.008	-0.007	-0.007	-0.007	-0.007	-0.008
	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Bank characteristics									
Size	**-0.004****	-0.003	**-0.005***	**-0.003**	**-0.004****	**-0.004****	**-0.003****	**-0.004****	**-0.003****
	(0.001)	(0.002)	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.001)**	**(0.001)**	**(0.002)**
Leverage	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Credit risk	0.001	0.005	-0.003	0.003	-0.010	0.002	0.009	0.000	0.003
	(0.022)	(0.025)	(0.022)	(0.022)	(0.029)	(0.022)	(0.019)	(0.024)	(0.026)
Liquidity ratio	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Non-interest income	**0.053***	**0.051***	**0.053***	**0.053***	**0.062***	**0.056***	**0.054***	**0.053***	0.051
	(0.027)	**(0.029)**	**(0.025)**	**(0.028)**	**(0.030)**	**(0.029)**	**(0.028)**	**(0.029)**	(0.032)
State ownership	-0.001	-0.000	-0.003	-0.002	-0.004	-0.002	-0.000	-0.002	-0.001
	(0.007)	(0.008)	(0.007)	(0.007)	(0.010)	(0.007)	(0.007)	(0.008)	(0.008)
Dummy SSM	-0.006	-0.006	-0.008	-0.005	-0.004	-0.005	-0.004	-0.007	-0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.005)	(0.006)
Dummy foreign ownership		0.007							
		(0.008)							
Dummy EBA			0.009						
			(0.012)						
International activity						0.005			
						(0.006)			
DTD							0.002		
							(0.002)		
Macroeconomic characteristics									
Boone indicator	-0.018	-0.020	-0.012	-0.026	-0.040	-0.021	-0.028	-0.021	-0.008
	(0.052)	(0.050)	(0.053)	(0.055)	(0.057)	(0.050)	(0.059)	(0.063)	(0.073)
Fiscal balance	**-0.102***	-0.093	**-0.110***	**-0.116****	**-0.187****	-0.090	**-0.114***	**-0.102***	**-0.108***
	(0.054)	(0.055)	**(0.059)**	**(0.046)**	**(0.075)**	(0.056)	**(0.060)**	**(0.054)**	**(0.057)**
Dummy crisis				-0.008					
				(0.008)					
Bailouts					-0.002				
					(0.011)				
Capital regulatory index								0.000	0.000
								(0.002)	(0.002)
Overall restrictions index									0.001
									(0.002)
Constant	**0.034***	**0.019**	**0.052***	0.018	**0.037***	**0.043****	0.017	0.031	0.025
	(0.018)	**(0.025)**	**(0.029)**	(0.027)	**(0.021)**	**(0.021)**	(0.023)	(0.028)	(0.030)
Observations	54	54	54	54	53	54	53	54	54
R-squared	0.304	0.314	0.321	0.315	0.335	0.310	0.321	0.305	0.308

Note: The table presents the empirical output regarding the determinants of cumulative abnormal returns of banks' stock prices when considering the EBA official event date. The following cross-sectional regression model has been estimated for the O-SIIs sample using the *OLS* estimator: $CAR_{ij}\ [t1;\ t2] = \alpha + \beta_1 \times Bank\ Characteristics_{ij} + \beta_2 \times Macro\ Controls_j + \varepsilon_{ij}$. The dependent variable is represented by the cumulative abnormal return (CAR_{ij}) of bank *i*'s from country *j* stock prices during the event window [0; 0], which corresponds to the event day (short-term period). Expected returns are estimated by a hybrid CAMP model that allows for global and regional factors as described in Eq. (1). $Bank\ Characteristics_{ij}$ is a vector of bank-level specific variables, $Macroeconomic\ Controls_j$ is a vector of macro/banking system indicators and ε_{ij} is the error term. Variables are winsorized within the 1% and 99% percentiles. Country-level clustered standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Table 7. Determinants of stock prices CAR for the official EBA event. Long-term analysis

Dependent variable	Stock CAAR [1; 5]								
Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
O-SII characteristics									
Buffer	-0.008	-0.008	-0.007	-0.008	-0.008	-0.008	-0.007	-0.008	-0.008
	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
Supervisory judgment	**0.042*** **	**0.043*** **	**0.045*** **	**0.044*** **	**0.041** **	**0.042*** **	**0.045*** **	**0.042*** **	**0.043*** **
	(0.007)	**(0.007)**	**(0.010)**	**(0.009)**	**(0.015)**	**(0.007)**	**(0.007)**	**(0.007)**	**(0.008)**
Dummy O-SII subsidiary	-0.008	-0.006	-0.010	-0.009	-0.008	-0.008	-0.008	-0.008	-0.006
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.017)
Bank characteristics									
Size	0.002	0.001	0.004	0.003	0.002	0.001	0.001	0.002	0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Leverage	0.001	0.001	0.002	0.002	0.001	0.002	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Credit risk	0.070	0.065	0.077	0.071	0.069	0.070	0.060	**0.073***	0.067
	(0.044)	(0.052)	(0.047)	(0.047)	(0.052)	(0.044)	(0.050)	**(0.042)**	(0.044)
Liquidity ratio	**-0.012*** **	**-0.012*** **	**-0.012*** **	**-0.012*** **	**-0.012*** **	**-0.012*** **	**-0.011*** **	**-0.011*** **	**-0.011*** **
	(0.003)	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**
Non-interest income	**0.066***	**0.069***	**0.067** **	**0.066***	**0.067***	**0.069***	**0.064***	**0.065***	**0.071***
	(0.034)	**(0.035)**	**(0.031)**	**(0.034)**	**(0.033)**	**(0.033)**	**(0.033)**	**(0.034)**	**(0.039)**
State ownership	**-0.032** **	**-0.033** **	**-0.029** **	**-0.032** **	**-0.032** **	**-0.032** **	**-0.034** **	**-0.031** **	**-0.032** **
	(0.014)	**(0.014)**	**(0.013)**	**(0.014)**	**(0.015)**	**(0.014)**	**(0.015)**	**(0.014)**	**(0.015)**
Dummy SSM	**0.031*** **	**0.032*** **	**0.035*** **	**0.032*** **	**0.031** **	**0.032*** **	**0.027*** **	**0.033** **	**0.036*** **
	(0.010)	**(0.011)**	**(0.010)**	**(0.010)**	**(0.011)**	**(0.011)**	**(0.009)**	**(0.013)**	**(0.012)**
Dummy foreign ownership		-0.007							
		(0.018)							
Dummy EBA			-0.017						
			(0.019)						
International activity						0.004			
						(0.014)			
DTD							-0.003		
							(0.003)		
Macroeconomic characteristics									
Boone indicator	**-0.325*** **	**-0.323*** **	**-0.336*** **	**-0.331*** **	**-0.325*** **	**-0.328*** **	**-0.308*** **	**-0.316*** **	**-0.345*** **
	(0.067)	**(0.068)**	**(0.066)**	**(0.069)**	**(0.078)**	**(0.069)**	**(0.065)**	**(0.068)**	**(0.068)**
Fiscal balance	**0.398*** **	**0.388** **	**0.414*** **	**0.388*** **	**0.403** **	**0.408*** **	**0.416*** **	**0.397*** **	**0.411*** **
	(0.127)	**(0.139)**	**(0.124)**	**(0.125)**	**(0.173)**	**(0.127)**	**(0.129)**	**(0.129)**	**(0.133)**
Dummy crisis				-0.005					
				(0.014)					
Bailouts					0.002				
					(0.025)				
Capital regulatory index								-0.001	-0.001
								(0.003)	(0.003)
Overall restrictions index									-0.002
									(0.003)
Constant	-0.048	-0.032	-0.081	-0.060	-0.047	-0.042	-0.026	-0.038	-0.024
	(0.044)	(0.056)	(0.050)	(0.056)	(0.050)	(0.047)	(0.050)	(0.049)	(0.056)
Observations	54	54	54	54	53	54	53	54	54
R-squared	0.346	0.348	0.361	0.347	0.341	0.346	0.355	0.347	0.352

Note: The table presents the empirical output regarding the determinants of cumulative abnormal returns of banks' stock prices when considering the EBA official event date. The following cross-sectional regression model has been estimated for the O-SIIs sample using the *OLS* estimator: $CAR_{ij}\ [t1; t2] = \alpha + \beta_1 \times Bank\ Characteristics_{ij} + \beta_2 \times Macro\ Controls_j + \varepsilon_{ij.}$ The dependent variable is represented by the cumulative abnormal return (CAR_{ij}) of bank *i*'s from country *j* stock prices during the event window [1; 5], which corresponds to a post-event period (long-term period). Expected returns are estimated by a hybrid CAMP model that allows for global and regional factors as described in Eq. (1). $Bank\ Characteristics_{ij}$ is a vector of bank-level specific variables, $Macroeconomic\ Controls_j$ is a vector of macro/banking system indicators and ε_{ij} is the error term. Variables are winsorized within the 1% and 99% percentiles. Country-level clustered standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Appendix

Appendix A

Market reaction to the national O-SII lists disclosure. Event study on stock returns

	Stock CAARs national event dates (%)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	-0.82	-0.34	-4.00	-2.51
Euro zone banks	-1.00	-1.01	-6.38	-6.03
Non-Eurozone banks	-0.63	0.37	-1.46	1.23
Significance tests: Full sample				
t-test	**-2.23**	-0.93	**-4.11**	**-3.06**
(p-value)	(0.03)	(0.35)	(0.00)	(0.00)
Boehmer test	**-2.34**	0.65	**-4.23**	-0.43
(p-value)	(0.02)	(0.52)	(0.00)	(0.66)
Corrado and Zivney rank test	-1.29	0.62	-1.29	0.48
(p-value)	(0.20)	(0.54)	(0.20)	(0.63)
Generalized sign test	-1.42	1.08	**-3.42**	1.08
(p-value)	(0.15)	(0.28)	(0.00)	(0.28)
Significance tests: Euro zone banks				
t-test	-1.53	-1.55	**-3.71**	**-4.16**
(p-value)	(0.13)	(0.12)	(0.00)	(0.00)
Boehmer test	-1.20	0.40	**-3.18**	**-1.96**
(p-value)	(0.23)	(0.69)	(0.00)	(0.05)
Corrado and Zivney rank test	-0.81	0.43	-1.41	-1.23
(p-value)	(0.42)	(0.66)	(0.16)	(0.22)
Generalized sign test	-1.16	1.27	**-2.91**	-1.16
(p-value)	(0.24)	(0.20)	(0.00)	(0.24)
Significance tests: Non-Euro zone banks				
t-test	**-1.93**	1.12	**-1.69**	**1.69**
(p-value)	(0.05)	(0.26)	(0.09)	(0.09)
Boehmer test	**-2.08**	0.51	**-2.76**	1.15
(p-value)	(0.04)	(0.61)	(0.01)	(0.25)
Corrado and Zivney rank test	-1.00	0.47	-0.45	**1.95**
(p-value)	(0.32)	(0.64)	(0.66)	(0.05)
Generalized sign test	-0.84	0.24	**-1.92**	**2.76**
(p-value)	(0.40)	(0.81)	(0.05)	(0.01)

Note: This table shows the cumulative average abnormal returns (CAARs) of banks' stock prices for the Full sample, the euro zone subsample and non-euro zone subsample, considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. Data correspond to the national events date (when the national regulatory authorities submitted the O-SII list to the EBA). The estimation window is 250 days and the model employed to compute the expected returns is a hybrid CAMP model that allows for global and regional factors as described in Eq. (1). The number of observations is as follows: Full sample – 64, Euro zone banks – 33, Non-Euro zone banks – 31. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the national events date. The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Appendix B

Market reaction to the O-SII list disclosure (event study on stock returns). Robustness assessment using the hybrid market model

	A. Stock CAARs EBA date (%)				B. Stock CAARs national date (%)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	-0.95	1.26	3.27	1.05	-0.67	-0.19	-2.87	-1.68
Euro zone	-1.19	1.27	4.44	1.40	-0.85	-0.84	-5.29	-5.19
Non-Eurozone	-0.57	1.26	1.44	0.49	-0.47	0.51	-0.30	2.06
Significance tests: Full sample								
t-test	**-2.18**	**2.91**	**2.85**	1.08	**-1.81**	-1.51	**-2.96**	**-2.04**
(p-value)	(0.03)	(0.00)	(0.00)	(0.28)	(0.07)	(0.61)	(0.00)	(0.04)
Boehmer test	**-5.01**	**4.50**	**4.07**	**3.56**	-1.60	1.31	**-2.21**	0.77
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.11)	(0.19)	(0.03)	(0.44)
Corrado and Zivney rank test	-1.57	1.59	1.13	0.45	-0.98	0.96	-0.50	1.15
(p-value)	(0.12)	(0.11)	(0.26)	(0.65)	(0.33)	(0.34)	(0.62)	(0.25)
Generalized sign test	**-2.60**	**4.75**	**2.58**	**2.30**	-1.27	1.23	-1.27	**1.98**
(p-value)	**(0.01)**	(0.00)	(0.01)	(0.02)	(0.20)	(0.22)	(0.20)	(0.05)
Significance tests: Euro zone banks								
t-test	**-1.75**	**1.87**	**2.47**	0.92	-1.31	-1.30	**-3.08**	**-3.58**
(p-value)	(0.08)	(0.06)	(0.01)	(0.36)	(0.19)	(0.19)	(0.00)	(0.00)
Boehmer test	**-4.43**	**3.32**	**-3.57**	**3.80**	-0.68	0.91	**-1.72**	-0.98
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.50)	(0.36)	(0.09)	(0.33)
Corrado and Zivney rank test	-1.61	1.39	1.41	0.63	-0.51	0.77	-0.69	-0.62
(p-value)	(0.11)	(0.16)	(0.16)	(0.53)	(0.61)	(0.44)	(0.49)	(0.53)
Generalized sign test	**-2.4**	**3.48**	**3.13**	**2.43**	-0.97	1.47	-0.62	0.42
(p-value)	**(0.01)**	(0.00)	(0.00)	(0.01)	(0.33)	(0.14)	(0.54)	(0.67)
Significance tests: Non-Euro zone banks								
t-test	-1.62	**3.58**	1.55	0.63	-1.44	1.58	-0.34	**2.84**
(p-value)	(0.33)	(0.03)	(0.36)	(0.71)	(0.15)	(0.11)	(0.73)	(0.00)
Boehmer test	**-2.43**	**2.99**	**2.00**	1.38	-1.55	0.92	-1.38	**1.92**
(p-value)	(0.02)	(0.00)	(0.05)	(0.17)	(0.12)	(0.36)	(0.17)	(0.06)
Corrado and Zivney rank test	-1.16	1.57	0.35	0.17	-0.88	0.57	-0.05	**2.34**
(p-value)	(0.25)	(0.12)	(0.73)	(0.86)	(0.38)	(0.57)	(0.96)	(0.02)
Generalized sign test	-1.10	**3.26**	0.21	0.74	-0.83	0.25	-1.19	**2.40**
(p-value)	(0.27)	(0.00)	(0.84)	(0.52)	(0.41)	(0.80)	(0.23)	(0.02)

Note: The table presents the results corresponding to the robustness assessment where we compute the expected returns using a hybrid market model, allowing simultaneously a global index (i.e., *the MSCI World index*) and two regional indices depending on the locations of the banks (i.e., the *Eurostoxx 50 index* for the Euro zone banks and the *STOXX 600 excluding euro zone* for the Non-Euro zone banks). The cumulative average abnormal returns (CAARs) of banks' stock prices are determined for the Full sample, the euro zone subsample and non-euro zone subsample, considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. The estimation window is 250 days. In Panel A the data refers to the official event, corresponding to the date when the EBA published the O-SII list. In Panel B the data correspond to the national events date (when the national regulatory authorities submitted the O-SII list to the EBA). The number of observations for the official event day (Panel A) is as follows: Full sample – 54, Euro zone banks – 33, Non-Euro zone banks – 21; the number of observations for the national events date (Panel B) is as follows: Full sample – 64, Euro zone banks – 33, Non-Euro zone banks – 31. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the official event date of EBA (Panel A) and the national events date when the central banks submitted the O-SII list to the EBA (Panel B). The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Appendix C

Market reaction to the O-SII list disclosure (event study on stock returns). Robustness assessment using the simple CAPM model

	A. Stock CAARs EBA date (%)				B. Stock CAARs national date (%)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	-1.19	1.38	2.87	0.71	-0.63	-0.68	-3.91	-2.85
Euro zone	-1.57	1.36	4.31	0.65	-0.67	-1.64	-6.09	-6.55
Non-Eurozone	-0.59	1.40	0.60	0.82	-0.60	0.35	-1.59	1.10
Significance tests: Full sample								
t-test	**-2.64**	**3.05**	**2.40**	0.71	**-1.67**	**-1.78**	**-3.89**	**-3.35**
(p-value)	(0.01)	(0.00)	(0.02)	(0.48)	(0.10)	(0.08)	(0.00)	(0.00)
Boehmer test	**-5.71**	**4.44**	**2.68**	**3.31**	-1.19	-0.84	**-3.50**	-1.13
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.24)	(0.40)	(0.00)	(0.26)
Corrado and Zivney rank test	-1.36	1.38	0.71	0.46	-0.36	-0.70	-1.10	0.03
(p-value)	(0.17)	(0.17)	(0.48)	(0.65)	(0.72)	(0.48)	(0.27)	(0.97)
Generalized sign test	**-3.62**	**5.10**	**2.65**	**2.92**	-0.88	**-1.63**	**-2.63**	1.12
(p-value)	(0.00)	(0.00)	(0.01)	(0.00)	(0.38)	(0.10)	(0.01)	(0.26)
Significance tests: Euro zone banks								
t-test	**-2.24**	**1.93**	**2.32**	0.41	-1.00	**-2.45**	**-3.44**	**-4.38**
(p-value)	(0.03)	(0.05)	(0.02)	(0.68)	(0.32)	(0.01)	(0.01)	(0.00)
Boehmer test	**-5.31**	**3.15**	**3.08**	**2.92**	0.12	**-1.70**	**-1.99**	**-2.58**
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.91)	(0.09)	(0.05)	(0.01)
Corrado and Zivney rank test	-1.57	1.19	0.99	0.32	0.30	-1.44	-1.02	-1.59
(p-value)	(0.12)	(0.24)	(0.32)	(0.75)	(0.76)	(0.15)	(0.31)	(0.11)
Generalized sign test	**-3.30**	**3.67**	**2.97**	**1.93**	0.29	**-2.49**	-1.45	-1.45
(p-value)	(0.00)	(0.00)	(0.00)	(0.05)	(0.77)	(0.01)	(0.15)	(0.15)
Significance tests: Non-Euro zone banks								
t-test	-1.54	**3.65**	0.59	0.95	**-1.74**	1.01	**-1.75**	1.43
(p-value)	(0.12)	(0.00)	(0.56)	(0.34)	(0.08)	(0.31)	(0.08)	(0.15)
Boehmer test	**-2.53**	**3.11**	0.38	**1.86**	**-1.96**	0.49	**-2.95**	0.94
(p-value)	(0.01)	(0.00)	(0.70)	(0.06)	(0.05)	(0.62)	(0.00)	(0.35)
Corrado and Zivney rank test	-0.83	1.46	-0.02	0.51	-0.84	0.45	-0.59	**1.63**
(p-value)	(0.41)	(0.15)	(0.98)	(0.61)	(0.40)	(0.65)	(0.56)	(0.10)
Generalized sign test	**-1.67**	**3.58**	0.52	**2.27**	-1.57 (0.12)	0.23	**-2.29**	**3.12**
(p-value)	(0.10)	(0.00)	(0.60)	(0.02)		(0.81)	(0.02)	(0.00)

Note: The table presents the results corresponding to the robustness assessment where the expected returns are computed using a simple CAPM model for both events (EBA date and national events date). The main market index is *MSCI World index* and the risk-free rate is the one-month *T-Bill rate*. The cumulative average abnormal returns (CAARs) of banks' stock prices are determined for the Full sample, the euro zone subsample and non-euro zone subsample, considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. The estimation window is 250 days. In Panel A the data refers to the official event, corresponding to the date when the EBA published the O-SII list. In Panel B the data correspond to the national events date (when the national regulatory authorities submitted the O-SII list to the EBA). The number of observations for the official event day (Panel A) is as follows: Full sample – 54, Euro zone banks – 33, Non-Euro zone banks – 21; the number of observations for the national events date (Panel B) is as follows: Full sample – 64, Euro zone banks – 33, Non-Euro zone banks – 31. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the official event date of EBA (Panel A) and the national events date when the central banks submitted the O-SII list to the EBA (Panel B). The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Appendix D

Market reaction to the O-SII list disclosure (event study on CDS spreads). Robustness assessment using a different market index

	CDS CAARs EBA date (b. p.)			
Event window	**[0; 0]**	**[1; 1]**	**[-3; 3]**	**[1; 5]**
Full sample	127.58	-24.93	-340.87	179.73
Significance tests				
t-test	**2.07**	-0.40	**-2.09**	0.62
(p-value)	(0.04)	(0.69)	(0.04)	(0.53)
Boehmer test	**4.20**	-0.77	**-4.42**	0.31
(p-value)	(0.00)	(0.44)	(0.00)	(0.75)
Corrado and Zivney rank test	0.64	-0.22	**-1.91**	-0.79
(p-value)	(0.52)	(0.82)	(0.06)	(0.43)
Generalized sign test	**3.46**	1.53	**-2.98**	**2.49**
(p-value)	(0.00)	(0.13)	(0.00)	(0.01)

Note: The table presents the results corresponding to the robustness assessment where we employ the market model to compute the expected returns as described in Eq. (3) based on the Datastream Europe Banks 5 years CDS index as market portfolio for the official EBA event date. The cumulative average abnormal returns (CAARs) of banks' CDS spreads for the full sample are determined considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. The estimation window is 250 days. Data refers to the official event, corresponding to the date when the EBA published the O-SII list. The number of observations is 40. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the official event date of EBA. The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Appendix E

Market reaction to the O-SII list disclosure in terms of stock returns and CDS spreads. Robustness assessment for a different estimation window

	A. Stock CAARs EBA date (%)				B. CDS CAARs EBA date (b. p.)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	-1.02	1.13	2.53	0.62	133.06	-17.28	-346.46	65.63
Significance tests								
t-test	**-2.24**	**2.48**	**2.10**	0.61	**2.73**	-0.35	**-2.69**	0.60
(p-value)	(0.03)	(0.01)	(0.04)	(0.54)	(0.01)	(0.72)	(0.01)	(0.55)
Boehmer test	**-5.48**	**3.94**	**2.66**	**2.20**	**4.12**	-0.63	**-3.58**	-0.08
(p-value)	(0.00)	(0.00)	(0.01)	(0.03)	(0.00)	(0.53)	(0.00)	(0.94)
Corrado and Zivney rank test	-1.58	1.59	1.06	0.69	0.76	0.01	-1.92	-0.99
(p-value)	(0.11)	(0.11)	(0.29)	(0.49)	(0.45)	(0.99)	(0.06)	(0.32)
Generalized sign test	**-3.31**	**4.63**	**2.17**	**1.89**	**3.20**	**2.88**	**-3.14**	**1.93**
(p-value)	(0.00)	(0.00)	(0.03)	(0.06)	(0.00)	(0.00)	(0.00)	(0.05)

Note: The table presents the results corresponding to the robustness assessment where the estimation window is 150 days. The cumulative average abnormal returns (CAARs) of banks' stock prices and CDS spreads are determined for the Full sample, considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. In Panel A the data correspond to the CAARs associated with stock returns. We employ a hybrid CAMP model that allows for global and regional factors as described in Eq. (1) to compute the expected returns. In Panel B the data correspond to the CAARs associated with CDS spreads. The model employed to compute the expected returns is the market model that uses as market portfolio the iTraxx Europe 5 years CDS index as described in Eq. (3). In both panels the data refers to the official event, corresponding to the date when the EBA published the O-SII list. The number of observations is 54 for Panel A and 40 for Panel B. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the official event date of EBA. The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Appendix F

Market reaction to the O-SII list official disclosure (event study on stock returns). Estimation for different sub-samples

	A. Stock CAARs of large O-SIIs (%)				B. Stock CAARs of small O-SIIs (%)			
Event window	**[0; 0]**	**[1; 1]**	**[-3; 3]**	**[1; 5]**	**[0; 0]**	**[1; 1]**	**[-3; 3]**	**[1; 5]**
	-1.72	2.20	2.91	0.02	-0.50	-0.06	1.12	0.48
Significance tests								
t-test	**-5.12**	**6.58**	**3.28**	0.02	-0.61	-0.07	0.52	0.26
(p-value)	(0.00)	(0.00)	(0.00)	(0.98)	(0.54)	(0.94)	(0.60)	(0.79)
Boehmer test	**-7.92**	**6.45**	**4.00**	**1.87**	-1.56	-0.32	-0.36	0.32
(p-value)	(0.00)	(0.00)	(0.00)	(0.06)	(0.12)	(0.75)	(0.72)	(0.75)
Corrado and Zivney rank test	**-2.22**	**2.17**	1.37	-0.04	-0.62	0.15	-0.50	0.59
(p-value)	(0.03)	(0.03)	(0.17)	(0.97)	(0.53)	(0.88)	(0.62)	(0.55)
Generalized sign test	**-3.71**	**4.78**	**3.24**	0.92	-1.07	**1.63**	-0.29	1.25
(p-value)	(0.00)	(0.00)	(0.00)	(0.36)	(0.29)	(0.10)	(0.77)	(0.21)

	C. Stock CAARs of O-SIIs without G-SIBs (%)				D. Stock CAARs of O-SIIs without top 1 banks (%)			
Event window	**[0; 0]**	**[1; 1]**	**[-3; 3]**	**[1; 5]**	**[0; 0]**	**[1; 1]**	**[-3; 3]**	**[1; 5]**
	-0.85	0.52	1.37	0.44	-1.20	1.45	2.44	-0.13
Significance tests								
t-test	-1.45	-0.89	0.88	0.34	**-2.12**	**2.57**	**1.64**	-0.11
(p-value)	(0.15)	(0.37)	(0.38)	(0.74)	(0.03)	(0.01)	(0.10)	(0.92)
Boehmer test	**-3.74**	**1.66**	0.45	1.00	**-5.09**	**3.96**	**2.66**	0.71
(p-value)	(0.00)	(0.10)	(0.66)	(0.32)	(0.00)	(0.00)	(0.01)	(0.48)
Corrado and Zivney rank test	-1.33	0.98	0.01	0.59	**-1.79**	**1.82**	0.67	-0.10
(p-value)	(0.18)	(0.32)	(0.99)	(0.55)	(0.07)	(0.07)	(0.50)	(0.92)
Generalized sign test	**-2.39**	**3.06**	0.50	1.46	**-2.96**	**4.39**	**2.38**	0.71
(p-value)	(0.02)	(0.00)	(0.62)	(0.14)	(0.00)	(0.00)	(0.02)	(0.48)

Note: The table presents the results corresponding to sub-samples of the official EBA list. The cumulative average abnormal returns (CAARs) of banks' stock prices are determined for the large banks from the sample in Panel A (with the value of total assets at the end of 2015 greater than the median of the sample), the small banks in Panel B (with the value of total assets at the end of 2015 smaller than the median of the sample), for O-SIIs without the G-SIBS in Panel C, and for O-SIIs without the top one banks in Panel D (according to their size at the end of 2015) from their country, considering the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. The estimation window is 250 days and the model employed to compute the expected returns is a hybrid CAMP model that allows for global and regional factors as described in Eq. (1). The number of observations is the following: 27 banks for large O-SIIs, 27 banks for small O-SIIs, 39 banks for O-SIIs without G-SIBs and 36 banks for O-SIIs without top one banks. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the official event date of EBA (Panel A) and the national events date when the central banks submitted the O-SII list to the EBA (Panel B). The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Appendix G

Market reaction to other events related to systemically important financial institutions (event study on stock returns)

Panel A. Market reaction to the publication of G-SIBs list by Financial Times and of the official G-SIBs list by FSB

	A1. Stock CAARs G-SIBs FT (%)				A2. Stock CAARs G-SIBs official date (%)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	0.35	-2.29	-2.44	-3.36	-0.58	-0.59	-4.97	-1.65
Significance tests								
t-test	0.45	**-2.93**	-1.19	**-1.93**	**-1.64**	**-1.66**	**-5.28**	**-2.08**
(p-value)	(0.65)	(0.00)	(0.24)	(0.05)	(0.10)	(0.10)	(0.00)	(0.04)
Boehmer test	1.50	**-8.00**	**-2.79**	**-7.98**	-0.87	**-2.81**	**-6.52**	**-3.19**
(p-value)	(0.13)	(0.00)	(0.01)	(0.00)	(0.38)	(0.01)	(0.00)	(0.00)
Corrado and Zivney rank test	0.90	**-2.94**	**-1.07**	**-2.17**	-0.22	-0.98	-1.32	-0.68
(p-value)	(0.37)	(0.00)	(0.29)	(0.03)	(0.83)	(0.33)	(0.19)	(0.50)
Generalized sign test	1.89	**-3.79**	**-1.14**	**-4.17**	-0.42	**-2.32**	**-3.83**	**-1.94**
(p-value)	(0.06)	(0.00)	(0.25)	(0.00)	(0.67)	(0.02)	(0.00)	(0.05)

Panel B. Market reaction to the publication of the list of banks subjects to stress tests conducted by EBA and of the lists of banks included in the Single Supervisory Mechanism by ECB

	B1. Stock CAARs EBA (%)				B2. Stock CAARs SSM (%)			
Event window	[0; 0]	[1; 1]	[-3; 3]	[1; 5]	[0; 0]	[1; 1]	[-3; 3]	[1; 5]
Full sample	0.24	0.36	-0.23	-1.05	0.47	1.12	0.38	0.65
Significance tests								
t-test	0.82	1.23	-0.30	-1.60	1.37	**3.25**	0.42	0.84
(p-value)	(0.42)	(0.22)	(0.77)	(0.11)	(0.17)	(0.09)	(0.68)	(0.40)
Boehmer test	**2.03**	0.86	0.97	**-2.17**	0.06	**4.63**	-1.19	**2.24**
(p-value)	(0.04)	(0.39)	(0.33)	(0.03)	(0.95)	(0.00)	(0.24)	(0.03)
Corrado and Zivney rank test	0.75	0.55	0.01	-0.91	0.41	**1.73**	-0.19	0.46
(p-value)	(0.46)	(0.59)	(0.99)	(0.36)	(0.68)	(0.08)	(0.85)	(0.64)
Generalized sign test	**1.93**	0.97	0.50	**-2.36**	**2.02**	**2.54**	0.46	0.72
(p-value)	(0.05)	(0.33)	(0.62)	(0.02)	(0.04)	(0.01)	(0.65)	(0.47)

Note: This table shows the cumulative average abnormal returns (CAARs) of banks' stock prices when considering other events related to systemically important financial institutions: the first date when the *Financial Times* publication leaked the supposed G-SIBs list (November 30th, 2009) in Panel A1; the official publication of the G-SIBs list (November 4th, 2011) in Panel A2; the stress test exercises of EBA in Panel B1; and, the publication of the lists of banks included in the Single Supervisory Mechanism by ECB in Panel B2 (November 4th, 2014). CAARs are determined using an estimation window of 250 days and the following event windows: [0; 0], [1; 1], [-3; 3], and [1; 5]. The expected returns are computed for G-SIBs using a hybrid CAPM described in Eq. (1), that allows simultaneously for a global index (*MSCI World index*) and three regional indices, depending on the location of the banks: *MSCI Europe* for the European G-SIBS, *MSCI USA* for the American G-SIBs and *MSCI Pacific* for the Asian G-SIBs. For the other events, we use the benchmark model from Eq. (1) to compute the expected return. As a risk-free rate we use the one-month *T-Bill* rate. The number of the observations is 28 for Panel A, 71 for Panel B1 and 59 for Panel B2. The table also reports the statistics and the associated p-values of the tests used to assess the significance of CAARs over the *Financial Times* leaked G-SIBs list and over the official date when the list of G-SIBs was disclosed. The data correspond to the parametric *t-test* and the *Boehmer et al. (1991) test*, the non-parametric *Corrado and Zivney (1992) rank test* and the *generalized sign test* of Cowan (1992). In bold are the tests with a maximum level of significance of 10%.

Appendix H

Banks subject to the publication of different lists on systemically important financial institutions

Number	Bank	Country of origin	G-SIBs list	Stress test list	SSM list
1	Erste Group Bank	Austria	NO	YES	YES
2	Raiffeisen Bank International	Austria	NO	YES	YES
3	KBC Group	Belgium	NO	YES	YES
4	Dexia	Belgium	YES	YES	YES
5	Bank of China	China	YES	NO	NO
6	Bank of Cyprus	Cyprus	NO	YES	YES
7	Hellenic Bank	Cyprus	NO	YES	YES
8	Marfin Popular Bank	Cyprus	NO	YES	NO
9	Danske Bank	Denmark	NO	YES	NO
10	Sydbank	Denmark	NO	YES	NO
11	Jyske bank	Denmark	NO	YES	NO
12	BNP Paribas	France	YES	YES	YES
13	Societe Generale	France	YES	YES	YES
14	Credit Agricole	France	YES	YES	YES
15	Natixis	France	NO	NO	YES
16	Crédit Agricole Atlantique Vendée	France	NO	NO	YES
17	Crédit Agricole Normandie Seine	France	NO	NO	YES
18	Crédit Agricole Loire Haute Loire	France	NO	NO	YES
19	Crédit Agricole Touraine Poitou	France	NO	NO	YES
20	CRCAM LANGUED CCI	France	NO	NO	YES
21	Crédit Agricole Brie Picardie	France	NO	NO	YES
22	Crédit Agricole du Morbihan	France	NO	NO	YES
23	CRCAM NORD DE FRANCE CCI	France	NO	NO	YES
24	Crédit Agricole Toulouse	France	NO	NO	YES
25	Crédit Industriel et Commercial	France	NO	NO	YES
26	Crédit Agricole Alpes Provence	France	NO	NO	YES
27	Crédit Agricole d'Ile de France	France	NO	NO	YES
28	Crédit Agricole Sud Rhône Alpes	France	NO	NO	YES
29	Deutsche Bank	Germany	YES	YES	YES
30	Commerzbank	Germany	YES	YES	YES
31	Landesbank Berlin	Germany	NO	YES	NO
32	Deutsche Postbank	Germany	NO	YES	NO
33	Aareal Bank	Germany	NO	YES	YES
34	IKB Deutsche Industriebank	Germany	NO	YES	NO
35	DVB Bank	Germany	NO	NO	YES
36	National Bank of Greece	Greece	NO	YES	YES
37	Alpha Bank	Greece	NO	YES	YES
38	Bank of Piraeus	Greece	NO	YES	YES
39	Eurobank Ergasias	Greece	NO	YES	YES
40	Agricultural Bank of Greece	Greece	NO	YES	NO
41	TT Hellenic Postbank	Greece	NO	YES	NO
42	OTP Bank	Hungary	NO	YES	NO
43	FHB Jelzálogbank Nyrt	Hungary	NO	YES	NO
44	The Governor and Company of the Bank of Ireland	Ireland	NO	YES	YES
45	Allied Irish Bank	Ireland	NO	YES	YES
46	Permanent TSB Group Holdings	Ireland	NO	YES	YES
47	Unicredit Group S.p.A.	Italy	YES	YES	YES
48	Gruppo Monte dei Paschi di Siena	Italy	NO	YES	YES
49	Intesa Sanpaolo	Italy	NO	YES	YES
50	Unione di Banche Italiane	Italy	NO	YES	YES
51	Banca Carige	Italy	NO	YES	YES
52	Banca Piccolo Credito Valtellinese SpA	Italy	NO	YES	NO
53	Credito Emiliano	Italy	NO	YES	NO
54	Banca Popolare di Milano	Italy	NO	YES	YES
55	Banca Popolare di Sondrio	Italy	NO	YES	YES
56	Banco popolare - Societa Cooperativa	Italy	NO	YES	YES
57	Mediobanca	Italy	NO	YES	YES
58	Banco di Sardegna	Italy	NO	NO	YES
59	Mitsubishi UFJ FG	Japan	YES	NO	NO
60	Mizuho FG	Japan	YES	NO	NO
61	Sumitomo Mitsui FG	Japan	YES	NO	NO
62	Bank of Valletta	Malta	NO	YES	YES
63	HSBC Bank Malta	Malta	NO	NO	YES
64	ING Group	Netherlands	YES	YES	YES
65	DNB ASA	Norway	NO	YES	NO
66	Handlowy	Poland	NO	YES	NO
67	PKO Bank	Poland	NO	YES	NO
68	Getin Noble Bank	Poland	NO	YES	NO
69	Bank BPH	Poland	NO	YES	NO
70	Alior Bank	Poland	NO	YES	NO
71	Banco BPI	Portugal	NO	YES	YES
72	Banco Comercial Português	Portugal	NO	YES	YES
73	Banco Espirito Santo	Portugal	NO	YES	NO
74	Tatra Banka	Slovakia	NO	NO	YES
75	Vseobecna Uverova Banka	Slovakia	NO	NO	YES
76	Nova Kreditna Banka Maribor	Slovenia	NO	YES	NO
77	Banco Santander	Spain	YES	YES	YES
78	Caixabank	Spain	NO	YES	YES
79	BBVA	Spain	NO	YES	YES
80	Banco Popular Espanol	Spain	NO	YES	YES
81	Banco de Sabadell	Spain	NO	YES	YES
82	Caja de Ahorros del Mediterraneo	Spain	NO	YES	NO
83	Bankinter	Spain	NO	YES	YES
84	Banco Pastor	Spain	NO	YES	NO
85	Banco Guipuzcoano	Spain	NO	YES	NO
86	Liberbank	Spain	NO	YES	YES
87	Bankia	Spain	NO	NO	YES
88	Swedbank	Sweden	NO	YES	NO
89	Svenska Handelsbanken AB	Sweden	NO	YES	NO
90	Nordea Bank	Sweden	YES	YES	NO
91	Skandinaviska Enskilda Banken AB	Sweden	NO	YES	NO
92	Credit Suisse Group	Switzerland	YES	NO	NO
93	UBS Group	Switzerland	YES	NO	NO
94	HSBC Holdings Plc	UK	YES	YES	NO
95	Barclays Plc	UK	YES	YES	NO
96	Royal Bank of Scotland Group Plc	UK	YES	YES	NO
97	Lloyds Banking Group Plc	UK	YES	YES	NO
98	Bank of America	USA	YES	NO	NO
99	Bank of New York Mellon	USA	YES	NO	NO
100	Citigroup	USA	YES	NO	NO
101	Goldman Sachs Group	USA	YES	NO	NO
102	JP Morgan Chase	USA	YES	NO	NO
103	Morgan Stanley	USA	YES	NO	NO
104	State Street	USA	YES	NO	NO
105	Wells Fargo	USA	YES	NO	NO
	Total number of events		*28*	*71*	*59*

Note: The table shows the O-SIIs from our sample included in the G-SIBs list published by Financial Supervisory Board, in the stress test exercises by EBA and in the Single Supervisory Mechanism by ECB with data available on Datastream.

Appendix I

Description of the statistic tests used to assess the abnormal returns

In our event study, we examined the cumulative average abnormal return (CAAR) for the whole sample and we employed parametric and non-parametric tests in order to evaluate the significance of the CAARs. All tests have the following null hypothesis:

$$H_0: CAAR\ [t_1;\ t_2] = 0$$

The alternative hypothesis is:

$$H_a: CAAR\ [t_1;\ t_2]\ \neq 0$$

A. Parametric tests. The parametric tests are based on the assumption that the abnormal returns are normally distributed (Serra, 2002).

A1. The t-test. The t-test for the CAAR has the following form:

$$t_{CAAR_{T1,T2}} = \frac{CAAR\ [t_1; t_2]}{\sigma_{CAAR\ [t_1; t_2]}} \quad \text{(I1)}$$

where $\sigma_{CAAR\ [t_1; t_2]}$ is the estimated standard deviation of the $CAAR\ [t_1;\ t_2]$ for the $[t_1;\ t_2]$ event window defined as

$$\sigma_{CAAR\ [t_1; t_2]} = \sqrt{\frac{1}{N(N-d)} \sum_{i=1}^{N} (CAR_i[t_1;\ t_2] - CAAR\ [t_1;\ t_2])^2} \quad \text{(I2)}$$

N is the number of the firms in the sample, $CAR_i[t_1;\ t_2]$ is the cumulative abnormal return of firm *i* for the $[t_1;\ t_2]$ interval and *d* represents the degrees of freedom. The t-test assumes cross-sectional independence, i.e., the residuals are not correlated across firms.

A2. Boehmer et al.'s (1991) test. This test is corrected for event-induced changes in volatility and it is based on the standardization process of abnormal returns (ARs), as in the Patell's (1976) test, which is robust to heteroscedastic event-window abnormal returns:

$$SAR_{it} = \frac{AR_{it}}{\sigma_{AR_i}} \tag{I3}$$

where SAR_{it} is the standardized abnormal return for firm *i* at time *t.* The standard deviation is estimated using the following formula:

$$\sigma_{AR_i} = \sqrt{\frac{1}{D_i - d}\sum_{t=t1}^{t2}(AR_{it})^2} \tag{I4}$$

where D_i is the number of days in firm *i*'s estimation period (usually 250 or 150). Under the null hypothesis, each SAR_{it} follows a Student t-distribution with $D_i - d$ degrees of freedom. SARs can be cumulated over different intervals $[t_1;\ t_2]$ to get the cumulative standardized abnormal return (CSAR):

$$CSAR_i[t_1;\ t_2] = \sum_{t=t_1}^{t_2} SAR_{it} \tag{I5}$$

The expected value of the $CSAR_i[t_1;\ t_2]$ is zero and the standard deviation is given by:

$$\sigma_{CSAR_i[t_1;\ t_2]} = \sqrt{(t_2 - t_1 - 1)\frac{D_i - d}{D_i - 2d}} \tag{I6}$$

Under the null hypothesis of statistically indistinguishable from zero CAARs, the test is given in Eq. (K7):

$$Boehmer - test = \frac{1}{\sqrt{N}}\sum_{i=1}^{N}\frac{CSAR_i[t_1;\ t_2]}{\sigma_{CSAR_i[t_1;\ t_2]}} \tag{I7}$$

where the denominator (standard deviation) is defined as

$$\sigma_{CSAR_i[t_1;\, t_2]} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(CSAR_i[t_1;\, t_2] - \frac{1}{N}\sum_{i=1}^{N} CSAR_i[t_1;\, t_2])^2} \quad \text{(I8)}$$

B. Non-parametric tests. Unlike the parametric tests, the non-parametric tests do not assume a specific distribution of the abnormal returns.

B1. Corrado and Zivney's (1992) rank test. Corrado (1989) assigns a rank based on abnormal return to each day *t* of each individual firm *i* in the sample:

$$K_{it} = rank(AR_{it}) \quad \text{(I9)}$$

Based on the estimation window, rank one denotes the smallest abnormal return and rank *t* denotes the largest abnormal return. Corrado and Zivney (1992) standardize the ranks to allow for missing returns:

$$U_{it} = \frac{K_{it}}{(1+ M_i)} \quad \text{(I10)}$$

where M_i is the number of non-missing returns during the event period. For each day the test can be written as follows:

$$Corrado - test = \frac{1}{\sqrt{N}}\sum_{i=1}^{N}\frac{\sum_{i=1}^{N}(U_{it}-\frac{1}{2})}{\sigma_{U_{it}}} \quad \text{(I11)}$$

where *N* is the number of the firms in the sample and $\sigma_{U_{it}}$ is the standard deviation of the ranks. For the CAARs, we use the aggregation formula from Cowan (1992). In Eq. (K11), M_i represents the number of non-missing returns of firm *i*. If there are no missing returns, $M_i = M = t_2 - t_1 + 1$. The mean rank across estimation and event window period is:

$$\widetilde{K} = \frac{D+M+1}{2} \quad \text{(I12)}$$

where *D* is the length of the estimation window. For the $[t_1;\, t_2]$ event window the Corrado and

Zivney rank test has the following form:

$$Corrado\ and\ Zivney - test = \sqrt{t_2 - t_1 + 1}\frac{\overline{K\ [t_1; t_2]} - \widetilde{K}}{[\sqrt{\sum_{t=1}^{D+E}(\overline{K_t} - \widetilde{K})^2/(D+E)}]} \quad \text{(I13)}$$

where $\overline{K\ [t_1;\ t_2]} = \frac{1}{t_2 - t_1 + 1}\sum_{t=t_1}^{t_2}\frac{1}{N}\sum_{i=1}^{N}K_{it}$ is the average rank across all *N* firms in the sample and $t_2 - t_1 + 1$ days of the event window and $\overline{K_t} = \frac{1}{N}\sum_{i=1}^{N}K_{it}$ is the average rank across *N* firms on day *t* of the combined estimation and event period. The Corrado and Zivney rank test is corrected for event-induced volatility of rankings.

B2. The generalized sign test. This test assesses whether the firms with positive CARs in the event window exceeds the number expected from a period unaffected by the event (Cowan, 1992). The number expected is based on the fraction of positive CARs in the estimation period (*T*), usually set at 250 or 150 days:

$$\hat{p} = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T}\sum_{t=1}^{T}S_{it} \quad \text{(I14)}$$

where

$$S_{it} = \begin{cases} 1\ if\ CAR_{it} > 0 \\ 0 \quad otherwise \end{cases} \quad \text{(I15)}$$

The ratio of positive cumulative abnormal returns is a binominal random variable, and the generalized sign test statistic has the following form (with the null $CAAR\ [t_1;\ t_2] = 0$):

$$Generalised\ sign - test = \frac{w - n\hat{p}}{\sqrt{n\hat{p}(1-\hat{p})}} \quad \text{(I16)}$$

where *w* is the number of firms in the event window for which $CAR\ [t_1;\ t_2]$ is positive. The generalized sign test is well specified in the presence of skewed returns.