Discussion Paper

Deutsche Bundesbank
No 09/2020

The market impact of systemic risk capital surcharges

Yalin Gündüz

Deutsche Bundesbank, Wilhelm-Epstein-Straße 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-0

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax +49 69 9566-3077

Internet http://www.bundesbank.de

ISBN 978–3–95729–676–4 (Printversion)
ISBN 978–3–95729–677–1 (Internetversion)

Non-technical summary

Research Question

This paper tests whether an increase or decrease of the capital surcharge for being a global systemically important bank (G-SIB) envisaged by regulators has a market impact measured in terms of the bank's credit default swap (CDS) prices. On the one hand, the announcement of a reallocation to a higher bucket could mean that the bank might have lower projected income in the future, since raising new equity is costly. This could in turn indicate more intrusive supervision by the authorities and higher perceived risk in markets. On the other hand, the classification as a G-SIB may be perceived by the market as being a "too-big-to-fail" bank, which brings in a higher probability that banks will be bailed out with capital and liquidity as needed. They might therefore attract funds at relatively lower interest rates and have decreased CDS spreads.

Contribution

Earlier studies have looked at similar research questions only by considering a 0/1 decision of being a global systemically important bank (G-SIB) or not. Our paper contributes to the literature by considering the degree of systemic importance through the buckets assigned by regulators. This brings in the additional dimension of increases in the costs of capital surcharges for each increase in the degree of systemic importance.

Results

We indeed find evidence that the CDS spreads of a G-SIB bank increase (decrease) after the announcement of a higher (lower) capital surcharge. These findings imply that the effect of having a higher capital surcharge and more stringent regulation outweigh the implicit advantages of being too big to fail. However, this effect is temporary, as the mean CDS spreads revert to pre-announcement level, dropping sharply after the initial rise. Overall, although the CDS market initially prices a reallocation of the degree of systemic importance, market participants could be repricing the fact that the banks fully absorb the effect on their capital after a certain time interval.

Nichttechnische Zusammenfassung

Fragestellung

In der vorliegenden Studie wird geprüft, ob sich durch eine Erhöhung oder Verminderung des von den Regulierungsbehörden vorgesehenen Kapitalzuschlags für global systemrelevante Banken (G-SIBs) Auswirkungen auf die Preise für Credit Default Swaps (CDS) der jeweiligen Institute ergeben. Einerseits könnte die Ankündigung, eine Bank einem höheren Bucket zuzuordnen bedeuten, dass die Ertragsprognosen für das betroffene Institut in Zukunft niedriger ausfallen, da die Aufnahme neuen Eigenkapitals mit Kosten verbunden ist. Dies könnte wiederum darauf hindeuten, dass die Aufsichtsbehörden die Institute enger begleiten und sich das wahrgenommene Marktrisiko erhöht. Andererseits deutet die Einstufung von Banken als G-SIBs darauf hin, dass sie vom Markt als Too-big-to-fail-Institute wahrgenommen werden, was die Wahrscheinlichkeit erhöht, dass sie bei Bedarf durch Kapital- und Liquiditätsspritzen gerettet werden. Somit könnten sie sich Mittel zu vergleichsweise niedrigeren Zinssätzen beschaffen.

Beitrag

In früheren Studien zu diesem Thema wurde lediglich als Ja/Nein-Entscheidung beobachtet, ob eine Bank global systemrelevant ist oder nicht. Unser Beitrag zur Literatur besteht darin, den Grad der Systemrelevanz anhand des jeweiligen Buckets zu berücksichtigen, das die Regulierungsbehörden der Bank zugewiesen haben. Dadurch wird der zusätzlichen Dimension Rechnung getragen, dass jede Erhöhung der systemischen Relevanz zu einem Anstieg der mit Kapitalzuschlägen verbundenen Kosten führen kann.

Ergebnisse

Wir haben Hinweise darauf gefunden, dass die CDS-Prämien einer global systemrelevanten Bank nach Ankündigung eines höheren (niedrigeren) Kapitalzuschlags zunehmen (abnehmen). Dies bedeutet, dass die Auswirkungen eines höheren Kapitalzuschlags und einer strengeren Regulierung die impliziten Vorteile überwiegen, die sich durch die Klassifizierung als Too-big-to-fail-Institut ergeben. Hierbei handelt es sich jedoch um einen vorübergehenden Effekt, denn nach einem anfänglichen Anstieg sinkt der Mittelwert der CDS-Prämien wieder deutlich und kehrt so auf das vor der Ankündigung bestehende Niveau zurück. Auch wenn sich eine Neuzuordnung der Systemrelevanz zunächst im Preis auf dem CDS-Markt niederschlägt, könnten die Marktteilnehmer im weiteren Verlauf den Umstand einpreisen, dass die Banken die Auswirkungen auf ihr Eigenkapital nach Ablauf eines bestimmten Zeitraums vollständig absorbieren.

Deutsche Bundesbank Discussion Paper No 09/2020

The Market Impact of Systemic Risk Capital Surcharges*

Yalin Gündüz
Deutsche Bundesbank

Abstract

This paper tests whether an increase or decrease of the capital surcharge for being a global systemically important bank (G-SIB) envisaged by regulators has an impact on the CDS prices of these banks. We find evidence that the CDS spreads of a G-SIB bank increase (decrease) after the announcement of a higher (lower) capital surcharge. However, this effect is temporary, as the mean CDS spreads revert to pre-announcement level, dropping sharply after the initial rise. Our analysis contributes to the debate on whether being designated as a G-SIB bank necessarily leads to implicit "too-big-to-fail" subsidies. The findings imply that the investors immediately update their beliefs on the systemic risk of the bank after the bucket reallocation announcement and temporarily demand more hedging against systemic risk.

Keywords: Too-big-to-fail, CDS spreads, systemically important banks, G-SIBs, G-SIB capital surcharges.

JEL classification: G21, G28.

*Contact address: Wilhelm Epstein Str. 14, 60431 Frankfurt am Main, Germany. Phone: +49-69-9566-8163. E-Mail: yalin.gunduz@bundesbank.de. I would like to thank Daniel Foos, Björn Imbierowicz and Lars Norden for detailed discussions and comments from which this paper truly benefited. I would also like to thank Alexander Schulz and other participants from the Macroprudential Supervision Group for the engagement in the Basel Committee for Banking Supervision discussions. Excellent research assistance was provided by Pinar Arar, Rugved Joshi and Marco Simnacher. The views expressed in this paper are those of the author and do not necessarily coincide with the views of the Deutsche Bundesbank or the Eurosystem.

1 Introduction

The global financial crisis of 2008 led to heightened concerns about the systemic dependence of large banks. Since then, regulatory authorities have imposed a wide variety of regulations to monitor and reduce the systemic risk due to a failure of so-called "Too-Big-to-Fail" (TBTF) banks. Not only has the newly formed Financial Stability Board (FSB) actively investigated the too-big-to-fail problem, but also the Basel Committee on Banking Supervision's Macroprudential Supervision Group (BCBS-MPG) has reached several milestones in its campaign to regulate systemically important banks (Basel Committee on Banking Supervision (2011, 2013, 2018)).

The FSB has been publishing a list of global systemically important banks ("G-SIBs") in consultation with the BCBS and national authorities every year in November since 2012. By identifying and allocating systemically important banks to different levels of additional capital requirement buckets, the G-SIB framework provides incentives for G-SIBs to align their systemic importance by waiving these higher requirements.

In this paper, we investigate whether inclusion of a bank in the G-SIB list, or a change in the bucket of an existing G-SIB, results in significant changes in its credit risk, measured in terms of its credit default swap (CDS) spread. We implement a panel analysis based on daily relative CDS spreads and a standard event study approach, in which we primarily use the average CDS spreads of G-SIBs that do not change buckets as a control for the average default risk.

Although being designated as a G-SIB should create disadvantages, the coin has indeed two sides. On the one hand, the announcement of a reallocation to a higher bucket could simply mean that the bank might have lower projected income in the future, since raising new equity is costly. This could in turn indicate more intrusive supervision by regulators and higher perceived risk in markets. In essence, the announcement is an update of information on the systemic importance of the bank and this may result in investors preferring to hedge against this specific increase in systemic risk in their portfolios by purchasing CDS. Thus, the announcement would increase demand for the affected bank's CDS, pushing its price higher. On the other hand, being a G-SIB effectively labels banks as Too-Big-to-Fail, indicating the greater insurance due to the reluctance of regulators to close or unwind complex and large banks. This might create excessive risk taking with the expectation that they will be bailed out with capital and/or liquidity as needed (Farhi and Tirole (2012)). These banks could therefore possibly attract funds at relatively lower interest rates and decrease the banks' CDS spread. One can argue that this mechanism can also be prevalent within the G-SIB list, although its magnitude can differ between the buckets. Moreover, the additional G-SIB related capital that the banks have to hold might make banks even safer, and therefore decrease their CDS spreads.

Since our observation period covers G-SIB designations between 2012 and 2017, our results are unaffected by the recent introduction of recovery and resolution regimes. This notwithstanding, a significant decrease in bailout expectations may date back as early as just after the global financial crisis. A recent paper by Berndt, Duffie, and Zhu (2018) document a significant reduction in CDS market-implied probabilities of a TBTF government intervention for post-crisis U.S. G-SIBs. Their results may signal that the effect of any bailout expectations on CDS spreads might be outweighed by the effect of higher capital requirements in force since 2011.

There are four interesting results arising from our analysis. Firstly, the CDS markets react directly after bucket reallocation to a higher (lower) bucket due to significantly positive (negative) abnormal CDS spread changes. This result suggests that a bucket reallocation of a G-SIB is valued by CDS market participants in recognition of the fact that, due to this treatment, the bank's credit risk would deviate from that of the benchmark sample banks. These results are robust to different alternative samples and methodologies. Secondly, there is also evidence that this pricing of a bucket reallocation immediately after the announcement reverts to its original levels, since we find the abnormal CDS spread changes to be significantly negative between 30-60 days after the event. Third, the panel analysis reveals that reallocations to buckets with higher capital surcharge requirement are related to daily positive relative CDS spread increases, whereas reallocations to lower buckets are not. Finally, a new G-SIB status or a G-SIB bucket reallocation has only temporary effects on the credit risk of these banks, as the abnormal CDS spread changes are not significantly different from zero when considered across the entire event window $[-90, 90]$. A possible reason for this is that the CDS market participants could view the effects of a G-SIB bucket reallocation to be fully absorbed by the affected bank.

The main contribution of our paper is the inclusion of the important dimension of required regulatory capital in the TBTF debate, which we measure through the bucket reallocations. Although the recent formation of resolution funds (since 2018) limits the degree of possible implicit TBTF subsidies, our paper points to regulatory capital to potentially rebalance this effect as observed from market spreads.

Related literature

Systemic risk of banks has been a major cornerstone of research in financial stability in general. Although attention had been given to financial systemic risk even before[1] the global crisis, the field has attracted high interest not only through papers that suggest measures of systemic risk[2], but also through papers that empirically evaluate the degree of this risk.[3] This paper intersects with the literature on systemic risk through the dimension of how being designated as a systemically important bank has a market impact.[4]

This paper builds on to the previous literature in two strands. Primarily, it contributes to the debate on how bank capital and TBTF are related. Acharya (2009) models the economy, suggesting that capital adequacy requirements should not only consider a single bank's own risk, but also its correlation with other banks, which yields the degree of systemic risk. The model in Zhou (2013) adds the claim that imposing capital requirements can lower individual risk, yet simultaneously creates systemic risk through linkages. Although there exist varying views on how to achieve a fair capital requirements scheme for systemically important banks, it is mostly agreed that excessively low capital adequacy requirements create incentives to align with implicit TBTF subsidies. Passmore and von Hafften (2017) put forward that the Basel G-SIB surcharges are too low, as they underestimate default probability. Kupiec (2016) additionally claims that the Total Loss Absorbing Capacity (TLAC) requirements will also fail to reduce the TBTF problem, since subsidiaries might still have access to supplemental injections. Among other papers that advocate a systemic perspective on bank capital regulation are Gauthier, Lehar, and Souissi (2012) and Laeven, Ratnovski, and Tong (2016).

Secondly, this paper contributes to analyses on how banks' CDS spreads respond to possible measures of systemic importance (Völz and Wedow (2011); Barth and Schn-

[1]See for instance, Rochet and Tirole (1996); Freixas, Parigi, and Rochet (2000); Bartram, Brown, and Hund (2007); Huang, Zhou, and Zhu (2009) or Acharya (2009)

[2]See especially Acharya, Engle, and Richardson (2012); Adrian and Brunnermeier (2016); Acharya, Pedersen, Philippon, and Richardson (2017) and Brownlees and Engle (2017)

[3]For instance, Engle, Jondeau, and Rockinger (2015); Huang, Zhou, and Zhu (2012); Puzanova and Düllmann (2013); Zhang, Vallascas, Keasey, and Cai (2015) and Bostandzic and Weiß (2018) among others.

[4]An extensive literature investigates the impact of being a TBTF bank (O'Hara and Shaw (1990); Boyd and Gertler (1994); Stern and Feldman (2004); Kaufman (2002, 2014); Morrison (2011)) on their stock returns (Kabir and Hassan (2005); Demirgüç-Kunt and Huizinga (2013); Abreu and Gulamhussen (2013); Kleinow, Nell, Rogler, and Horsch (2014); Moenninghoff, Ongena, and Wieandt (2015); Bongini, Nieri, and Pelagatti (2015)), business models (Afonso, Santos, and Traina (2014); Oliveira, Schiozer, and Barros (2015); Violon, Durant, and Toader (2018)), mergers and acquisitions (Penas and Unal (2004); Brewer and Jagtiani (2013)), or credit risk pricing (more below), whereas a parallel strand of literature analyze adverse incentives due to related government guarantees (Flannery and Sorescu (1996); Freixas, Rochet, and Parigi (2004); Marques, Correa, and Sapriza (2013); Gropp, Gruendl, and Guettler (2014); Balasubramnian and Cyree (2014); Acharya, Anginer, and Warburton (2016)).

abel (2013); Demirgüç-Kunt and Huizinga (2013); Araten and Turner (2013); Cetina and Loudis (2016); Ahmed, Anderson, and Zarutskie (2015)). The study by Moenninghoff et al. (2015) has pioneered the empirical efforts on the effects of G-SIB regulation on international banks, by undertaking a comprehensive analysis on its impacts on their market values. Our choice of CDS spreads as a funding cost metric to measure the effect of capital requirements and TBTF relies on CDS contracts being available as a contract but not as securities, such that they can be arbitrarily set up anytime. The large literature on CDS markets refers to these contracts as highly liquid instruments, which are less prone to market frictions.[5,6]

Although the literature agrees that being a TBTF bank is negatively associated with CDS spreads, there has not been any study that particularly looks at the effects of capital requirement bucket changes on the market pricing of credit risk. The additional granular dimension introduced in this paper, i.e. instead of looking at G-SIB designation or being a large bank as a 0/1 event, enables us to carve out cases in which a marginally higher capital requirement balances out the TBTF subsidy identified in the previous literature. Moreover, event study analysis with CDS has been mostly on the effects of credit rating changes[7], and this paper extends this methodology to TBTF evaluation.

The structure of this paper is as follows: Section 2 summarizes the data we use. Section 3 introduces the approaches we implement in our analysis. Section 4 provides an overview of our results. The final section concludes.

2 G-SIB Lists and Data

The regulatory methodology that designates banks as G-SIBs necessitates the calculation of a score as outlined in the reports by the Basel Committee on Banking Supervision (2011, 2013, 2018). A large sample of banks are classified by an indicator-based approach based on the scores they receive from five underlying, equally weighted categories: (i) size, (ii) cross-jurisdictional activity, (iii) interconnectedness, (iv) substitutability/financial institution infrastructure and (v) complexity. The score of the banks in the G-SIB list ranges from 130 as a cutoff level to be classified as a G-SIB, up to 530. Currently, there are five buckets, which change with an increment of 100, i.e. the highest bucket would be a

[5] See especially Blanco, Brennan, and Marsh (2005); Longstaff, Mithal, and Neis (2005); Gehde-Trapp, Gündüz, and Nasev (2015); Junge and Trolle (2015); Tang and Yan (2017)

[6] Alternative instruments used in the literature to look at the effects of being TBTF have been deposit rates as in Jacewitz and Pogach (2018); Bassett (2016), bond spreads GAO US (2014); Santos (2014); Ahmed et al. (2015) or credit rating uplift Ueda and Di Mauro (2013); Schich and Toader (2017)

[7] See Norden and Weber (2004); Hull, Predescu, and White (2004); Afonso, Furceri, and Gomes (2012); Finnerty, Miller, and Chen (2013) and Ismailescu and Kazemi (2010)

score more than 530. The lowest G-SIB bucket has the lowest additional capital requirement with 1% of risk-weighted assets, whereas the fifth bucket has the highest capital buffer requirement of 3.5% of risk-weighted assets. In 2017, only JP Morgan Chase is in the fourth bucket with the highest capital requirement for all G-SIBs with 2.5% of risk-weighted assets. Whenever a non G-SIB bank passes the threshold score of 130, it will be added to the list in the lowest bucket. Overall, the report published in 2017 has classified 29 banks as G-SIBs.

Our dataset consists of daily CDS spreads of banks in the G-SIB list from the Markit database and covers the time period from January 1, 2012 to March 27, 2018. Our choice of CDS spreads as a metric relies on CDS contracts being available as a contract but not as securities, such that they can be arbitrarily set up anytime. Thus, the large literature on CDS markets refers to them as highly liquid instruments, which are less prone to market frictions. By choosing CDS spreads as our measure, we refrain from using bond spreads as in GAO US (2014) or Santos (2014), since they may have liquidity premiums or call provision that are priced in, or deposit rates as in Jacewitz and Pogach (2018) or Bassett (2016) for which fees or other cross-bank metrics are in play.

The dataset includes CDS spreads for all major currencies and maturities between 6 months and 30 years in all liquid restructuring clause features. We focus only on the most liquid 5-year CDS spreads and the restructuring clause prevalent in the region and currency where the headquarters of the bank operates. Restructuring clauses define the eligible credit events in case of a credit quality deterioration, by accepting restructuring of debt renegotiation as a default event or not. The market practice defines "No Restructuring" (XR) as the regional standard for North American-based contracts, whereas "Modified modified Restructuring" (MM) or "Complete Restructuring" (CR) are standards for European or Asian contracts.[8]

We consider three samples depending on the currency choice and headquarters location of the bank: a USD, a EUR and a mixed sample. It can be seen in Table 1 that in the first two columns, the USD and EUR samples consist of a restructuring clause selection for the banks independently from the currency choice, but based on the headquarters. In the third column, we opt for creating not only a USD or EUR-based sample, but also a mixed currency sample, where the currency and the restructuring clause depends on the location of the bank headquarters. The combined sample makes use of EUR for European banks and USD for North American and Asian banks as the most dominant currency.

[8]See the Big Bang and Small Bang Protocol definitions published by Markit (2009a,b). The International Swaps and Derivatives Association (ISDA) 2014 Credit Derivatives Definitions adds CR14, XR14 and MM14 to these restructuring clauses, which include government intervention as a credit event as well.

Table 1: The list of G-SIBs in the sample with the respective restructuring clause of their credit default swap prices

Bank	USD	EUR	MIX
Bank of America	XR	XR	XR (USD)
Bank of New York Mellon	XR	–	XR (USD)
Citigroup	XR	XR	XR (USD)
Goldman Sachs	XR	XR	XR (USD)
JP Morgan Chase	XR	XR	XR (USD)
Morgan Stanley	XR	XR	XR (USD)
Royal Bank of Canada	XR	XR14	XR (USD)
State Street	XR	–	XR (USD)
Wells Fargo	XR	XR	XR (USD)
Barclays	MM	MM	MM (EUR)
BBVA	MM	MM	MM (EUR)
BNP Paribas	MM	MM	MM (EUR)
Credit Suisse	MM	MM	MM (EUR)
Deutsche Bank	MM	MM	MM (EUR)
Group Crédit Agricole	MM	MM	MM (EUR)
Groupe BPCE	MM	MM	MM (EUR)
HSBC	MM	MM	MM (EUR)
ING Bank	MM	MM	MM (EUR)
Nordea	MM	MM	MM (EUR)
Royal Bank of Scotland	MM	MM	MM (EUR)
Santander	MM	MM	MM (EUR)
Société Générale	MM	MM	MM (EUR)
Standard Chartered	MM	MM	MM (EUR)
UBS	MM	MM	MM (EUR)
Unicredit Group	MM	MM	MM (EUR)
Agricultural Bank of China	CR	–	CR (USD)
Bank of China	CR	CR	CR (USD)
China Construction Bank	CR	CR	CR (USD)
Industrial and Commercial Bank of China Limited	CR	–	CR (USD)
Mitsubishi UFJ FG	MR	–	MR (USD)
Mizuho FG	CR14	CR14	CR (USD)

CR/CR14, XR/XR14 and MM/MM14 refer to Complete Restructuring, No Restructuring, and Modified Modified Restructuring, respectively.

Between 2012 and 2017 there are 16 European, 9 North American and 6 Asian-based banks that appear as a G-SIB.[9] We define an affected bank as one that has experienced a bucket allocation between 2013 and 2017, where this also includes removing and adding a bank to the G-SIB list. Table 2 shows all 24 bucket reallocations from 2013 to 2017, with each of them being announced on a day in November. Overall, the affected sample

[9]Although the first G-SIB list was published in November 2011, it did not indicate the breakdown into specific buckets.

Table 2: The list of bucket reallocations in the sample

Event date	Affected banks	Bucket reallocation
11.11.2013	Deutsche Bank	4 to 3
	Citigroup	4 to 3
	Bank of New York Mellon	2 to 1
	Group Crédit Agricole	1 to 2
	ICBC China	0 to 1
06.11.2014	Group Crédit Agricole	2 to 1
	UBS	2 to 1
	Agricultural Bank of China	0 to 1
03.11.2015	Royal Bank of Scotland	2 to 1
	China Construction Bank	0 to 1
21.11.2016	Citigroup	3 to 4
	HSBC	4 to 3
	Barclays	3 to 2
	Bank of America	2 to 3
	ICBC China	1 to 2
	Wells Fargo	1 to 2
	Morgan Stanley	2 to 1
21.11.2017	Citigroup	4 to 3
	BNP Paribas	3 to 2
	Bank of China	1 to 2
	Credit Suisse	2 to 1
	China Construction Bank	1 to 2
	Groupe BPCE	1 to 0
	Royal Bank of Canada	0 to 1

includes 13 banks that were reallocated to a lower bucket and 11 banks to a higher bucket by the FSB. The quantity of changes per year range from 2 to 7. Our goal is to see if any of these bucket reallocations affected the credit risk, i.e. CDS spreads, of the affected bank.

We choose event windows to cover 90 trading days before and after the event. As the G-SIB list is published every November, there is no bank with overlapping events in any given year. Due to the unavailability of data for 7 cases in the EUR sample and 1 case in the USD sample, we had to exclude their bucket reallocation events from the analysis. In total, there are 23, 17, and 23 bucket reallocations for the USD, EUR and mixed samples respectively.

3 Hypothesis Development

3.1 Market Impact

It should be initially discussed whether a market impact is to be expected after an announcement of the G-SIB lists every November since 2011 at all. In particular, the Basel Framework calibrates the G-SIB scores of individual banks by dividing by a denominator that is computed through the scores of all participating banks. This implies that, although individual banks might estimate the projected new bucket roughly, there is indeed a window for an announcement effect. Since the market may not know the full list of parameters for all participating banks, there is a surprise component attached to each year's announcement.

An initial panel analysis looks at whether the relative CDS spreads in event windows of $[-90, 90]$ of the affected banks are particularly driven by an upwards or downwards bucket reallocation. The specification we use is;

$$\Delta CDS_{it} = \alpha + \beta_1 * I_{up} + \beta_2 * I_{down} + \beta_3 * I_T + \beta_4 * I_{up} * I_T + \beta_5 * I_{down} * I_T + \gamma_i + \epsilon \quad (1)$$

where ΔCDS_{it} is the relative daily CDS spread:

$$\Delta CDS_{it} = \frac{(CDS_{it} - CDS_{it-1})}{CDS_{it-1}}. \quad (2)$$

for all banks i on trading day t, with I_{up} being an indicator with value 1 for an upwards bucket reallocation of bank i and I_{down} being an indicator with value 1 for a downwards bucket reallocation of bank i. Indicator T has a value of 1 separately in each regression for time intervals of [-60, -31], [-30, -2], [-1, 1], [2, 20], [31, 60], [-60, 60], and [-90, 90] and a value of zero for the days outside of each year's [-90, 90] interval. This necessitates dropping the observations within the [-90, 90] event window for other intervals than the particular time interval of interest, since otherwise the remaining time intervals in the event window would have confining zero values that might enter into the regression, which would contaminate the results. As an example, for a panel regression for the [-30, 2] window with an indicator T value of 1, [-90, 31] and [1, 90] intervals of every year have to be dropped, and the remaining daily values outside the event window of [-90, 90] received a T value of zero. Finally, γ_i indicates bank fixed effects.

3.2 Impact Direction

3.2.1 Hypotheses

Two alternative hypotheses could be particularly relevant for understanding the direction of the market impact of bucket reallocations.

On the one hand, the announcement of a reallocation to a higher bucket could simply mean that the bank might have lower projected income in the future, since raising new equity is costly. This could, in turn, indicate more intrusive supervision by the authorities and higher perceived risk in markets (Imbierowicz, Kragh, and Rangvid (2018)). A further possible explanation is that the announcement is an update of information on the systemic importance of the bank, and that, investors would like to hedge against this specific increase in systemic risk in their portfolios by purchasing CDS. Thus, the announcement would increase the demand of the affected bank's CDS, pushing its price higher.

A more technical explanation could reside in the structural credit risk model literature. Additional capital requirements would implicitly move the default threshold upwards in Merton (1974) type models, since it is easier to violate the higher capital requirements designated by regulators, i.e., the bank is implicitly closer to default. This would cause distance-to-default, a major parameter in structural type models, to decrease, which in turn would be reflected in higher CDS prices.

$\mathbf{H}_1$: *The CDS spreads of affected banks increase for reallocation to a higher bucket and decrease for reallocation to a lower bucket more significantly than the benchmarks during the event window.*

This hypothesis would provide evidence that higher G-SIB capital surcharges results in a higher CDS spread for the bank. This would signal that the CDS market participants might be pricing the marginal cost of additional capital required by the G-SIB into the credit risk of the bank.

On the other hand, being a G-SIB effectively labels banks as a "too-big-to-fail", which comes with greater insurance that they will be bailed out with capital and liquidity as needed. They might therefore attract funds at relatively lower interest rates (Farhi and Tirole (2012)). The recent formation of resolution funds limits the degree of possible implicit TBTF subsidies, yet the period between 2012 and 2017, from which are data come, is still prone to this effect.

$\mathbf{H}_2$: *The CDS spreads of affected banks decrease for reallocation to a higher bucket and increase for reallocation to a lower bucket more significantly than the benchmarks during the event window.*

This hypothesis would provide evidence that higher G-SIB buckets label banks as TBTF, which comes with higher implicit insurance and thus, lower CDS spreads. Particularly, the CDS market response to changes in G-SIB surcharges would be negative with a reallocation to a higher bucket. Moreover, the additional G-SIB related capital that the banks have to hold might make banks even safer, and therefore reduce their CDS spreads.

Once again, the structural explanation behind a decrease in CDS spreads could be based on banks' adjustment of risk-weighted assets (RWA). It has been documented in the literature that banks might choose to reduce their RWA in case of additional capital requirements (Gropp, Mosk, Ongena, and Wix (2018)), even by shifting their portfolios to zero risk-weight assets (Acharya and Steffen (2015)). This would indicate less perceived credit risk by investors, and thus, reduce the CDS spreads of the bank.

The second part of the analysis will test these hypotheses in separate t-tests and Wilcoxon sign-rank tests.

3.2.2 Methodology

In order to look at these two hypotheses, this section summarizes our event study approach for CDS markets as described in Norden and Weber (2004) and Hull et al. (2004), which is based on computing abnormal CDS premiums of the affected group with respective to the CDS prices of a control group.

Benchmark Selection

For the event study implementation, we use three different benchmark group compositions to control for the average default risk of the affected G-SIBs. In general, we define a group $\mathcal{T}$ of the 24 bucket reallocations in Table 2. In addition, $\mathcal{S}$ is the group of all G-SIB banks that have been in the sample at least once between 2012 and 2017.

We define a baseline benchmark (control) group as an equally-weighted average of the CDS spreads of all banks in the old and new bucket allocation of the affected bank, with the bucket to be differing before and after the event. This control group selection is similar to the differentiation by credit ratings of previous papers on CDS spreads (Norden and Weber (2004); Hull et al. (2004); Finnerty et al. (2013)):

$$BM_{it}^{1} = \begin{cases} \frac{1}{n_{o1}} \sum_{k \in N_{o1}} CDS_{kt} & \text{if } t < 0, \\ \frac{1}{n_{n1}} \sum_{k \in N_{n1}} CDS_{kt} & \text{if } t \geq 0 \end{cases} \tag{3}$$

with BM_{it}^1 : benchmark for affected bank $i \in \mathcal{T}$ on trading day $t \in [-90, 90]$, CDS_{kt} : observed CDS spread for the control group bank k on day t, $N_{B1} \in \mathcal{S}, B \in \{o,\ n\}$ for the group of non-affected banks in the bucket of i before the bucket reallocation for $(o)ld$ and after for $(n)ew$, n_{B1} is the number of banks in N_{B1}. Hence, benchmark 1 results in two series before and after day zero, depending on the old and new bucket of the affected bank.

This benchmark controls for a possible bias due to a large variability observed across buckets. Figure 1 compares the CDS spreads of all years depending on the bucket and the currency. The CDS spreads of all banks in a bucket in the corresponding year are merged across all years and depicted in the boxplot. The mean of CDS spreads denoted by a (large) dot represents the average default risk of the banks in the corresponding bucket. It is observed from Figure 1 that G-SIB banks that are required to hold a higher capital surcharge have a lower average CDS spread; i.e., the mean CDS spread of bucket 3 is the lowest for every currency, and the mean for bucket one is the highest. These descriptive statistics indicate that it seems appropriate to control for the average default risk of the buckets. Finally, the red dots mark the outliers in our data, defined as CDS spreads that are 1.5 times larger than the interquartile range.

In addition, there could be two alternative methods to compute a benchmark (control) group in the following way:

$$BM_{it}^j = \frac{1}{n_{ij}} \sum_{k \in N_{ij}} CDS_{kt} \tag{4}$$

where BM_{it}^j : benchmark for bank $i \in \mathcal{T}$ on trading day $t \in [-90, 90]$, CDS_{kt} : observed CDS spread for bank k on day t, $N_{ij} \in \mathcal{S}$ for the group of non-affected banks in the year of the bucket reallocation of i for the second benchmark ($j = 2$) and the group of all banks except the bank i in that event window in the G-SIB list for the third benchmark ($j = 3$); n_{ij} is the number of banks in N_{ij}. As a result, the calculation of benchmark 2 depends on the affected banks in a given year[10] and benchmark 3 on the affected bank independent of the year.

Abnormal CDS spread changes

In this section, we define three approaches we use to calculate the abnormal CDS spread changes (ASC).

For the purpose of analysis, the CDS spread changes are adjusted by benchmark 1 of

[10] The notation results in BM_{it}^2 is equal for all $i \in \mathcal{T}$ in a given year.

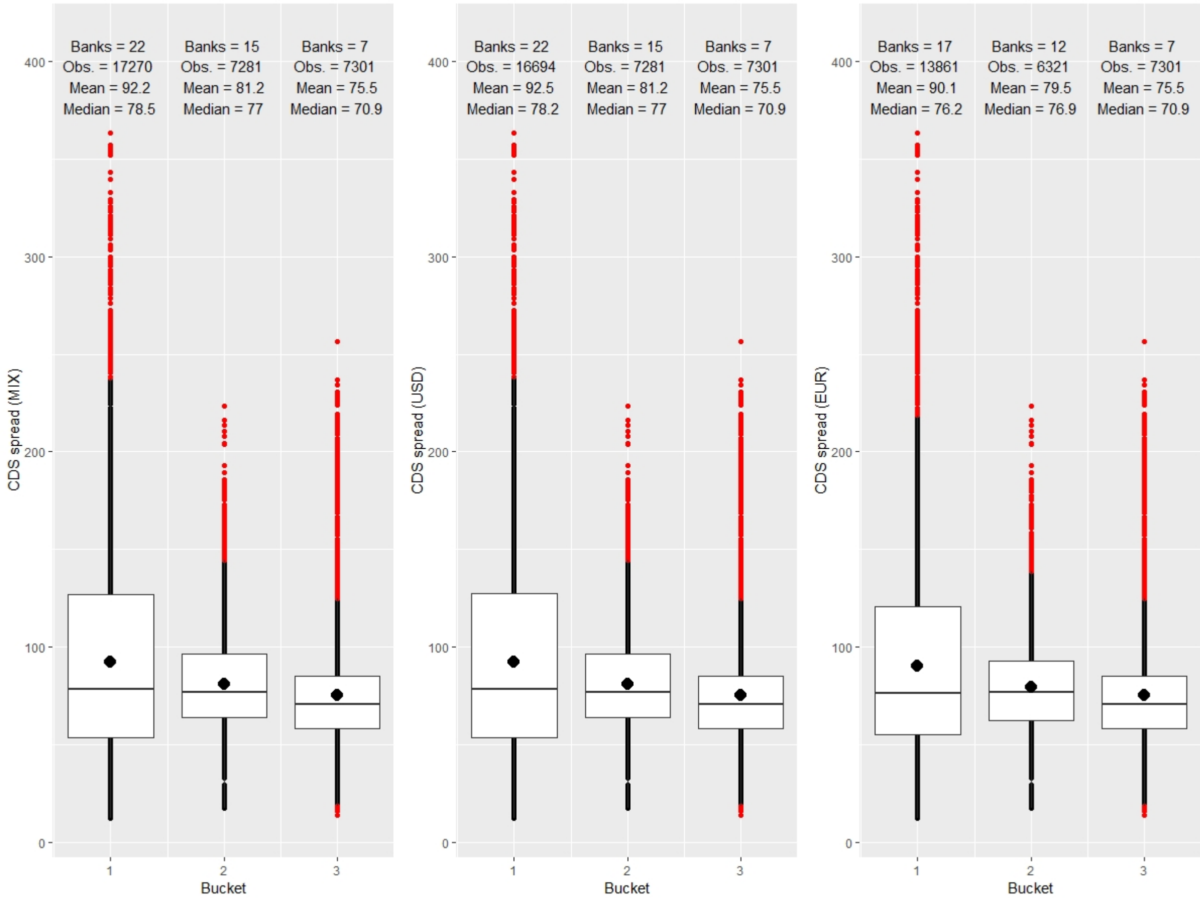

Figure 1: *CDS spreads of all banks and currencies, independent of the year.*

the affected bank and its corresponding bucket before day zero. To control for the average default risk after day zero, the CDS spread changes are adjusted by the new bucket.

$$ASC_{it} = \begin{cases} (CDS_{it} - CDS_{it-1}) - (BM^1_{ot} - BM^1_{ot-1}) & \text{if } t < 0, \\ (CDS_{it} - CDS_{it-1}) - (BM^1_{nt} - BM^1_{nt-1}) & \text{if } t \geq 0. \end{cases} \tag{5}$$

Similarly, we calculate the absolute abnormal CDS spread changes of the affected banks by adjusting it with benchmark 2 and 3 as

$$ASC_{it} = (CDS_{it} - CDS_{it-1}) - (BM^j_{it} - BM^j_{it-1}). \tag{6}$$

Since the CDS spreads of the banks from Table 1 are not homogeneous within the buckets, the results could be driven by banks with high CDS spreads. This can be illustrated by the following example. Consider the CDS spreads of two affected banks at day t of the event window,

$$CDS_{bank1t} \approx 182$$
$$CDS_{bank2t} \approx 50$$

Hence, for a 1% increase in the CDS spreads of both banks we obtain the absolute CDS spread changes of,

$$CDSincrease_{bank1t} \approx 1.82$$
$$CDSincrease_{bank2t} \approx 0.5$$

In this case, the bank with the higher CDS spread would be more influential if we test whether average ASCs across the affected banks for every time interval are significantly different than zero. Therefore, it is also reasonable to look at relative changes in the abnormal CDS spreads of affected banks.

The phenomenon described in the example could also have an effect on the benchmarks. The existing literature constructs the benchmark by averaging cross-sectional CDS spreads across rating classes to control for the average default risk of that class. However, the G-SIB list does not differentiate the buckets based on the credit ratings of the banks. We observe CDS spreads ranging from 50 bps to 350 bps within buckets as seen in Figure 1, which if averaged across banks within a bucket could give us a skewed picture of the average default risk. This results in biased abnormal CDS spread changes of the G-SIB banks.

An alternative way to compute the abnormal CDS spread changes could account for this bias. Similar to Section 3.1 the daily relative CDS spread changes[11] are calculated as

$$\Delta CDS_{it} = \frac{(CDS_{it} - CDS_{it-1})}{CDS_{it-1}}. \tag{7}$$

Benchmark 1 is calculated with ΔCDS_{kt} instead of CDS_{kt},

$$\widetilde{BM}^1_{it} = \begin{cases} \frac{1}{n_{o1}} \sum_{k \in N_{o1}} \Delta CDS_{kt} & \text{if } t < 0, \\ \frac{1}{n_{n1}} \sum_{k \in N_{n1}} \Delta CDS_{kt} & \text{if } t \geq 0. \end{cases} \tag{8}$$

[11]For robustness we compute an alternative relative spread measure, which is described in the appendix.

as in equation 3 and we obtain the benchmarks 2 and 3 by

$$\widetilde{BM}^{j}_{it} = \frac{1}{n_{ij}} \sum_{k \in N_{ij}} \Delta CDS_{kt}, \;\; where \; j \in \{2, 3\}. \tag{9}$$

as in equation 4. Hence, the CDS spread changes are adjusted by these benchmarks similar to equations 5 and 6

$$ASC_{it} = \begin{cases} (\Delta CDS_{it}) - (\widetilde{BM}^{1}_{ot}) & \text{if } t < 0, \\ (\Delta CDS_{it}) - (\widetilde{BM}^{1}_{nt}) & \text{if } t \geq 0. \end{cases} \tag{10}$$

$$ASC_{it} = \Delta CDS_{it} - \widetilde{BM}^{j}_{it}, \text{ where } j \in \{2, 3\}. \tag{11}$$

We expect a reallocation to a higher bucket to have an opposite effect than reallocation to a lower bucket. As described in Table 2, we observe bucket reallocations to lower and higher buckets. Since these two types of bucket reallocations have opposite signs on the abnormal CDS spread changes, we multiply the time series of the banks that migrate into a lower bucket by -1 in order to make all our bucket reallocations are comparable for the calculation of the ASCs. This will enable us to undertake one-sided tests of significance in increases and decreases separately.

Finally, the cumulative abnormal relative CDS spread changes (CASCs) are be computed by summing up the daily ASCs in the event window (similar to Norden and Weber (2004)).

4 Results

In this section, we describe the results of our analysis.

4.1 Panel Estimation

The panel specification in Section 3.1 yields interesting results. In Table 3 for almost all time intervals, the interaction of the indicator of a reallocation of a higher bucket with the indicator of the time interval is significantly positive. This implies that there are marginally higher daily relative CDS changes during these time intervals around a reallocation to a higher bucket of the bank. Interestingly, the same is not true for a reallocation to a lower bucket. A possible explanation for this result is that investors update their prior beliefs regarding the systemic risk of the bank, even before the announcement, and

Table 3: Panel regression

	Daily Rel CDS	**Daily Rel CDS**	**Daily Rel CDS**	**Daily Rel CDS**	**Daily Rel CDS**	**Daily Rel CDS**	**Daily Rel CDS**
Time Dummy	[-60, -31]	[-30, -2]	[-1, 1]	[2, 30]	[31, 60]	[-60, 60]	[-90, 90]
Upwards Reallocation	**0.0050*****	**0.0053*****	**0.0050*****	**0.0051*****	**0.0051*****	**0.0053*****	**0.0052*****
p-value	**0.0001**	**0.0000**	**0.0001**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Downwards Reallocation	0.0012	0.0011	0.0013	0.0011	0.0013	0.0012	0.0012
p-value	0.3483	0.3794	0.3161	0.3879	0.3182	0.3515	0.3334
Time Dummy	0.0004	**0.0016*****	0.0015	**0.0008***	**0.0036*****	0.0002	0.0000
p-value	0.2391	**0.0001**	0.3756	**0.0578**	**0.0000**	0.4618	0.8965
Upwards * Time Dummy	**0.0061*****	**0.0047*****	**0.0082***	**0.0051*****	**0.0024***	**0.0047*****	**0.0044*****
p-value	**0.0001**	**0.0031**	**0.0671**	**0.0012**	**0.0995**	**0.0004**	**0.0006**
Downwards * Time Dummy	0.0008	0.0002	0.0020	0.0013	0.0013	0.0001	0.0005
p-value	0.5843	0.8888	0.5075	0.3794	0.4216	0.9324	0.7101
Observations	64,887	64,389	54,178	64,420	64,797	100,663	124,339
R^2	0.0005	0.0008	0.0007	0.0007	0.0019	0.0004	0.0003
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table provides the results of the panel regression that explains the daily relative CDS spreads (*Daily Rel CDS*) with indicator variables based on time intervals around possible upward and downward bucket reallocations, and their interaction. *Upwards Reallocation* takes the value one whenever the day that the relative CDS spread of a bank is computed lies within the [-90, 90] event window of an upwards bucket reallocation for the bank, and zero otherwise. *Downwards Reallocation* takes the value one whenever the day that the relative CDS spread of a bank is computed lies within the [-90, 90] event window of an downwards bucket reallocation for the bank, and zero otherwise. *Time Dummy* takes the value one if the day that the relative CDS spread of a bank is computed lies within the time interval in the header, and zero for outside of the [-90, 90] event window, while all other observations within the event window were dropped. The terms *Upwards * Time Dummy* and *Downwards * Time Dummy* consist of the interaction of these variables. All specifications make use of bank fixed effects and robust standard errors. ***, ** and * indicate statistical significance with p-values $p < 0.01$, $p < 0.05$ and $p < 0.1$ respectively.

would like to hedge against this specific increase in systemic risk in their portfolios by purchasing CDS of these banks. The following section will analyze this result by looking at abnormal CDS spreads around the event.

4.2 Event Study

An initial visual inspection shows the mean cumulative abnormal absolute and relative CDS spreads in Figures 2 and 3 depending on the benchmarks and currencies. The graphs display no significant change in the ASCs up to t = -1. However, the figure shows that there has been an increase in the ASCs for every currency and benchmark between the time interval -1 to 30. Overall, the relative CASCs reach a maximum of 6 per cent, which reveals that the CDS spread changes of affected banks increase faster than the respective benchmark. We will investigate this visual observation through formal tests.

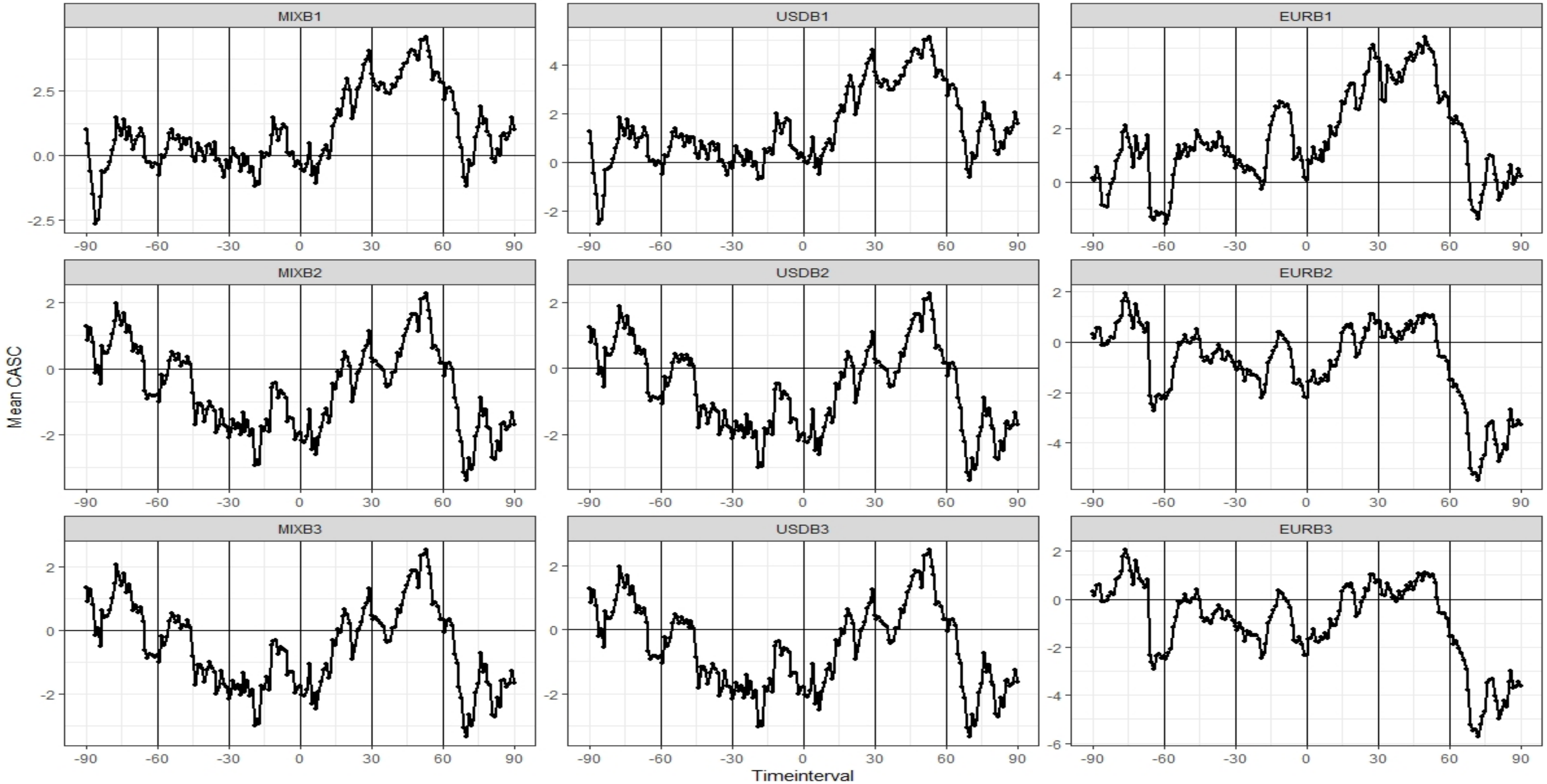

Figure 2: *Mean cumulative abnormal absolute CDS spreads*

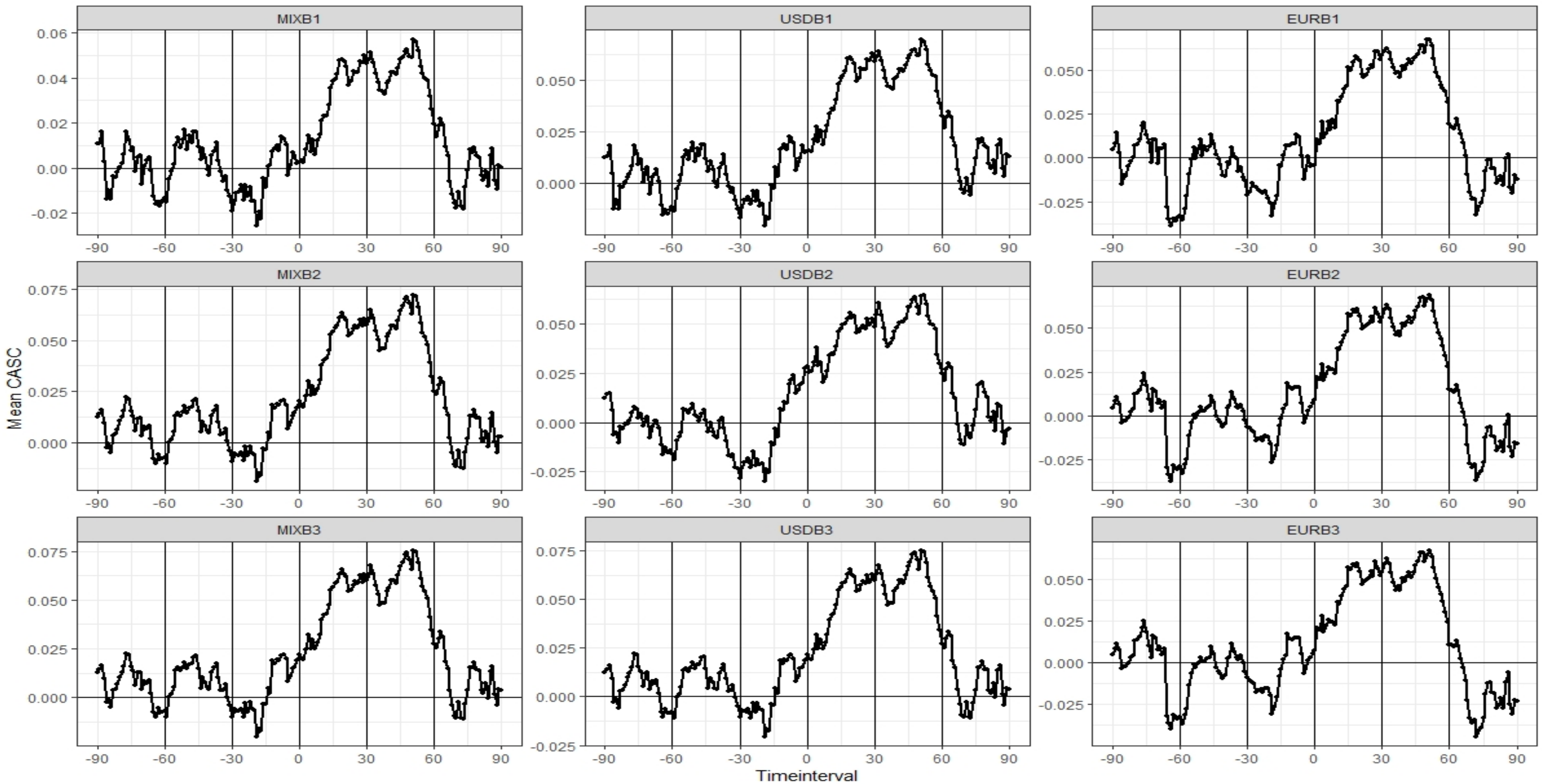

Figure 3: *Mean cumulative abnormal relative CDS spreads*

We compute the time series of means across the abnormal CDS spread changes of all affected banks as outlined in Section 3.2. We employ one-sided cross-sectional t-tests and Wilcoxon sign-rank tests in order to determine if there is evidence on a significant increase in abnormal CDS spreads for the affected group. Tables 4 and 5 display the mean, median and their *p-value* of the one-sided t-test and Wilcoxon sign-rank test, respectively.

As can be seen in Table 4 the mean absolute abnormal CDS spread changes are significantly greater than the benchmark spreads for all currencies controlled against almost all benchmark groups for the time interval $[2, 30]$. This observation provides initial support for H_1, such that a higher capital surcharge leads to higher realized CDS spreads for the banks after controlling for increases in benchmark group's CDS spreads. Additionally, there is an indication of anticipation of the bucket reallocations for EUR banks. On the other hand, Table 4 already provides an indication that this increase in CDS spreads is insignificant in $[-60, 60]$ or in $[-90, 90]$ intervals, i.e. the effect resolves beyond the event window.

As argued in Section 3.2.2, the analysis of absolute CDS spreads can be biased due to the heterogeneity of the CDS spreads of the G-SIBs. Since the relative approach corrects for this possible bias, the results ought to be more accurate. Indeed, we observe similar effects as with the absolute analysis in Table 5; i.e., the mean abnormal relative CDS spread changes are almost always significantly greater than the benchmark groups for all currencies at a 5% level for the time interval 2 to 30, except for two benchmark groups in the EUR sample. Moreover, the anticipation of the CDS markets can be also observed in the intervals $[-60, -31]$ for EUR. Once again, although the bucket reallocation effect in CDS spreads disappears when we look at the $[-60, 60]$ or $[-90, 90]$ intervals, thus it reveals to be temporary.

The reason of this temporary effect is due to a projected trend as in Figure 3; i.e, a decline from day 45 after the event with a convergence to very initial CDS spread levels after day 70. From the figure we can observe that the CASCs reach around -4%, which implies that the CDS spread changes of the affected banks decrease almost $8 - 10\%$ faster than the benchmarks during this time period.

In Tables 6 and 7, we test the hypothesis of a significant decline in CDS spreads for the affected group. We observe significant negative mean absolute ASCs for EUR for the interval $[31, 60]$ in Table 6. The same results can be found for all combinations at a 5%-level in Table 7. This strongly supports H_2 in the relative as well as the absolute analysis 31 to 60 days after the announcement. Apart from that, there is no statistical evidence to reject the hypotheses in any other time interval.

Table 4: Tests of increases in the absolute spread

Currency/BM	Description	[-60, -31]	[-30, -2]	[-1, 1]	[2, 30]	[31, 60]	[-60, 60]	[-90, 90]
Mix B1	Mean	0.0041	−0.0076	−0.0402	**0.1265****	−0.0111	0.0188	0.0056
	t-test p-val	0.4667	0.5372	0.5720	**0.0602**	0.5921	0.1920	0.3977
	Median	0.0738	0.1056	0.2592	0.1063	−0.0448	0.0224	−0.0048
	Rank test p-val	0.1050	0.5000	0.1050	0.2024	0.7976	0.3388	0.6612
Mix B2	Mean	−0.0309	−0.0127	−0.0124	**0.0867***	−0.0051	0.0012	−0.0095
	t-test p-val	0.7183	0.5582	0.5312	**0.0748**	0.5375	0.4815	0.6635
	Median	0.0341	0.0571	0.2415	0.0633	−0.0359	0.0076	0.0049
	Rank test p-val	0.5000	0.5000	0.1050	0.3388	0.8950	0.3388	0.5000
Mix B3	Mean	−0.0314	−0.0057	−0.0136	**0.0856***	−0.0039	0.0024	−0.0092
	t-test p-val	0.7195	0.5279	0.5334	**0.0537**	0.5298	0.4620	0.6611
	Median	0.0351	0.0566	0.3000	0.0654	−0.0289	0.0058	0.0034
	Rank test p-val	0.5000	0.5000	0.2024	0.5000	0.8950	0.3388	0.5000
USD B1	Mean	−0.0023	0.0068	−0.0394	**0.1265***	−0.0111	0.0224	0.0087
	t-test p-val	0.5186	0.4669	0.5704	**0.0608**	0.5920	0.1537	0.3454
	Median	0.0627	0.1088	0.2746	0.1063	−0.0307	0.0224	−0.0048
	Rank test p-val	0.1050	0.5000	0.1050	0.2024	0.7976	0.3388	0.6612
USD B2	Mean	−0.0294	−0.0123	−0.0123	**0.0867***	−0.0046	0.0012	−0.0094
	t-test p-val	0.7102	0.5576	0.5310	**0.0750**	0.5344	0.4823	0.6602
	Median	0.0570	0.0802	0.2538	0.0633	−0.0269	0.0102	−0.0009
	Rank test p-val	0.5000	0.5000	0.1050	0.3388	0.8950	0.2024	0.6612
USD B3	Mean	−0.0301	−0.0060	−0.0136	**0.0857***	−0.0035	0.0023	−0.0091
	t-test p-val	0.7122	0.5296	0.5332	**0.0538**	0.5267	0.4639	0.6595
	Median	0.0564	0.0753	0.2887	0.0652	−0.0206	0.0079	0.0033
	Rank test p-val	0.5000	0.5000	0.2024	0.5000	0.8950	0.3388	0.5000
EUR B1	Mean	**0.0711****	−0.0028	−0.0080	**0.1312****	−0.0729	0.0163	0.0012
	t-test p-val	**0.0377**	0.5148	0.5091	**0.0476**	0.9690	0.2714	0.4780
	Median	**0.0688****	0.0500	−0.0335	0.1712	−0.0560	0.0308	0.0235
	Rank test p-val	**0.0481**	0.5927	0.7597	0.1189	0.9519	0.2403	0.4073
EUR B2	Mean	**0.0490***	−0.0308	0.0647	0.0812	−0.0753	−0.0095	−0.0182
	t-test p-val	**0.0886**	0.6106	0.4176	0.1486	0.9338	0.6227	0.7632
	Median	0.0482	0.1014	0.0661	0.1411	−0.0547	0.0027	0.0217
	Rank test p-val	0.1189	0.4073	0.2403	0.1189	0.9846	0.5927	0.2403
EUR B3	Mean	**0.0527***	−0.0317	0.0745	0.0833	−0.0762	−0.0099	−0.0201
	t-test p-val	**0.0689**	0.6294	0.4079	0.1214	0.9499	0.6266	0.7876
	Median	**0.0503****	0.1024	0.0887	0.1286	−0.0655	0.0040	0.0132
	Rank test p-val	**0.0481**	0.4073	0.2403	0.1189	0.9846	0.5927	0.4073

[EUR/USD/MIX]B1 is Abnormal absolute CDS Spread changes with Benchmark 1, [EUR/USD/MIX]B2 is Abnormal absolute CDS Spread changes with Benchmark 2, and [EUR/USD/MIX]B3 is Abnormal absolute CDS Spread changes with Benchmark 3. The null hypothesis under the t-test is mean ASC ≤ 0 and under the Wilcoxon sign rank test is median ASC ≤ 0 ***, ** and * indicate statistical significance with p-values $p < 0.01$, $p < 0.05$ and $p < 0.10$ respectively.

Table 5: Tests of increases in the relative spread

Currency/BM	Description	[-60, -31]	[-30, -2]	[-1, 1]	[2, 30]	[31, 60]	[-60, 60]	[-90, 90]
Mix B1	Mean	0.0001	0.0006	−0.0008	**0.0015***	−0.0009	0.0001	0.0000
	t-test p-val	0.4499	0.2388	0.6045	**0.0091**	0.9579	0.2937	0.4963
	Median	0.0009	0.0008	0.0009	**0.0020**	−0.0012	0.0002	0.0000
	Rank test p-val	0.1050	0.2024	0.5000	**0.0173**	0.8950	0.5000	0.7976
Mix B2	Mean	0.0001	0.0006	0.0014	**0.0014***	−0.0011	0.0002	0.0000
	t-test p-val	0.4099	0.2384	0.2688	**0.0086**	0.9795	0.2571	0.4735
	Median	0.0007	0.0009	0.0007	**0.0016**	−0.0015	0.0003	0.0000
	Rank test p-val	0.3388	0.2024	0.5000	**0.0466**	0.9534	0.5000	0.5000
Mix B3	Mean	0.0001	0.0007	0.0015	**0.0014***	−0.0011	0.0002	0.0000
	t-test p-val	0.4193	0.2171	0.2290	**0.0058**	0.9823	0.2247	0.4608
	Median	0.0008	0.0006	0.0009	**0.0021**	−0.0013	0.0003	0.0000
	Rank test p-val	0.3388	0.2024	0.5000	**0.0466**	0.9827	0.2024	0.5000
USD B1	Mean	0.0000	0.0011	−0.0007	**0.0015***	−0.0009	0.0002	0.0001
	t-test p-val	0.4932	0.1295	0.6000	**0.0064**	0.9548	0.1634	0.3609
	Median	0.0009	0.0008	0.0009	**0.0020**	−0.0012	0.0002	0.0000
	Rank test p-val	0.2024	0.2024	0.5000	**0.0173**	0.8950	0.5000	0.7976
USD B2	Mean	0.0001	0.0006	0.0014	**0.0014***	−0.0011	0.0002	0.0000
	t-test p-val	0.4066	0.2342	0.2680	**0.0050**	0.9780	0.2360	0.4715
	Median	0.0008	0.0015	0.0007	**0.0016**	−0.0014	0.0003	0.0000
	Rank test p-val	0.3388	0.2024	0.5000	**0.0466**	0.9534	0.5000	0.5000
USD B3	Mean	0.0001	0.0007	0.0015	**0.0014***	−0.0011	0.0002	0.0000
	t-test p-val	0.4172	0.2131	0.2280	**0.0037**	0.9814	0.2073	0.4580
	Median	0.0009	0.0016	0.0009	**0.0019***	−0.0014	0.0003	0.0000
	Rank test p-val	0.3388	0.2024	0.5000	**0.0053**	0.9827	0.2024	0.5000
EUR B1	Mean	**0.0007***	0.0003	0.0052	**0.0016**	−0.0013	0.0001	−0.0001
	t-test p-val	**0.0902**	0.3928	0.1984	**0.0321**	0.9893	0.3458	0.5968
	Median	**0.0010**	0.0004	−0.0018	**0.0024**	−0.0015	−0.0001	0.0000
	Rank test p-val	**0.0481**	0.4073	0.7597	**0.0154**	0.9846	0.7597	0.5927
EUR B2	Mean	**0.0009**	0.0003	0.0055	0.0011	−0.0014	0.0001	−0.0001
	t-test p-val	**0.0296**	0.3967	0.1692	0.1056	0.9904	0.3954	0.6100
	Median	**0.0008**	0.0013	0.0012	**0.0022**	−0.0015	0.0004	−0.0001
	Rank test p-val	**0.0481**	0.2403	0.1189	**0.0481**	0.9846	0.4073	0.7597
EUR B3	Mean	**0.0010**	0.0003	0.0060	0.0012	−0.0014	0.0001	−0.0001
	t-test p-val	**0.0236**	0.3904	0.1588	0.1007	0.9947	0.4126	0.6670
	Median	**0.0010**	0.0007	0.0012	0.0022	−0.0014	0.0003	0.0000
	Rank test p-val	**0.0481**	0.2403	0.4073	0.1189	0.9993	0.2403	0.5927

[EUR/USD/MIX]B1 is Abnormal relative CDS Spread changes with Benchmark 1, [EUR/USD/MIX]B2 is Abnormal relative CDS Spread changes with Benchmark 2, and [EUR/USD/MIX]B3 is Abnormal relative CDS Spread changes with Benchmark 3. The null hypothesis under the t-test is mean ASC ≤ 0 and under the Wilcoxon sign rank test is median ASC ≤ 0 ***, ** and * indicate statistical significance with p-values $p < 0.01$, $p < 0.05$ and $p < 0.10$ respectively.

Table 6: Tests of decreases in the absolute spread

Currency/BM	**Description**	**[-60, -31]**	**[-30, -2]**	**[-1, 1]**	**[2, 30]**	**[31, 60]**	**[-60, 60]**	**[-90, 90]**
Mix B1	Mean	0.0041	−0.0076	−0.0402	0.1265	−0.0111	0.0188	0.0056
	t-test p-val	0.5333	0.4628	0.4280	0.9398	0.4079	0.8080	0.6023
	Median	0.0738	0.1056	0.2592	0.1063	−0.0448	0.0224	−0.0048
	Rank test p-val	0.9534	0.6612	0.9534	0.8950	0.3388	0.7976	0.5000
Mix B2	Mean	−0.0309	−0.0127	−0.0124	0.0867	−0.0051	0.0012	−0.0095
	t-test p-val	0.2817	0.4418	0.4688	0.9252	0.4625	0.5185	0.3365
	Median	0.0341	0.0571	0.2415	0.0633	−0.0359	0.0076	0.0049
	Rank test p-val	0.6612	0.6612	0.9534	0.7976	0.2024	0.7976	0.6612
Mix B3	Mean	−0.0314	−0.0057	−0.0136	0.0856	−0.0039	0.0024	−0.0092
	t-test p-val	0.2805	0.4721	0.4666	0.9463	0.4702	0.5380	0.3389
	Median	0.0351	0.0566	0.3000	0.0654	−0.0289	0.0058	0.0034
	Rank test p-val	0.6612	0.6612	0.8950	0.6612	0.2024	0.7976	0.6612
USD B1	Mean	−0.0023	0.0068	−0.0394	0.1265	−0.0111	0.0224	0.0087
	t-test p-val	0.4814	0.5331	0.4296	0.9392	0.4080	0.8463	0.6546
	Median	0.0627	0.1088	0.2746	0.1063	−0.0307	0.0224	−0.0048
	Rank test p-val	0.9534	0.6612	0.9534	0.8950	0.3388	0.7976	0.5000
USD B2	Mean	−0.0294	−0.0123	−0.0123	0.0867	−0.0046	0.0012	−0.0094
	t-test p-val	0.2898	0.4424	0.4690	0.9250	0.4656	0.5177	0.3398
	Median	0.0570	0.0802	0.2538	0.0633	−0.0269	0.0102	−0.0009
	Rank test p-val	0.6612	0.6612	0.9534	0.7976	0.2024	0.8950	0.5000
USD B3	Mean	−0.0301	−0.0060	−0.0136	0.0857	−0.0035	0.0023	−0.0091
	t-test p-val	0.2878	0.4704	0.4668	0.9462	0.4733	0.5361	0.3405
	Median	0.0564	0.0753	0.2887	0.0652	−0.0206	0.0079	0.0033
	Rank test p-val	0.6612	0.6612	0.8950	0.6612	0.2024	0.7976	0.6612
EUR B1	Mean	0.0711	−0.0028	−0.0080	0.1312	**−0.0729****	0.0163	0.0012
	t-test p-val	0.9623	0.4852	0.4909	0.9524	**0.0310**	0.7286	0.5220
	Median	0.0688	0.0500	−0.0335	0.1712	−0.0560	0.0308	0.0235
	Rank test p-val	0.9846	0.5927	0.4073	0.9519	0.1189	0.8811	0.7597
EUR B2	Mean	0.0490	−0.0308	0.0647	0.0812	**−0.0753***	−0.0095	−0.0182
	t-test p-val	0.9114	0.3894	0.5824	0.8514	**0.0662**	0.3773	0.2368
	Median	0.0482	0.1014	0.0661	0.1411	**−0.0547****	0.0027	0.0217
	Rank test p-val	0.9519	0.7597	0.8811	0.9519	**0.0481**	0.5927	0.8811
EUR B3	Mean	0.0527	−0.0317	0.0745	0.0833	**−0.0762***	−0.0099	−0.0201
	t-test p-val	0.9311	0.3706	0.5921	0.8786	**0.0501**	0.3734	0.2124
	Median	0.0503	0.1024	0.0887	0.1286	**−0.0655****	0.0040	0.0132
	Rank test p-val	0.9846	0.7597	0.8811	0.9519	**0.0481**	0.5927	0.7597

[EUR/USD/MIX]B1 is Abnormal absolute CDS Spread changes with Benchmark 1, [EUR/USD/MIX]B2 is Abnormal absolute CDS Spread changes with Benchmark 2, and [EUR/USD/MIX]B3 is Abnormal absolute CDS Spread changes with Benchmark 3. The null hypothesis under the t-test is mean ASC ≥ 0 and under the Wilcoxon sign rank test is median ASC ≥ 0 ***, ** and * indicate statistical significance with p-values $p < 0.01$, $p < 0.05$ and $p < 0.10$ respectively.

Table 7: Tests of decreases in the relative spread

Currency/BM	Description	[-60, -31]	[-30, -2]	[-1, 1]	[2, 30]	[31, 60]	[-60, 60]	[-90, 90]
Mix B1	Mean	0.0001	0.0006	−0.0008	0.0015	**−0.0009****	0.0001	0.0000
	t-test p-val	0.5501	0.7612	0.3955	0.9909	**0.0421**	0.7063	0.5037
	Median	0.0009	0.0008	0.0009	0.0020	−0.0012	0.0002	0.0000
	Rank test p-val	0.9534	0.8950	0.6612	0.9947	0.2024	0.6612	0.3388
Mix B2	Mean	0.0001	0.0006	0.0014	0.0014	**−0.0011****	0.0002	0.0000
	t-test p-val	0.5901	0.7616	0.7312	0.9914	**0.0205**	0.7429	0.5265
	Median	0.0007	0.0009	0.0007	0.0016	−0.0015	0.0003	0.0000
	Rank test p-val	0.7976	0.8950	0.6612	0.9827	0.1050	0.6612	0.6612
Mix B3	Mean	0.0001	0.0007	0.0015	0.0014	**−0.0011****	0.0002	0.0000
	t-test p-val	0.5807	0.7829	0.7710	0.9942	**0.0177**	0.7753	0.5392
	Median	0.0008	0.0006	0.0009	0.0021	**−0.0013****	0.0003	0.0000
	Rank test p-val	0.7976	0.8950	0.6612	0.9827	**0.0466**	0.8950	0.6612
USD B1	Mean	0.0000	0.0011	−0.0007	0.0015	**−0.0009****	0.0002	0.0001
	t-test p-val	0.5068	0.8705	0.4000	0.9936	**0.0452**	0.8366	0.6391
	Median	0.0009	0.0008	0.0009	0.0020	−0.0012	0.0002	0.0000
	Rank test p-val	0.8950	0.8950	0.6612	0.9947	0.2024	0.6612	0.3388
USD B2	Mean	0.0001	0.0006	0.0014	0.0014	**−0.0011****	0.0002	0.0000
	t-test p-val	0.5934	0.7658	0.7320	0.9950	**0.0220**	0.7640	0.5285
	Median	0.0008	0.0015	0.0007	0.0016	−0.0014	0.0003	0.0000
	Rank test p-val	0.7976	0.8950	0.6612	0.9827	0.1050	0.6612	0.6612
USD B3	Mean	0.0001	0.0007	0.0015	0.0014	**−0.0011****	0.0002	0.0000
	t-test p-val	0.5828	0.7869	0.7720	0.9963	**0.0186**	0.7927	0.5420
	Median	0.0009	0.0016	0.0009	0.0019	**−0.0014****	0.0003	0.0000
	Rank test p-val	0.7976	0.8950	0.6612	0.9987	**0.0466**	0.8950	0.6612
EUR B1	Mean	0.0007	0.0003	0.0052	0.0016	**−0.0013****	0.0001	−0.0001
	t-test p-val	0.9098	0.6072	0.8016	0.9679	**0.0107**	0.6542	0.4032
	Median	0.0010	0.0004	−0.0018	0.0024	**−0.0015****	−0.0001	0.0000
	Rank test p-val	0.9846	0.7597	0.4073	0.9962	**0.0481**	0.4073	0.5927
EUR B2	Mean	0.0009	0.0003	0.0055	0.0011	**−0.0014*****	0.0001	−0.0001
	t-test p-val	0.9704	0.6033	0.8308	0.8944	**0.0096**	0.6046	0.3900
	Median	0.0008	0.0013	0.0012	0.0022	**−0.0015****	0.0004	−0.0001
	Rank test p-val	0.9846	0.8811	0.9519	0.9846	**0.0481**	0.7597	0.4073
EUR B3	Mean	0.0010	0.0003	0.0060	0.0012	**−0.0014*****	0.0001	−0.0001
	t-test p-val	0.9764	0.6096	0.8412	0.8993	**0.0053**	0.5874	0.3330
	Median	0.0010	0.0007	0.0012	0.0022	**−0.0014*****	0.0003	0.0000
	Rank test p-val	0.9846	0.8811	0.7597	0.9519	**0.0038**	0.8811	0.5927

[EUR/USD/MIX]B1 is Abnormal relative CDS Spread changes with Benchmark 1, [EUR/USD/MIX]B2 is Abnormal relative CDS Spread changes with Benchmark 2, and [EUR/USD/MIX]B3 is Abnormal relative CDS Spread changes with Benchmark 3. The null hypothesis under the t-test is mean ASC ≥ 0 and under the Wilcoxon sign rank test is median ASC ≥ 0 ***, ** and * indicate statistical significance with p-values $p < 0.01$, $p < 0.05$ and $p < 0.10$ respectively.

5 Summary of the Results and Conclusion

This paper tests whether and how the CDS market mirrors an increase or decrease of the G-SIB capital surcharge envisaged by regulators. We indeed find evidence that CDS spreads of a G-SIB bank increase (decrease) after the announcement of a higher (lower) capital surcharge. However, this effect is temporary, because the mean CDS spreads revert to pre-announcement level, dropping sharply after this rise. Furthermore, the panel analysis also revealed that reallocation to buckets with a higher capital surcharge requirement is associated with daily positive relative CDS spread increases, whereas reallocation to lower buckets does not have this effect.

These results support the idea that the announcement of a reallocation to a higher bucket could simply imply a lower projected income in the future, since raising new equity is costly. This could in turn indicate more intrusive supervision by the regulators and higher perceived risk in markets. Moreover, the update of information on the systemic importance of the bank could create a signal for investors to hedge against this specific increase in systemic risk in their portfolios by purchasing CDS. Thus, the initial announcement would increase demand for the affected bank's CDS, pushing its price higher. A more structural explanation for the initial increase of CDS spreads may potentially be found in the structural credit risk model literature. Additional capital requirements would implicitly move the default threshold upwards in Merton (1974) type models, since it is easier to violate the higher capital requirements designated by regulators, i.e., the bank is implicitly closer to default. This would cause distance-to-default, a major parameter in structural type models, to decrease, which would, in turn, be reflected in higher CDS prices. Similarly, the reason for the consequent decrease in CDS spreads could follow this structural explanation and be based on banks' adjustment of risk-weighted assets (RWA). It has been documented in the literature that banks might choose to reduce their RWA in case of additional capital requirements, even by shifting their portfolios to zero risk-weight assets. The $[31, 60]$ interval could be a time window when the bank adjusts its RWA, and as investors perceive less credit risk, the CDS spread of the bank decreases.

Our analysis contributes to the debate on whether being designated as a TBTF bank necessarily implies funding cost advantages to G-SIBs. These results indicate that the effect of a higher capital surcharge and more stringent regulation outweigh the implicit advantages of being TBTF. Our findings also have implications for the further regulation of G-SIBs by the FSB and BCBS-MPG. Overall, the temporary effect on the credit risk of the banks should be viewed as a transitory shock to announcements of higher capital surcharges.

References

Abreu, J. F. and M. A. Gulamhussen (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 & Money 25*, 49–72.

Acharya, V., R. Engle, and M. Richardson (2012). Capital shortfall: A New approach to ranking and regulating systemic risks. *American Economic Review 102*(3), 59–64.

Acharya, V. V. (2009). A Theory of systemic risk and design of prudential bank regulation. *Journal of Financial Stability 5*(3), 224–255.

Acharya, V. V., D. Anginer, and A. J. Warburton (2016). The End of market discipline? Investor expectations of implicit government guarantees. Working paper.

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

Acharya, V. V. and S. Steffen (2015). The "Greatest" carry trade ever? Understanding Eurozone bank risks. *Journal of Financial Economics 115*(2), 215–236.

Adrian, T. and M. K. Brunnermeier (2016). CoVar. *American Economic Review 106*(7), 1705–1741.

Afonso, A., D. Furceri, and P. Gomes (2012). Sovereign credit ratings and financial markets linkages: Application to European data. *Journal of International Money & Finance 31*(3), 606–638.

Afonso, G., J. Santos, and J. Traina (2014). Do "Too-Big-To-Fail" banks take on more risk? *FRBNY Economic Policy Review*, December 2014, 41–58.

Ahmed, J., C. Anderson, and R. Zarutskie (2015). Are the borrowing costs of large financial firms unusual? FEDS Working Paper 2015-024.

Araten, M. and C. Turner (2013). Understanding the funding cost differences between global systemically important banks (G-SIBs) and non-G-SIBs in the USA. *Journal of Risk Management in Financial Institutions 6*(4), 387–410.

Balasubramnian, B. and K. Cyree (2014). Has market discipline on banks improved after the Dodd-Frank act? *Journal of Banking & Finance 41*, 155–166.

Barth, A. and I. Schnabel (2013). Why banks are not Too Big To Fail–evidence from the CDS market. *Economic Policy 28*(74), 335–369.

Bartram, S. M., G. W. Brown, and J. E. Hund (2007). Estimating systemic risk in the international financial system. *Journal of Financial Economics 86*(3), 835–869.

Basel Committee on Banking Supervision (2011). Global systemically important banks: Assessment methodology and the additional loss absorbency requirement, Report. *Bank for International Settlements*.

Basel Committee on Banking Supervision (2013). Global systemically important banks: Updated assessment methodology and the higher loss absorbency requirement, Report. *Bank for International Settlements*.

Basel Committee on Banking Supervision (2018). Global systemically important banks: Revised assessment methodology and the higher loss absorbency requirement, Report. *Bank for International Settlements*.

Bassett, W. F. (2016). Using insured deposits to refine estimates of the large bank funding advantage. *Journal of Law, Finance, & Accounting 1*(1), 41–91.

Berndt, A., D. Duffie, and Y. Zhu (2018). The Decline of too big to fail. Working paper.

Blanco, R., S. Brennan, and I. W. Marsh (2005). An Empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps. *The Journal of Finance 60*(5), 2255–2281.

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

Bostandzic, D. and G. N. Weiß (2018). Why do some banks contribute more to global systemic risk? *Journal of Financial Intermediation 35*(A), 17–40.

Boyd, J. H. and M. Gertler (1994). The Role of large banks in the recent U.S. banking crisis. *Federal Reserve Bank of Minneapolis Quarterly Review 18*(1), 2–21.

Brewer, E. and J. Jagtiani (2013). How much did banks pay to become Too-Big-To-Fail and to become systemically important? *Journal of Financial Services Research 43*(1), 1–35.

Brownlees, C. and R. F. Engle (2017). SRISK: A Conditional capital shortfall measure of systemic risk. *The Review of Financial Studies 30*(1), 48–79.

Cetina, J. and B. Loudis (2016). The Influence of systemic importance indicators on banks' credit default swap spreads. *Journal of Risk Management in Financial Institutions 9*(1), 17–31.

Demirgüç-Kunt, A. and H. Huizinga (2013). Are banks too big to fail or too big to save? International evidence from equity prices and CDS spreads. *Journal of Banking & Finance 37*(3), 875–894.

Engle, R., E. Jondeau, and M. Rockinger (2015, 03). Systemic risk in Europe. *Review of Finance 19*(1), 145–190.

Farhi, E. and J. Tirole (2012). Collective moral hazard, maturity mismatch, and systemic bailouts. *American Economic Review 102*(1), 60–93.

Finnerty, J. D., C. D. Miller, and R.-R. Chen (2013). The Impact of credit rating announcements on credit default swap spreads. *Journal of Banking & Finance 37*(6), 2011–2030.

Flannery, M. J. and S. M. Sorescu (1996). Evidence of bank market discipline in subordinated debenture yields: 1983–1991. *The Journal of Finance 51*(4), 1347–1377.

Freixas, X., B. M. Parigi, and J.-C. Rochet (2000). Systemic risk, interbank relations, and liquidity provision by the central bank. *Journal of Money, Credit & Banking 32*(3), 611–638.

Freixas, X., J.-C. Rochet, and B. M. Parigi (2004). The lender of last resort: A Twenty-first century approach. *Journal of the European Economic Association 2*(6), 1085–1115.

GAO US (2014). Evidence from the bond market on banks' "Too-Big-to-Fail" subsidy, GAO 14–621. *US Government Accountability Office Report to Congress.*

Gauthier, C., A. Lehar, and M. Souissi (2012). Macroprudential capital requirements and systemic risk. *Journal of Financial Intermediation 21*(4), 594–618.

Gehde-Trapp, M., Y. Gündüz, and J. Nasev (2015). The Liquidity premium in CDS transaction prices: Do frictions matter? *Journal of Banking & Finance 61*, 184–205.

Gropp, R., C. Gruendl, and A. Guettler (2014). The Impact of public guarantees on bank risk-taking: Evidence from a natural experiment. *Review of Finance 18*(2), 457–488.

Gropp, R., T. Mosk, S. Ongena, and C. Wix (2018). Banks response to higher capital requirements: Evidence from a quasi-natural experiment. *The Review of Financial Studies 32*(1), 266–299.

Huang, X., H. Zhou, and H. Zhu (2009). A Framework for assessing the systemic risk of major financial institutions. *Journal of Banking & Finance 33*(11), 2036–2049.

Huang, X., H. Zhou, and H. Zhu (2012). Systemic risk contributions. *Journal of Financial Services Research 42*(1-2), 55–83.

Hull, J., M. Predescu, and A. White (2004). The Relationship between credit default swap spreads, bond yields, and credit rating announcements. *Journal of Banking & Finance 28*(11), 2789–2811.

Imbierowicz, B., J. Kragh, and J. Rangvid (2018). Time-varying capital requirements and disclosure rules: Effects on capitalization and lending decisions. *Journal of Money, Credit and Banking 50*(4), 573–602.

Ismailescu, I. and H. Kazemi (2010). The Reaction of emerging market credit default swap spreads to sovereign credit rating changes. *Journal of Banking & Finance 34*(12), 2861–2873.

Jacewitz, S. and J. Pogach (2018). Deposit rate advantages at the largest banks. *Journal of Financial Services Research 53*(1), 1–35.

Junge, B. and A. B. Trolle (2015). Liquidity risk in credit default swap markets. Research Paper 13-65, Swiss Finance Institute.

Kabir, M. H. and M. K. Hassan (2005). The Near-collapse of LTCM, US financial stock returns, and the Fed. *Journal of Banking & Finance 29*(2), 441–460.

Kaufman, G. G. (2002). Too Big to Fail in banking: What remains? *The Quarterly Review of Economics and Finance 42*(3), 423–436.

Kaufman, G. G. (2014). Too Big to Fail in banking: What does it mean? *Journal of Financial Stability 13*(C), 214–223.

Kleinow, J., T. Nell, S. Rogler, and A. Horsch (2014). The Value of being systemically important: Event study on regulatory announcements for banks. *Applied Financial Economics 24*(24), 1585–1604.

Kupiec, P. H. (2016). Will TLAC regulations fix the G-SIB too-big-to-fail problem? *Journal of Financial Stability 24*, 158–169.

Laeven, L., L. Ratnovski, and H. Tong (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking & Finance 69*, 25–34.

Longstaff, F. A., S. Mithal, and E. Neis (2005). Corporate yield spreads: Default risk or liquidity? New evidence from the credit default swap market. *The Journal of Finance 60*(5), 2213–2253.

Marques, M. L. B., M. R. Correa, and M. H. Sapriza (2013). International evidence on government support and risk taking in the banking sector. Working Paper 13/94, International Monetary Fund.

Merton, R. C. (1974). On the pricing of corporate debt: The Risk structure of interest rates. *Journal of Finance 29*(2), 449–470.

Moenninghoff, S. C., S. Ongena, and A. Wieandt (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*, 221–236.

Morrison, A. D. (2011). Systemic risks and the "Too-Big-to-Fail" problem. *Oxford Review of Economic Policy 27*(3), 498–516.

Norden, L. and M. Weber (2004). Informational efficiency of credit default swap and stock markets: The impact of credit rating announcements. *Journal of Banking & Finance 28*(11), 2813–2843.

O'Hara, M. and W. Shaw (1990). Deposit insurance and wealth effects: The Value of being "Too Big to Fail". *The Journal of Finance 45*(5), 1587–1600.

Oliveira, R. d. F., R. F. Schiozer, and L. A. d. C. Barros (2015). Depositors' perception of "Too-Big-to-Fail". *Review of Finance 19*(1), 191–227.

Passmore, W. and A. von Hafften (2017). Are Basel's capital surcharges for global systemically important banks too small? FEDS Working Paper 2017-021.

Penas, M. F. and H. Unal (2004). Gains in bank mergers: Evidence from the bond markets. *Journal of Financial Economics 74*(1), 149–179.

Puzanova, N. and K. Düllmann (2013). Systemic risk contributions: A credit portfolio approach. *Journal of Banking & Finance 37*(4), 1243–1257.

Rochet, J.-C. and J. Tirole (1996). Interbank lending and systemic risk. *Journal of Money, Credit & Banking 28*(4), 733–762.

Santos, J. A. C. (2014). Evidence from the bond market on banks' "Too-Big-to-Fail" subsidy. *FRBNY Economic Policy Review*, December 2014, 29–39.

Schich, S. and O. Toader (2017). To be or not to be a G-SIB: Does it matter? *Journal of Financial Management, Markets and Institutions 5*(2), 169–192.

Stern, G. H. and R. J. Feldman (2004). *Too Big to Fail: The Hazards of Bank Bailouts.* Washington, D.C.: Brookings Institution Press.

Tang, D. Y. and H. Yan (2017). Understanding transactions prices in the credit default swaps market. *Journal of Financial Markets 32*, 1–27.

Ueda, K. and B. W. Di Mauro (2013). Quantifying structural subsidy values for systemically important financial institutions. *Journal of Banking & Finance 37*(10), 3830–3842.

Violon, A., D. Durant, and O. Toader (2018). The Impact of the identification of GSIBs on their business model. Débats économiques et financiers 33, Banque de France.

Völz, M. and M. Wedow (2011). Market discipline and Too-Big-To-Fail in the CDS market: Does banks' size reduce market discipline? *Journal of Empirical Finance 18*(2), 195–210.

Zhang, Q., F. Vallascas, K. Keasey, and C. X. Cai (2015). Are market-based measures of global systemic importance of financial institutions useful to regulators and supervisors? *Journal of Money, Credit and Banking 47*(7), 1403–1442.

Zhou, C. (2013). The Impact of imposing capital requirements on systemic risk. *Journal of Financial Stability 9*, 320–329.

Appendix A Alternative relative ASC approach

In Section 3.2, we have described two different approaches which we applied in order to draw our conclusions: the absolute CDS changes approach and the relative CDS changes approach. We have also explained the reasons for which the relative CDS changes approach might be more appropriate and more robust than the absolute one. In this Appendix we illustrate a third approach similar to the relative approach which further robustifies our results.

As opposed to the relative ASC approach described in Section 3.2, where the benchmark is a mean of the relative changes, in the alternative approach benchmarks are computed by first taking the average CDS spread of the G-SIBs included in the benchmark and then by performing the calculation of the relative changes.

We define the benchmarks' average CDS spreads same as in Section 3.2. The notation of the indexes also reflects the one in Section 3.2.

Benchmark 1:

$$BM_{it}^{1} = \begin{cases} \frac{1}{n_{o1}} \sum_{k \in N_{o1}} CDS_{kt} & \text{if } t < 0, \\ \frac{1}{n_{n1}} \sum_{k \in N_{n1}} CDS_{kt} & \text{if } t \geq 0 \end{cases} \tag{A.1}$$

Benchmark 2 and 3:

$$BM_{it}^{j} = \frac{1}{n_{ij}} \sum_{k \in N_{ij}} CDS_{kt} \tag{A.2}$$

The abnormal relative CDS spread changes in the alternative approach with benchmark 1 are calculated similarly to equation 5 in Section 3.2.

$$ASC_{it} = \begin{cases} \frac{(CDS_{it} - CDS_{it-1})}{CDS_{it-1}} - \frac{(BM_{ot}^{1} - BM_{ot-1}^{1})}{BM_{ot-1}^{1}} & \text{if } t < 0, \\ \frac{(CDS_{it} - CDS_{it-1})}{CDS_{it-1}} - \frac{(BM_{nt}^{1} - BM_{nt-1}^{1})}{BM_{nt-1}^{1}} & \text{if } t \geq 0. \end{cases} \tag{A.3}$$

Where BM_{ot}^{1} represents the average CDS spread level at time t of the G-SIBs belonging to the same bucket of the affected bank before reallocation to a new bucket (i.e. before t=0) and BM_{nt}^{1} is the average CDS spread at time t of the G-SIBs belonging to the same bucket of the affected bank after reallocation to a new bucket (i.e. after t=0).

The abnormal relative CDS spread changes in the alternative approach with benchmarks 2 and 3 are calculated similarly to equation 6 in Section 3.2.

$$ASC_{it} = \frac{(CDS_{it} - CDS_{it-1})}{CDS_{it-1}} - \frac{(BM_{it}^{j} - BM_{it-1}^{j})}{BM_{it-1}^{j}}, \ \textit{where } j \in \{2, 3\}. \tag{A.4}$$

Following the definition of the benchmarks in Section 3.2, BM_{it}^{2} is representing the average

CDS spread level of the non-affected G-SIBs in year t while BM^3_{it} is the average CDS spread level of all G-SIB banks except bank i.

Tables A1 and A2 present the results for the tests on hypotheses H1 and H2, looking at different time intervals. Overall, results are symmetric to Tables 5 and 7, using the relative CDS changes approach. We find significant support for hypothesis H1 of increasing abnormal CDS spread changes for the time interval [2, 30] and for hypothesis H2 of decreasing abnormal CDS spread changes for the time interval [31, 60]. The bucket reallocation effect resolves at the [-60, 60] or [-90, 90] intervals, thus it reveals that the effect is temporary.

The alternative approach overall confirms the findings of the paper. We find evidence that CDS spreads of a G-SIB bank increases (decreases) after the announcement of a higher (lower) capital surcharge. However, this effect is temporary.

Table A1: Tests of increases in the alternative relative spread

Currency/BM	Description	[-60, -31]	[-30, -2]	[-1, 1]	[2, 30]	[31, 60]	[-60, 60]	[-90, 90]
Mix B1	Mean	0.0004	0.0002	0.0023	**0.0017****	−0.0009	0.0002	0.0001
	t-test p-val	0.2546	0.4059	0.1861	**0.0181**	0.9571	0.1422	0.3389
	Median	0.0013	0.0008	0.0048	0.0018	−0.0007	0.0002	0.0001
	Rank test p-val	0.3388	0.2024	0.2024	0.2024	0.9534	0.5000	0.3388
Mix B2	Mean	0.0001	0.0005	0.0022	**0.0014****	−0.0010	0.0002	0.0000
	t-test p-val	0.4538	0.3125	0.1139	**0.0166**	0.9197	0.2215	0.4544
	Median	0.0011	0.0010	0.0037	0.0007	−0.0013	0.0000	0.0000
	Rank test p-val	0.5000	0.3388	0.2024	0.3388	0.9534	0.6612	0.6612
Mix B3	Mean	0.0001	0.0006	0.0023	**0.0014****	−0.0010	0.0002	0.0000
	t-test p-val	0.4527	0.2792	0.1119	**0.0108**	0.9376	0.2069	0.4522
	Median	0.0011	0.0010	0.0038	0.0010	−0.0012	0.0000	0.0000
	Rank test p-val	0.5000	0.3388	0.2024	0.2024	0.9534	0.5000	0.6612
USD B1	Mean	0.0003	0.0005	0.0023	**0.0017****	−0.0009	0.0002	0.0001
	t-test p-val	0.3015	0.3271	0.1842	**0.0182**	0.9563	0.1154	0.2947
	Median	0.0013	0.0008	0.0043	0.0018	−0.0007	0.0002	0.0001
	Rank test p-val	0.3388	0.2024	0.2024	0.2024	0.8950	0.3388	0.3388
USD B2	Mean	0.0001	0.0005	0.0022	**0.0014****	−0.0010	0.0002	0.0000
	t-test p-val	0.4458	0.3091	0.1127	**0.0167**	0.9206	0.2239	0.4522
	Median	0.0011	0.0014	0.0039	0.0006	−0.0012	0.0000	0.0000
	Rank test p-val	0.5000	0.3388	0.2024	0.3388	0.9534	0.5000	0.6612
USD B3	Mean	0.0001	0.0006	0.0023	**0.0014****	−0.0010	0.0002	0.0000
	t-test p-val	0.4457	0.2791	0.1110	**0.0108**	0.9387	0.2092	0.4512
	Median	0.0011	0.0013	0.0038	0.0010	−0.0011	0.0001	0.0000
	Rank test p-val	0.5000	0.3388	0.2024	0.2024	0.9534	0.3388	0.6612
EUR B1	Mean	**0.0008***	0.0005	0.0048	**0.0016***	−0.0013	0.0002	0.0000
	t-test p-val	**0.0630**	0.3456	0.2145	**0.0505**	0.9913	0.2691	0.5240
	Median	**0.0012****	0.0005	−0.0002	0.0022	−0.0015	0.0002	0.0000
	Rank test p-val	**0.0481**	0.4073	0.5927	0.1189	0.9962	0.2403	0.4073
EUR B2	Mean	**0.0008***	0.0002	0.0056	0.0011	−0.0018	−0.0001	−0.0002
	t-test p-val	**0.0722**	0.4333	0.1691	0.1220	0.9783	0.5813	0.7377
	Median	**0.0012****	0.0014	0.0015	**0.0025****	−0.0018	0.0000	0.0002
	Rank test p-val	**0.0481**	0.4073	0.2403	**0.0481**	0.9962	0.5927	0.4073
EUR B3	Mean	**0.0008***	0.0002	0.0059	0.0011	−0.0018	−0.0001	−0.0002
	t-test p-val	**0.0570**	0.4228	0.1605	0.1174	0.9879	0.6051	0.8076
	Median	**0.0012****	0.0014	0.0013	**0.0024****	−0.0017	0.0000	0.0000
	Rank test p-val	**0.0481**	0.4073	0.2403	**0.0481**	0.9962	0.5927	0.5927

[EUR/USD/MIX]B1 is Abnormal alternative relative CDS Spread changes with Benchmark 1, [EUR/USD/MIX]B2 is Abnormal alternative relative CDS Spread changes with Benchmark 2, and [EUR/USD/MIX]B3 is Abnormal alternative relative CDS Spread changes with Benchmark 3. The null hypothesis under the t-test is mean ASC ≤ 0 and under the Wilcoxon sign rank test is median ASC ≤ 0 ***, ** and * indicate statistical significance with p-values $p < 0.01$, $p < 0.05$ and $p < 0.10$ respectively.

Table A2: Tests of decreases in the alternative relative spread

Currency/BM	Description	[-60, -31]	[-30, -2]	[-1, 1]	[2, 30]	[31, 60]	[-60, 60]	[-90, 90]
Mix B1	Mean	0.0004	0.0002	0.0023	0.0017	$-\mathbf{0.0009}^{**}$	0.0002	0.0001
	t-test p-val	0.7454	0.5941	0.8139	0.9819	**0.0429**	0.8578	0.6611
	Median	0.0013	0.0008	0.0048	0.0018	−0.0007	0.0002	0.0001
	Rank test p-val	0.7976	0.8950	0.8950	0.8950	0.1050	0.6612	0.7976
Mix B2	Mean	0.0001	0.0005	0.0022	0.0014	$-\mathbf{0.0010}^{*}$	0.0002	0.0000
	t-test p-val	0.5462	0.6875	0.8861	0.9834	**0.0803**	0.7785	0.5456
	Median	0.0011	0.0010	0.0037	0.0007	−0.0013	0.0000	0.0000
	Rank test p-val	0.6612	0.7976	0.8950	0.7976	0.1050	0.5000	0.5000
Mix B3	Mean	0.0001	0.0006	0.0023	0.0014	$-\mathbf{0.0010}^{*}$	0.0002	0.0000
	t-test p-val	0.5473	0.7208	0.8881	0.9892	**0.0624**	0.7931	0.5478
	Median	0.0011	0.0010	0.0038	0.0010	−0.0012	0.0000	0.0000
	Rank test p-val	0.6612	0.7976	0.8950	0.8950	0.1050	0.6612	0.5000
USD B1	Mean	0.0003	0.0005	0.0023	0.0017	$-\mathbf{0.0009}^{**}$	0.0002	0.0001
	t-test p-val	0.6985	0.6729	0.8158	0.9818	**0.0437**	0.8846	0.7053
	Median	0.0013	0.0008	0.0043	0.0018	−0.0007	0.0002	0.0001
	Rank test p-val	0.7976	0.8950	0.8950	0.8950	0.2024	0.7976	0.7976
USD B2	Mean	0.0001	0.0005	0.0022	0.0014	$-\mathbf{0.0010}^{*}$	0.0002	0.0000
	t-test p-val	0.5542	0.6909	0.8873	0.9833	**0.0794**	0.7761	0.5478
	Median	0.0011	0.0014	0.0039	0.0006	−0.0012	0.0000	0.0000
	Rank test p-val	0.6612	0.7976	0.8950	0.7976	0.1050	0.6612	0.5000
USD B3	Mean	0.0001	0.0006	0.0023	0.0014	$-\mathbf{0.0010}^{*}$	0.0002	0.0000
	t-test p-val	0.5543	0.7209	0.8890	0.9892	**0.0613**	0.7908	0.5488
	Median	0.0011	0.0013	0.0038	0.0010	−0.0011	0.0001	0.0000
	Rank test p-val	0.6612	0.7976	0.8950	0.8950	0.1050	0.7976	0.5000
EUR B1	Mean	0.0008	0.0005	0.0048	0.0016	$-\mathbf{0.0013}^{***}$	0.0002	0.0000
	t-test p-val	0.9370	0.6544	0.7855	0.9495	**0.0087**	0.7309	0.4760
	Median	0.0012	0.0005	−0.0002	0.0022	$-\mathbf{0.0015}^{**}$	0.0002	0.0000
	Rank test p-val	0.9846	0.7597	0.5927	0.9519	**0.0154**	0.8811	0.7597
EUR B2	Mean	0.0008	0.0002	0.0056	0.0011	$-\mathbf{0.0018}^{**}$	−0.0001	−0.0002
	t-test p-val	0.9278	0.5667	0.8309	0.8780	**0.0217**	0.4187	0.2623
	Median	0.0012	0.0014	0.0015	0.0025	$-\mathbf{0.0018}^{**}$	0.0000	0.0002
	Rank test p-val	0.9846	0.7597	0.8811	0.9846	**0.0154**	0.5927	0.7597
EUR B3	Mean	0.0008	0.0002	0.0059	0.0011	$-\mathbf{0.0018}^{**}$	−0.0001	−0.0002
	t-test p-val	0.9430	0.5772	0.8395	0.8826	**0.0121**	0.3949	0.1924
	Median	0.0012	0.0014	0.0013	0.0024	$-\mathbf{0.0017}^{**}$	0.0000	0.0000
	Rank test p-val	0.9846	0.7597	0.8811	0.9846	**0.0154**	0.5927	0.5927

[EUR/USD/MIX]B1 is Abnormal alternative relative CDS Spread changes with Benchmark 1, [EUR/USD/MIX]B2 is Abnormal alternative relative CDS Spread changes with Benchmark 2, and [EUR/USD/MIX]B3 is Abnormal alternative relative CDS Spread changes with Benchmark 3. The null hypothesis under the t-test is mean ASC ≥ 0 and under the Wilcoxon sign rank test is median ASC ≥ 0 ***, ** and * indicate statistical significance with p-values $p < 0.01$, $p < 0.05$ and $p < 0.10$ respectively.