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How does standardization affect OTC markets in the long term? Evidence from the small bang reform in the CDS market

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A R T I C L E I N F O

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A B S T R A C T

Focusing on the most liquid segment of the European CDS market, this paper studies the impact of a key standardization reform, known as the *CDS Small Bang*. We document that the reform provided unexpected long-term consequences. Particularly, we show that the introduction of an upfront fee to standardize the cash flow of CDS contracts created an initial capital cost for traders, which acts as a friction that increases CDS prices. This relation holds after accounting for well-known determinants of spreads, suggesting a separate funding channel driven by the greater capital intensity of trading. This effect grows in magnitude for several years following the implementation of the reform, becomes stronger when dealers are likely to bear the initial capital cost and is present across all industries, except for swaps written on financials shortly after the reform was introduced.

1. Introduction

Following the excessive risk taking and poor practices that emerged during the Global Financial Crisis (GFC), a set of regulatory reforms collectively known as the *CDS Small Bang*, were introduced in June 2009 in Europe aimed at promoting and facilitating standardization in CDS markets.[1] To standardize the heterogeneous cash flows of CDS contracts, the Small Bang introduced an upfront fee payable at the start of the contract, thus creating an additional initial capital requirement. Since the reform has made trading more capital intensive, and market participants sustain additional capital costs, the required risk premium to deal in CDS may increase under certain circumstances, increasing the cost to enter CDS contracts. While the literature has studied extensively the impact of central clearing on the functioning of derivative markets,[2] the impact of reforms aimed at contract standardization has been relatively less studied, particularly over the long term. In this paper, we address this issue in the context of the regulatory reforms aimed at improving standardization of CDS contracts and study whether these reforms have affected the cost to insure against the default of an entity in CDS markets.

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[1] A similar set of regulatory changes known as the *CDS Big Bang* was implemented in the US CDS market in April 2009. The US reforms defined only two fixed coupon rates of 100 bps and 500 bps, whereas the Small Bang introduced four fixed coupon rates of 25 bps, 100 bps, 500 bps, and 1000 bps. We provide more details on the differences between the standardization of coupon payments in the US vs Europe in Section 5.3. See Section 1A in the Appendix for a detailed description of regulatory reforms in the CDS market.

[2] Important contributions to the literature examining the impact of central clearing on the functioning of OTC markets include Acharya and Bisin (2014), Duffie and Zhu (2011), Duffie et al. (2015), and Loon and Zhong (2014). See Menkveld and Vuillemey (2021) for a recent review of this literature.

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As standardization increases the share of contracts cleared centrally (Vause, 2010), the reduction in counterparty risk should be reflected in lower costs of insurance against default in CDS.[3] However, we observe that since the introduction of these standardization reforms in European CDS markets, there has been a generalized increase in the level of CDS spreads (Figure 1). Indeed, we note that average CDS prices are higher in the post-reform period, and although CDS spreads have narrowed in the short term following the reform, and steadily declined following the peaks observed during the GFC and subsequent European Sovereign Debt Crisis, they have never reached the lows of their pre-GFC levels. The relatively higher level of spreads is especially notable since the CDS market was inherently less transparent prior to the GFC in the context of lower regulatory oversight. Moreover, downward pressure on CDS spreads could have been expected in a context of higher liquidity provided by the unprecedented unconventional monetary policy in the post-GFC period (Chodorow-Reich, 2014).[4] Motivated by this observation, we study whether standardization reforms have had unintended consequences and, in particular, resulted in a higher cost of insurance against default. Understanding the impact of the standardization reform on CDS prices is especially relevant because of the consequences for market quality and financial stability of a potential systemic increase in the cost for protection offered by CDS. If the standardization process results in higher prices for protection, this can potentially disrupt the role that CDS markets play in risk management and hedging strategies (Oehmke and Zawadowski, 2017), posing potential threats to financial stability (Stulz, 2010).

In this paper, we study the impact of the Small Bang focusing on single-name investment grade companies included in the Markit iTraxx Europe index, the most liquid segment of the CDS market in Europe. To assume a longer-term perspective, we employ over a decade of data from post-Small Bang in June 2009 to December 2019. The European market provides a unique setting to address this question. Compared to the US reforms, European regulation allows for greater flexibility in terms of contract specifications. Additionally, European markets have experienced a crisis episode, the European debt crisis, after the protocol changes. Thus, by focusing on European CDS markets we can assess the impact of the reforms across both relatively volatile and calm periods. Having documented higher CDS prices in the post-reform period compared to the period preceding the GFC (Figure 1), we investigate the potential channels through which the Small Bang affects CDS prices. In this respect, we study the introduction of the initial capital charge and its impact on CDS prices, focusing on different periods characterized by high and low volatility regimes. We further examine this relationship by differentiating between instances in which the protection buyer bears the initial capital requirement, as opposed to their counterparty, in the context of dealers positioning themselves, on aggregate, as net protection buyers (Aldasoro and Ehlers, 2018). Finally, following evidence in the literature about an inconsistent appraisal of counterparty risk for financial entities (Arora et al., 2012), we study the effect of the initial capital charge on CDS price changes separately for financial and nonfinancial entities, and explore whether the relationship is industry contingent.

We find that while the Small Bang reform may have provided market stability by reducing CDS prices in the short-term, taking a long-term view the upfront fee has increased the cost of insuring using CDS.[5] Specifically, the initial capital charge can be interpreted as an additional funding cost for the parties engaging in CDS transactions, creating a potential friction to trade. As the initial capital charge potentially increases dealers risk aversion, it subsequently leads to higher CDS prices. We document this effect while controlling for well-known determinants of CDS spreads, including firm-specific volatility and liquidity factors, and macroeconomic variables capturing market conditions and sentiment (Corò et al., 2013; Ericsson et al., 2009; Tang and Yan, 2010; Tang and Yan, 2017).

To further confirm the funding channel, we show that the impact of the regulatory change is present especially when protection buyers are more likely to bear the initial capital cost, noting that CDS dealers are on average protection buyers (Aldasoro and Ehlers 2018). Moreover, analysing different market conditions, we document that the impact of the fee on CDS prices is stronger in the most recent period, following the European debt crisis, when market conditions were relatively more benign. Finally, we document that the 'capital requirements – CDS price' relation is industry contingent. Financials are the only industry sector, out of the five industries in which entities in the iTraxx Europe index are categorised, for which CDS prices do not increase following the introduction of the initial capital cost as part of the standardization reform. On the one hand, in line with the findings of Arora et al. (2012), this may suggest that counterparty risk is not priced for financials. On the other hand, this may indicate that trading CDS written on financial entities is seen by dealers as essential to the good functioning of the market and, in conjunction with the high liquidity of financial firms CDS which are the most widely traded among industry sectors (ISDA, 2019), the initial capital charge is seen as a relatively small barrier to trading.

We make three main contributions to the literature. First, we contribute to the nascent literature on the impact of post-GFC reforms focused on standardization of OTC markets, doing so over a sample period long enough to assess the longer-term pricing effects of regulation. Most studies focus on the impact of standardization on liquidity, and over shorter periods. To this end, Wang et al. (2021) and Daures-Lescourret and Fulop (2022) study CDS standardization reforms in the US and Europe, noting a positive impact on liquidity. However, unexpected consequences of the reforms have also emerged, including increased illiquidity for CDS contracts with higher upfront capital charges (Wang et al., 2021). In this paper, we provide evidence that the cost of protection, measured through CDS spreads, increases due to the payment of upfront fees following the adoption of the Small Bang reforms, controlling for CDS

[3] As insurance contracts against the default of an entity, CDS prices reflect the probability of default of the entity, as well as the default risk of the counterparty of the CDS contract, the so-called counterparty risk. Moreover, CDS prices comprise a risk premium capturing subjective factors such as dealer risk aversion (Siriwardane, 2019). Also it is relevant to note that although the CDS and conventional insurance contracts are similar, an 'insurable interest' is a must for the validity of a conventional insurance contract.

[4] As an anonymous reviewer notes, it is possible that CDS prices rise post-reform because increased transparency may provide a better assessment of risk. To allow for this, our benchmark regressions are estimated from the post-Small Bang onwards.

[5] By introducing a friction in trading, the reform may potentially hinder CDS price discovery.

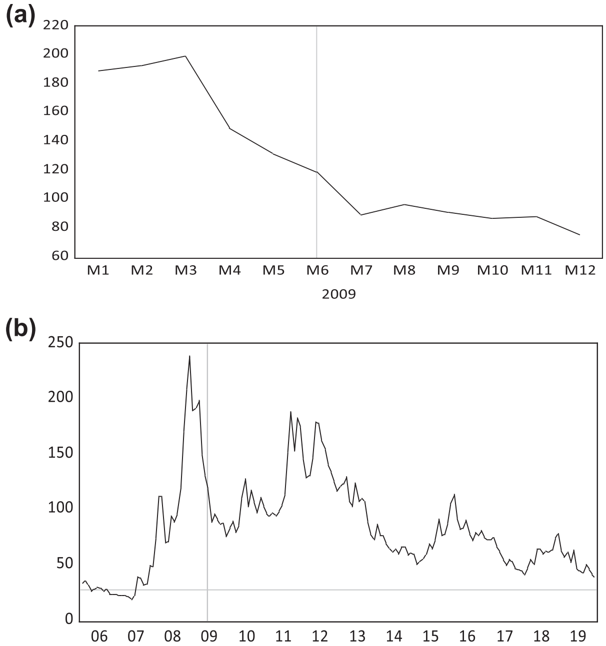

Fig. 1. CDS spreads – A short-term and a long-term view. Figure 1 plots average monthly CDS spreads for our sample of 103 Markit iTraxx Europe investment-grade companies. Panel A displays spreads in the period 6-month prior to 6-month after the CDS Small Bang event (January 2009 – December 2009). Panel B plots average spreads across the whole sample (January 2006 – December 2019). Spreads represent end-of-month values and are averaged across entities. The grey vertical line indicates the month when the Small Bang reforms were enacted (June 2009). The grey horizontal line from Panel B represents the average CDS spread observed in the pre-GFC period (January 2006 – March 2007). Data is obtained from Bloomberg.

liquidity and volatility, thus identifying a funding channel driven by the increase in capital intensity of engaging in CDS contracts that is separate from the sensitivity of CDS prices to liquidity or volatility factors documented in prior studies.

Secondly, we add to the literature examining the effects of funding constraints on financial markets (Adrian et al. 2014; Brunnermeier and Pedersen, 2009; He and Krishnamurthy, 2013; He et al., 2017; Siriwardane, 2019). Studying CDS specifically, Siriwardane (2019) documents a sizeable impact of dealers capital shocks on CDS prices that is comparable in magnitude to that of standard credit factors. We contribute to this literature by identifying substantial regulatory spillovers to dealers capital constraints. The requirement of payment of the initial upfront fee leads dealers, who, over the period following the reform act as net CDS protection buyers, to operate closer to their funding constraints due to protection buyers having to pay the fee in most cases throughout our sample, increasing their risk aversion, and translating to higher CDS prices. Lastly, by documenting that the fee payable at the inception of a CDS contract acts as an additional funding cost which results in higher CDS prices, and that this effect is not captured in the short-term by contracts written on financial entities, this paper contributes to the more general literature investigating the determinants of CDS spreads (Annaert et al., 2013; Corò et al., 2013; Ericsson et al., 2009; Galil et al., 2014; Koutmos, 2019; Pereira et al., 2018; Tang and Yan, 2017).

The rest of the paper is structured as follows. Section 2 details the institutional background, focusing on the regulatory reforms affecting the CDS market. Section 3 describes the data, sample and variable construction, and summary statistics. Section 4 presents the empirical methods employed and results. Section 5 outlines the robustness checks performed on our results. Section 6 concludes.

2. Institutional background and literature review

Standardization is a key element in the on-going regulatory reforms of over-the-counter (OTC) markets.[6] Contract standardization is a process that allows matching of cash flows in terms of amount and maturity.[7] To standardize CDS contracts, the CDS Small Bang reforms introduced fixed coupons together with an upfront fee payable at the start of the contract.[8] In particular, the CDS Small Bang

[6] We provide more details on the reforms of the CDS market in the post-GFC period in Section 1A in the Appendix.

[7] Standardization of CDS contracts can also involve default-contingent payments, restructuring clauses, and the events that trigger default (see Vause (2010) for more details).

[8] A second feature of these protocol changes relates to the standardization of cash settlements in contractual CDS agreements following a credit event, the settlement price being decided through an auction mechanism (Augustin et al., 2014).

conventions restrict coupon rates to 25 bps, 100 bps, 500 bps and 1000 bps.[9] Hence, following the Small Bang reforms, CDS contracts require the exchange of an upfront fee at the initiation of the contract to settle the difference between the CDS spread and the present value of the fixed coupons. The difference is paid by the buyer (seller) if the fixed coupon is lower (higher) than the actual CDS spread. For further discussion on the rationale for the introduction of the Big Bang and Small Bang reforms, see Vause (2010), ISDA (2012), Markit (2009), and Casey (2009).

Contract standardization is essential for several aspects of Credit Default Swaps (CDS) trading, such central clearing and centralized trading.[10] Moreover, standardized contracts facilitate netting and trade compression (Vause, 2010) and are necessary to attain a certain degree of liquidity on centralized trading venues (Oehmke and Zawadowski, 2017). However, standardized contracts may not be able to meet specific risk management and trading objectives, for which agents rely on the customized contracts of OTC markets (Stulz, 2010). While the literature has studied extensively the impact of central clearing on the functioning of derivative markets,[11] the impact of reforms aimed at contract standardization has been relatively less studied.

Exploring the CDS reforms in the US and Europe, Wang et al. (2021) and Daures-Lescourret and Fulop (2022) find an improvement in aggregate CDS liquidity following the introduction of the reforms, though the improvement is greatly reduced for contracts that incur larger upfront fees (Wang et al., 2021). Moreover, Gündüz et al. (2021) document that CDS buying costs decrease for non-dealer banks following the CDS protocol changes in both Europe and the US, enabling such banks to extend more credit to affected firms and improve hedging. Separately, investigating the CDS Big Bang protocol changes, Narayanan and Uzmanoglu (2018) document a sharper decline in firm value for investment-grade firms compared to high-yield entities with traded CDS following the Big Bang. Danis (2017) uses the CDS Big Bang reforms as a natural experiment and focuses on the restructuring of distressed firms finding that participation rate among bondholders is lower if the company has CDS traded on its debt, while Gelpern and Gulati (2012) explore whether following the Big Bang, CDS contract interpretation has become more contextualist rather than textualist in nature.[12] In a recent paper, Wang et al. (2024) document that the difference in the cost of upfront payments between the two fixed coupons introduced after the U. S. Big Bang reforms positively impacts the difference in bid-ask spreads and the difference in mid spreads between the two coupons.

3. Data and variables

3.1. Data collection and sample construction

We source CDS spread mid, bid, and ask quotes for CDS contracts written on European investment-grade companies included in the Markit iTraxx Europe index from Bloomberg.[13] The Markit iTraxx Europe index comprises of 125 investment-grade entities with the most liquid single-name CDS in the European market.[14] The constituent list includes 100 non-financial firms and 25 companies that operate in the financial sector.

Our dataset includes monthly, end of month, observations spanning a period of fourteen years, from January 2006 to December 2019.[15] Therefore, the sample covers a period of around three and a half years (41 months) prior and ten and a half years (127 months) after the CDS Small Bang. The entities in the dataset are all the companies included in Markit iTraxx Europe index throughout our sample period for which we could source CDS and stock data from Bloomberg. To preserve the number of entities in our cross-section as

[9] In the US market, the CDS Big Bang reforms defined only two fixed coupon rates of 100 bps and 500 bps.

[10] The multilateral netting of positions via central counterparties requires standardized contracts, and a large share of contracts has to move to a central clearing counterparty for it to achieve the multilateral netting benefits sought by the regulators (IMF (2010)).

[11] Important contributions to the literature examining the impact of central clearing on the functioning of OTC markets include: Duffie and Zhu (2011), Duffie, Scheicher, and Vuillemey (2015), Acharya and Bisin (2014), Loon and Zhong (2014).

[12] Credit Derivatives Determination Committees set up by ISDA following the CDS Big Bang to help market participants reach decisions on issues such as whether a credit event has occurred or whether an auction should be held state an interpretative approach to contract adjudication, with members performing their obligations 'in a commercially reasonable manner', while being 'sensitive to the broader context of the CDS market' (Gelpern and Gulati, 2012, p. 364). However, contrasting this contextualist mission statement, the contract interpretation strategies adopted by ISDA for its credit derivatives contracts in the context of the Greek sovereign debt crisis 'emphasised fidelity to contract text as distinct from economic substance of the transaction'(Gelpern and Gulati, 2012, p. 385).

[13] The CDS data in Bloomberg is sourced using pricing code CBIN. Given the use of this data among financial market participants, we follow Boehmer et al. (2015) and Mayordomo et al. (2014) and argue that Bloomberg CDS prices are highly likely to be tradeable or are actually traded. Several studies have used CDS data sourced from Bloomberg including Das and Hanouna (2009), Saretto and Tookes (2013) and Nashikkar et al. (2011).

[14] Previous studies using data from the iTraxx Europe index include Alexander and Kaeck (2008) and Breitenfellner and Wagner (2010) which examine the determinants of the CDS indices, Berndt and Obreja (2010) who use index data to construct a factor mimicking economic catastrophe risk, Junge and Trolle (2015) who construct a new measure of CDS market liquidity and analyse whether liquidity risk impacts expected CDS returns, Calice (2014) who document that equity returns of systemically important financial institutions are inversely related to CDS index market shocks, with European institutions particularly sensitive to iTraxx index movements, and Hui, Lo, and Lau (2013) who explore option implied correlation between iTraxx Europe Financials and Non-Financials indexes.

[15] The sample start date is chosen due to relatively low CDS data availability prior to 2006.

well as focus on the most liquid CDS, we typically include in our sample reference entities that have not been excluded from the Markit iTraxx Europe index for more than ten index rolls throughout the post-Small Bang period.[16] We focus on CDS contracts with a five-year maturity as these contracts are the most liquid and widely traded (Annaert et al., 2013). All contracts are denominated in Euros and have a Modified-Modified restructuring clause, the most common restructuring rule in Europe. The final sample consists of 15878 (103 firms) monthly observations.

3.2. Description of variables

3.2.1. The upfront fee

Computing the upfront fee requires two components, the distance between the CDS spread and the coupon rate, and the prevailing funding cost in the market. Following the procedure outlined in Wang et al. (2021), we use the coupon rate closest to the CDS spread to obtain the distance between the spread and the coupon and construct, for each reference entity i in month t, a variable ($DIS_{i,t}$) measuring the minimum difference, in absolute terms, between the CDS spread and the fixed coupon rates.[17] The construction of the variable $DIS_{i,t}$ is shown in (1).

$$DIS_{i,t} = \min\left(\left|CDS_{i,t} - 25\right|, \left|CDS_{i,t} - 100\right|, \left|CDS_{i,t} - 500\right|, \left|CDS_{i,t} - 1000\right|\right) \tag{1}$$

To measure the funding cost per unit of payment prevailing in the market, we use the European TED spread, measured as the difference between the 3-month Euribor rate and 3-month German Government BuBill rate. We choose to use the European TED spread as the funding cost measure for our main analysis as Cerutti et al. (2017) convincingly show that European bank conditions, proxied through the European TED spread are better indicators of cross-border bank flows, especially outside of the GFC, compared to US banking conditions. However, in section 5.5., we show that our results are robust to using the US TED spread as the funding cost measure. We obtain end-of-month closing values of the European TED spread from Bloomberg, noting a great deal of variation, ranging from lows of just over 2 bps to highs of 282 bps during the most turbulent part of the GFC.

As in Wang et al. (2021), we define the upfront fee ($Fee_{i,t}$) as the product between the distance to the closest coupon ($DIS_{i,t}$) and the funding cost prevailing in the market ($TEDspread_t$), as shown in (2).

$$Fee_{i,t} = DIS_{i,t} \times TEDspread_t \tag{2}$$

We note that, in the post-Small Bang period, the mean fee at the 25 bps coupon is 0.07 bps, at the 100 bps coupon this is 0.17 bps, at the 500 bps coupon this is 0.72 bps, while at the 1000 bps coupon the mean fee is 0.60 bps. As expected, we see that the fee typically increases, in absolute terms, with the coupon rate.[18] The fee is paid by the protection buyer (seller) when the spread is higher (lower) than the closest fixed coupon. In our sample, the protection buyer bears the upfront fee in 63.3% of cases.

Figure 2 presents the variation of the average fee observed in our sample over time. We note that the mean fee was approximately 0.16 bps in the period following the Small Bang and prior to the inception of the European debt crisis, then spiked sharply during the European debt crisis period, reaching levels of 0.95 bps in November 2011.[19] The large spike in the fee during the European debt crisis can be attributed to increases in both funding costs as well as $DIS_{i,t}$ during this period. The mean fee decreased to averages of around 0.08 bps in the period following the European debt crisis.

3.2.2. Control variables

The control variables included are drawn from the literature and consist of well-documented firm-specific and macroeconomic determinants of CDS spreads and spread changes (e.g. Corò et al., 2013; Ericsson et al., 2009; Tang and Yan, 2010; Tang and Yan, 2017; Wang et al., 2024). As control variables, we therefore include firm-specific variables such as CDS illiquidity (CDS bid-ask spreads), 30-day realized CDS spread volatility, stock return, stock bid-ask spread (scaled by the midpoint of the bid and ask quotes), 30-day realized stock volatility, and leverage (the ratio of short and long term debt to market value of equity)[20], as well as

[16] The European Markit iTraxx index constituent list is reviewed with respect to liquidity and investment grade of entities every six months, with one index roll occurring in March and one in September. Throughout the time frame of the study, changes to the constituent list of the European iTraxx index are minor. This observation is also highlighted by Breitenfellner and Wagner (2012) who find only negligible effects of index roll changes on spread changes.

[17] For our sample of firms, in the post-Small Bang period, the closest coupon to the spread is the 25 bps coupon in 4447 (37.81%) cases, the 100 bps coupon in 7120 (60.54%) cases, the 500 bps coupon in 188 (1.60%) cases, and the 1000 bps coupon in 5 (0.04%) cases, highlighting the investment grade nature of CDS of the reference entities.

[18] The lower mean fee for the 1000 bps coupon can be attributed to a very low number of observations at this coupon rate (5 observations).

[19] We follow Acharya et al. (2018) and Acharya et al. (2019) and consider the most severe part of the European Debt Crisis to last from January 2010 until July 2012 when the Outright Monetary Transactions (OMT) program was launched which indirectly recapitalized European banks and reestablished market stability.

[20] Leverage is downloaded from Bloomberg at a monthly frequency. To obtain the monthly frequency for this variable, the most recently available value of short- and long-term debt is divided by the market capitalisation of the entity in the respective month.

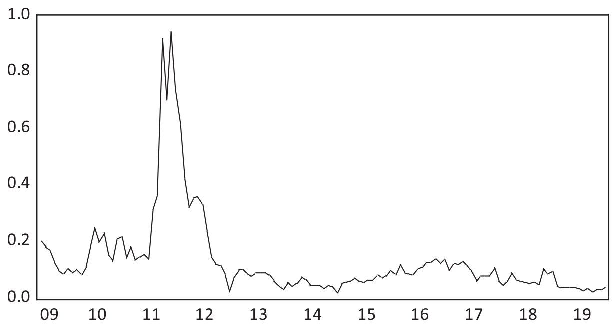

Fig. 2. Evolution of upfront fee over time. Fig. 2 presents the monthly cross-sectional average upfront fee (in bps) exchanged between the parties involved in the CDS transaction over time for our sample of 103 Markit iTraxx Europe investment-grade companies. The fee is calculated as shown in (2). The data span is the post-Small Bang period (June 2009 – December 2019).

macroeconomic variables such as the 10-year risk-free rate prevailing in Europe, the slope of the yield curve (the difference between the 10-year and 2-year Euro-area Government bond yields), and the level of the VSTOXX index to measure implied volatility.[21] In robustness tests, we also include the Bloomberg 1-year distance to default measure, country-specific 10-year risk-free rate, return on assets, the ratio of property, plant, and equipment to total assets, and the ratio of total capital to total assets. To assemble our control variables, we obtain CDS bid and ask quotes as well as stock level data and macroeconomic series from Bloomberg. A summary of the variables can be found in Table 1.

3.2.3. CDS spreads around the Small Bang: A short and a long-term view

As shown previously in the introduction, Figure 1 Panel A shows the evolution of CDS spreads using a 6-month window before and after the Small Bang event. We note that CDS spreads have steadily decreased from levels of around 200 bps observed in March 2009 and have continued their decreasing trend after the Small Bang event of June 2009, reaching levels of around 76 bps at the end of the 2009.[22] However, looking at the long-term picture of average spread behavior throughout our whole sample, displayed in Figure 1 Panel B*,* we see that cross-sectional average spreads not only increased relatively soon after the Small Bang, possibly also due to the European debt crisis, but they do not approach their average pre-GFC level until the end of our sample.[23] This is further evidenced by the descriptive statistics of our dataset reported in Table 2. There we show the smaller value of average CDS spread levels observed in the period preceding the Small Bang reforms (75.26 bps), compared to that following the Small Bang (91.41 bps).

This is noteworthy considering that the former period also includes the most turbulent part of the GFC. In our study we suggest that spreads have not declined to their pre-Small Bang levels, also in part due to the increase in capital intensity brought about by the introduction of upfront fees for transacting CDS which created an additional cost-related barrier to entry in the CDS market.

4. Empirical results

In the empirical analysis, we focus on examining CDS spread changes as our dependent variable, rather than spread levels for two reasons. Firstly, by using spread changes, we alleviate any non-stationarity concerns around CDS spreads, and independent variables.[24] Secondly, as Ericsson et al. (2009) note, spread differences should be harder to explain than spread levels. Therefore, by performing our estimations in first differences, we perform a stricter test of the effects of the upfront fees, as well as of other CDS determinants, on CDS spreads.[25]

Moreover, since the Small Bang upfront fee was introduced in June 2009 and given that our main research question relates to uncovering the long-term impact of the upfront fee on CDS spreads, our main estimations focus on the post-Small Bang sample (June 2009 – December 2019).[26]

[21] Following Pires et al. (2015), we focus on the absolute rather than the relative bid-ask spread as the authors convincingly show that the absolute measure should be used in the context of the CDS market. Contrasting this, stock bid-ask spreads are scaled by the midpoint of the bid and ask quotes, as commonly used in microstructure empirical research.

[22] Focusing on the liquidity effects of the CDS Big Bang reform, Wang et al. (2021) finds that CDS bid-ask spreads decrease in the 6 months following the reform.

[23] Following Corò et al. (2013) we consider the start month of the GFC to be April 2007.

[24] Previous studies investigating the determinants of CDS spread changes in the European market (Corò et al., 2013) and in the U.S. market (Galil et al., 2014) found evidence of non-stationarity in spread levels, whereas spread changes are stationary.

[25] Previous studies investigating CDS spread changes include Anderson (2017), Annaert et al. (2013), Corò et al. (2013), Ericsson et al. (2009), Galil et al. (2014), and Tang and Yan (2017).

[26] In robustness tests, we also estimate our model for the full sample period (January 2006-December 2019), and we confirm our main findings. We report the results in Table 5A in the Appendix.

Table 1
Description of variables. Table 1 presents the variables used in the analysis, together with a description of their construction.

Variable	Description/Construction
CDS spread	Midpoint of the bid and ask quotes of the CDS spreads (in bps)
DIS	Minimum difference, in absolute terms, between the CDS spread and the four possible coupon rates (in %)
Fee	Size of the upfront payment defined as the product between *DIS* and *TED* spread (in bps)
TED spread	Difference between the 3-month Euribor rate and the 3-month German Government BuBill (in %)
CDS bid-ask	Difference between the ask and bid quotes of the CDS spreads (in bps)
CDS volatility	30-day historical volatility of CDS spreads
Stock return	Monthly stock log return (in %)
Stock bid-ask	Difference between the ask and bid quotes of the stock divided by their midpoint.
Stock volatility	30-day historical volatility of stock returns
Leverage	Ratio of short- and long-term debt to the market value of equity
Risk-free rate	Yield on the 10-year Euro-area Government bond
Slope Yield	Difference between the 10-year and 2-year Euro-area Government bond yields
VSTOXX	Level of the VSTOXX implied volatility index
Distance to default	Bloomberg 1-year distance to default
PPE/TA	Net property, plant & equipment divided by total assets
CAP/TA	Total capital divided by total assets
ROA	Return on Assets

Table 2
Summary statistics. Table 2 presents summary statistics of our sample of 103 Markit iTraxx Europe investment-grade companies for the period January 2006 to December 2019 in Panel A, for the period preceding the Small Bang reforms from January 2006 to May 2009 in Panel B, and for the period following the Small Bang reforms from June 2009 to December 2019 in Panel C. Data is collected from Bloomberg.

Panel A: Whole sample (January 2006 to December 2019)						
Variable	Mean	Median	Max	Min	Std. Dev.	Obs
CDS spread	87.223	68.037	1380.453	3.417	75.889	15878
DIS	0.299	0.225	3.805	0.000	0.331	15878
CDS bid-ask	6.002	5.018	101.982	0.000	3.934	15878
CDS volatility	46.313	39.020	1006.920	4.060	29.519	15821
Stock return	0.066	0.446	67.711	-73.122	7.846	17179
Stock bid-ask	0.002	0.001	0.466	-0.045	0.006	17276
Stock volatility	27.616	23.634	387.014	2.754	15.824	17282
Leverage	1.627	0.455	110.669	0.013	4.519	16926
Risk-free rate	1.865	1.661	4.621	-0.700	1.522	17304
Slope Yield	1.042	1.052	2.246	0.024	0.592	17304
VSTOXX	22.433	20.391	60.677	11.986	8.012	17304
Panel B: Pre-Small Bang sample (January 2006 to May 2009)						
Variable	Mean	Median	Max	Min	Std. Dev.	Obs
CDS spread	75.264	45.691	1380.453	3.417	97.130	4118
CDS bid-ask	5.952	4.096	101.982	0.000	5.728	4118
CDS volatility	61.851	53.225	1006.920	4.060	41.799	4070
Stock return	-1.004	-0.163	67.711	-73.122	9.597	4111
Stock bid-ask	0.002	0.001	0.133	-0.029	0.004	4208
Stock volatility	34.161	26.973	387.014	4.683	23.577	4214
Leverage	1.364	0.382	68.537	0.030	4.332	4022
Risk-free rate	3.904	3.951	4.621	2.951	0.416	4223
Slope Yield	0.532	0.366	2.170	0.024	0.589	4223
VSTOXX	24.862	19.992	60.677	14.014	11.410	4223
Panel C: Post-Small Bang sample (June 2009 to December 2019)						
Variable	Mean	Median	Max	Min	Std. Dev.	Obs
CDS spread	91.411	72.576	1148.227	14.719	66.372	11760
Fee	0.144	0.078	2.739	0.000	0.245	11760
DIS	0.312	0.250	2.236	0.000	0.320	11760
CDS bid-ask	6.020	5.240	77.104	0.288	3.067	11760
CDS volatility	40.931	36.790	284.510	5.100	21.345	11751
Stock return	0.403	0.611	52.368	-62.260	7.175	13068
Stock bid-ask	0.002	0.001	0.466	-0.045	0.006	13068
Stock volatility	25.505	22.915	139.188	2.754	11.562	13068
Leverage	1.709	0.485	110.669	0.013	4.572	12904
Risk-free rate	1.207	0.890	3.387	-0.700	1.111	13081
Slope Yield	1.207	1.193	2.246	0.202	0.490	13081
VSTOXX	21.649	20.599	46.680	11.986	6.354	13081

4.1. The effect of the Small Bang upfront fee on CDS spreads

After documenting that CDS spreads are higher on average following the Small Bang reform, we next turn to a more formal analysis to determine whether the initial charge introduced by the reform drives CDS spreads. To assess whether the upfront fees brought about by the CDS Small Bang reforms increase CDS spreads after accounting for known firm-level and macroeconomic determinants of CDS spreads, we estimate the model presented in (3):

$$\Delta CDS_{i,t} = c_i + \beta_1 \Delta Fee_{i,t} + \gamma_1 \Delta X_{i,t} + \gamma_2 \Delta Y_t + u_i + \varepsilon_{i,t} \tag{3}$$

In (3) $\Delta CDS_{i,t}$ is the monthly change in the mid CDS spread of reference entity i in month t, c_i is a constant, $\Delta Fee_{i,t}$ represents the monthly change in the upfront fee for trading CDS of reference entity i in month t, $\Delta X_{i,t}$ is the first difference of the set of firm-level control variables described in section 3.2.2., ΔY_t is the first difference of the set of macroeconomic variables described in section 3.2.2., and u_i are the firm-level fixed effects.[27]

Results are presented in Table 3. Column (1) presents results for the post-Small Bang period (June 2009 – December 2019), while columns (2) and (3) present the sub-samples identifying the period between the Small Bang and the end of the European Debt Crisis (June 2009 – July 2012), and the post-European Debt Crisis period (August 2012 – December 2019), respectively.

We find that changes in CDS spreads significantly increase with changes in the fee (column 1). The coefficient of the term $\Delta Fee_{i,t}$ is 25.03 and is significant at the 1% significance level. This effect is also significant across the two subperiods examined (columns 2 and 3) with the coefficient of the term $\Delta Fee_{i,t}$ increasing in value to 67.09 in the period following the European debt crisis.[28] This finding also suggests that the effect of the fee is not directly related to the turbulent market episodes related to the crisis.[29] Indeed, during the post-European Debt Crisis period, CDS spreads are generally lower across companies, which implies that the fee should have a stronger effect on spreads, given that other factors such as market volatility, leverage or stock returns whilst remaining significant determinants of spreads are comparatively less impactful, as evidenced by their respective coefficients.

Importantly, the widening of CDS spreads due to the payment of upfront fees is observed after controlling for known determinants of CDS spreads, including CDS illiquidity. This is noteworthy since, in a related study focusing on CDS liquidity, rather than on CDS spreads as is the case with this paper, Wang et al. (2021) find that CDS bid-ask spreads increase due to the exchange of upfront fees. Additionally, we propose that the exchange of upfront fees between CDS buyers and sellers increases CDS spreads through a funding channel that is separate from liquidity or volatility transmission channels.[30] Moreover, it is important to note that in the post Small Bang period, CDS spreads have generally declined compared to the highs seen during the GFC, indicating that the Small Bang reforms have generally had a stabilizing effect. However, despite the general trend of decreasing spreads, the fee acts as a funding cost that drives spreads upwards.

4.2. Asymmetric effects of the upfront fee on CDS spreads

4.2.1. The effect of the protection buyer paying the upfront fee

Aldasoro and Ehlers (2018) show that reporting dealers are net CDS protection buyers. Moreover, in CDS markets, four of the largest CDS dealers are, on aggregate, net protection buyers in every year following the CDS Small Bang.[31] Therefore, we posit that the effect of the upfront fee on CDS spreads is larger when the CDS contract buyer pays the upfront fee as this would constitute an additional funding cost that, on aggregate, CDS dealers would have to bear to engage in CDS transactions. To test this, we first construct an indicator variable $Buyer_{i,t}$ which takes the value of 1 if the CDS spread on contract i in month t is larger than the closest fixed coupon, and 0 otherwise. We then estimate the regression model presented in (4).

$$\Delta CDS_{i,t} = c_i + \beta_1 \Delta Fee_{i,t} + \beta_2 \left(\Delta Fee_{i,t} \times Buyer_{i,t}\right) + \gamma_1 \Delta X_{i,t} + \gamma_2 \Delta Y_t + u_i + \varepsilon_{i,t} \tag{4}$$

We report the results in Table 4. In column (1) the point estimate of the coefficient on the term $\Delta Fee_{i,t} \times Buyer_{i,t}$ is 111.16 and significant at the 1% significance level, which is more than four times larger than the point estimate of the fee coefficient observed in the

[27] The vast majority of papers in the relevant literature (e.g., Wang et al., 2021) employ fixed effects. To assess the choice between fixed and random effects, we employed the appropriate Hausman test which commonly rejects random effects. Even when estimating using a random effects approach, the effect of changes in fees on spread changes remains qualitatively similar to results presented using fixed effects. These latter results are available on request.

[28] While the CDS Small Bang trading conventions began on June 20th, 2009, contract adherence closed on July 24th , 2009. To alleviate any concerns that the implementation period of the Small Bang conventions may influence results, we re-estimate (3) on a modified post-Small Bang sample starting from the month of July 2009. Regression results are qualitatively similar. Results available from the authors.

[29] To further strengthen our result that changes in the upfront fee, rather than changes in the prevailing funding costs, drive changes in CDS spreads, we re-estimate (3) on the post-Small Bang sample (June 2009 – December 2019), while also controlling for changes in the TED spread. We find that the TED spread does not significantly impact spreads, while the effect of the upfront fee on spreads remains positive and statistically significant. Results are available from the authors.

[30] We further confirm this by excluding that our findings are driven by changes in illiquidity in a robustness exercise reported in section 5.2.

[31] In unreported analysis employing DTCC data, we find that between 2008 and 2019, on aggregate, four of the largest CDS dealers (Morgan Stanley, Goldman Sachs, J.P. Morgan and Citigroup) are net protection buyers.

Table 3
The effect of the upfront fee on CDS spreads. Table 3 presents the impact of the upfront fees brought about by the CDS Small Bang on CDS spreads. Column (1) presents results of the effect of the upfront fee on CDS spreads in the post-Small Bang sample (June 2009 – December 2019). Column (2) presents results of the effect of the upfront fee between the Small Bang event and the end of the European Debt Crisis (June 2009 – July 2012). Column (3) presents results of the effect of the upfront fee after the European Debt Crisis (August 2012 – December 2019). The dependent variable in all models is the first difference of CDS spreads (Δ*CDS spread*). Estimations use independent variables in first differences (monthly changes). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All estimations are carried out using firm fixed effects and standard errors clustered by firm and time. Standard errors are presented in parentheses. Data is collected from Bloomberg.

Sample:	Post-Small Bang	Small Bang – Debt Crisis	Post-Debt Crisis
Period	June09-Dec19	June09-July12	Aug12-Dec19
	(1)	(2)	(3)
Constant	-0.18	1.68	-0.80
	(0.62)	(1.23)	(0.64)
Return	-0.82***	-0.93***	-0.72***
	(0.13)	(0.22)	(0.14)
Δ*Stock volatility*	0.13**	0.05	0.15***
	(0.06)	(0.10)	(0.06)
Δ*CDS volatility*	0.10***	0.14**	0.07***
	(0.03)	(0.06)	(0.03)
Δ*Stock bid-ask*	-32.69	-126.63	-24.51
	(21.85)	(157.37)	(17.89)
Δ*CDS bid-ask*	2.32***	2.46***	2.43***
	(0.50)	(0.60)	(0.77)
Δ*Leverage*	1.37***	1.77**	0.64***
	(0.48)	(0.72)	(0.22)
Δ*Risk-free rate*	-5.10	2.23	0.35
	(6.01)	(7.43)	(11.53)
Δ*Slope yield*	1.36	-2.98	0.37
	(8.33)	(9.33)	(14.04)
Δ*VSTOXX*	0.69***	1.32***	0.33*
	(0.18)	(0.37)	(0.19)
Δ*Fee*	**25.03*** **	**16.32***	**67.09*** **
	(7.84)	**(8.54)**	**(13.41)**
Observations:	11436	3790	7646
Number of companies:	103	102	103
Adj. R-squared:	0.41	0.45	0.40

baseline model reported in column (1) of Table 3.[32] This suggests that the impact of the fee is positive and large when the fee payer is the protection buyer (i.e. typically a dealer). Consequently, the coefficient of $\Delta Fee_{i,t}$ turns negative and significant indicating that CDS spreads decline when the initial cost is not borne by the dealer. Of course, the aggregate effect of changes in fees on spread changes is positive, as shown in Table 3. In columns (2) and (3) we isolate the period between the Small Bang and the European debt crisis, and the post-European debt crisis period, respectively, and find that the coefficients of the interaction term $\Delta Fee_{i,t} \times Buyer_{i,t}$ are 90.90 and 264.46, respectively, indicating that the asymmetric effect of the buyer paying the upfront fee is larger in the post-European debt crisis period (August 2012 – December 2019).

4.2.2. Examining financial and non-financial companies separately

It is important to note that significant differences between financial and non-financial firms exist, among others, in terms of regulation, funding methods, corporate governance, agency problems, capital structure, leverage levels, and calculation of distance to default (De Haan and Vlahu, 2016; Duan and Wang, 2012). Furthermore, *inter alia*, Alexander and Kaeck (2008) provide evidence that several variables that affect CDS spreads of non-financial entities do not influence spreads of companies operating in the financial sector.

Therefore, to examine whether the effects of the upfront fees on CDS spreads differ when examining contracts written on financial or non-financial entities, we split our sample of firms according to whether they operate in a non-financial or financial industry and estimate (5) separately on the two groups of firms.[33]

$$\Delta CDS_{i,t} = c_i + \beta_1 \Delta Fee_{i,t} + \gamma_1 \Delta X_{i,t} + \gamma_2 \Delta Y_t + u_i + \varepsilon_{i,t} \tag{5}$$

Table 5 presents the results. Column (1) explores the effects of the upfront fees on CDS spread of financial entities column (2) explores the effects of the upfront fees on CDS spreads of non-financial entities. We find that changes in upfront fees do not significantly increase

[32] As robustness, we re-estimate (4) by further including the indicator variable $Buyer_{i,t}$ as a separate independent variable in the model. Results indicate that the indicator variable is insignificant when estimating the model on the entire post Small Bang sample, as well as sub-samples, while the interaction term $\Delta Fee_{i,t} \times Buyer_{i,t}$ continues to significantly drive spreads.

[33] In our sample, we have 20 firms operating in the financial sector and 83 firms operating in non-financial sectors.

Table 4
Asymmetric effects of the Small Bang upfront fee. Table 4 presents the asymmetric effect of the upfront fee on CDS spreads dependent on whether the protection buyer or seller pays the upfront fee. Column (1) presents results of the asymmetric effect of the buyer paying the upfront fee on CDS spreads in the post-Small Bang sample (June 2009 – December 2019), while Columns (2) and (3) present these results between the Small Bang event and the end of the European Debt Crisis (EDC) (June 2009 – July 2012), and after the European Debt Crisis (August 2012 – December 2019), respectively. The dependent variable in all models is the first difference of CDS spreads (Δ*CDS spread*). Estimations use independent variables in first differences (monthly changes). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All estimations are carried out using firm fixed effects and standard errors clustered by firm and time. Standard errors are presented in parentheses. Data is collected from Bloomberg.

Sample:	Post-Small Bang	Small Bang – Debt Crisis	Post-Debt Crisis
Period	June09-Dec19	June09-July12	Aug12-Dec19
	(1)	(2)	(3)
Constant	-0.17	1.38	-0.54
	(0.53)	(1.02)	(0.50)
Return	-0.72***	-0.77***	-0.60***
	(0.12)	(0.20)	(0.14)
Δ*Stock volatility*	0.13***	0.07	0.12**
	(0.05)	(0.08)	(0.05)
Δ*CDS volatility*	0.09***	0.12**	0.05**
	(0.03)	(0.05)	(0.02)
Δ*Stock bid-ask*	-32.41	-114.05	-24.88
	(21.15)	(150.74)	(17.35)
Δ*CDS bid-ask*	2.11***	2.18***	2.20***
	(0.43)	(0.50)	(0.66)
Δ*Leverage*	1.04***	1.38**	0.45**
	(0.36)	(0.55)	(0.19)
Δ*Risk-free rate*	-4.37	-0.39	0.96
	(4.99)	(6.51)	(9.05)
Δ*Slope yield*	1.03	-1.91	-0.04
	(6.22)	(7.34)	(10.89)
Δ*VSTOXX*	0.52***	0.98***	0.20
	(0.16)	(0.32)	(0.16)
Δ*Fee*	**-61.57*** **	**-52.71** **	**-137.03*** **
	(22.30)	**(21.11)**	**(20.54)**
Δ*Fee* × *Buyer*	**111.16*** **	**90.90*** **	**264.46*** **
	(28.92)	**(27.13)**	**(23.48)**
Observations:	11436	3790	7646
Number of companies:	103	102	103
Adj. R-squared:	0.49	0.53	0.50

CDS spreads for financial entities, while the effect of changes in the fee on spread changes of non-financial entities is significant at the 1% significance level. When estimating (5) for the post-Small Bang sample of non-financial companies, the coefficient of the term $\Delta Fee_{i,t}$ is 34.11, which is larger in magnitude compared to the baseline regression presented in Column (1) of Table 3.

4.2.3. Is the effect of the upfront fee on spread changes industry contingent?

The result from section 4.2.2. calls for a deeper investigation into whether the impact of the Small Bang upfront fees on CDS spreads is contingent on the industry sector in which the underlying entity resides, firstly to explore whether there are other industries where the relationship does not hold, and secondly to check that the results found for the sub-sample including financial entities only are not primarily driven by the smaller sample size. Moreover, while theoretically the relationship between the Small Bang upfront fees and CDS spreads should not be dependent on the industry sector in which the underlying entity activates, as the fees would have to be exchanged between the counterparties in the transaction irrespective of the underlying entity, Arora et al (2012) documents that spreads of financial firms are less correlated with that of CDS dealers than might be expected. To examine whether the effects of the upfront fee on CDS spreads are captured differently across different industry sectors, and particularly across financials, we use the following procedure - First, we group firms in the iTraxx Europe index into one of five industry sectors as indicated by Markit. The five categories are: Automobile & Industrials, Consumer Products, Energy, Financials, and Telecommunications, Media & Technology. We then estimate the model presented in (6) separately for all time-series samples.

$$\Delta CDS_{i,t} = c_i + \sum_{k=1}^{5} \beta_k (\Delta Fee_{i,t} \times I_{sector_k}) + \gamma_1 \Delta X_{i,t} + \gamma_2 \Delta Y_t + u_i + \varepsilon_{i,t} \quad (6)$$

In (6), I_{sector_k} represent dummy (indicator) variables taking the value of one if company i is in sector k, and zero otherwise.

Regression estimation results are reported in Table 6. Column (1) presents results for the post-Small Bang sample, while columns (2) and (3) present results for the sample covering the post-Small Bang period until the end of the European debt crisis, and the post-

Table 5
Impact of upfront fee on CDS spreads - Distinguishing between financial and non-financial firms. Table 5 presents results highlighting the asymmetric effects of the exchange of upfront fees on CDS spreads written on financial and non-financial companies. Column (1) explores the effects of the upfront fees on CDS spreads of financial entities. Column (2) explores the effects of the upfront fees on CDS spreads of non-financial entities. Estimations use independent variables in first differences (monthly changes). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All estimations are carried out using firm fixed effects and standard errors clustered by firm and time. Standard errors are presented in parentheses. Data is collected from Bloomberg.

Sample of firms	Financial	Non-Financial
Sample Period	Post-Small Bang	Post-Small Bang
	(1)	(2)
Constant	-0.20	-0.24
	(0.99)	(0.56)
Return	-0.85***	-0.49***
	(0.17)	(0.10)
Δ*Stock volatility*	0.00	0.18***
	(0.11)	(0.05)
Δ*CDS volatility*	0.10**	0.10***
	(0.04)	(0.03)
Δ*Stock bid-ask*	-81.10	-22.96
	(92.19)	(16.71)
Δ*CDS bid-ask*	2.43***	2.16***
	(0.67)	(0.54)
Δ*Leverage*	1.21***	38.55**
	(0.40)	(16.81)
Δ*Risk-free rate*	-12.51	-2.83
	(10.61)	(5.75)
Δ*Slope yield*	24.13	-3.85
	(17.73)	(7.43)
Δ*VSTOXX*	1.56***	0.51***
	(0.39)	(0.15)
Δ*Fee*	**1.17**	**34.11*** **
	(13.47)	**(7.35)**
Observations:	2279	9157
Number of companies:	20	83
Adj. R-squared:	0.48	0.43

European debt crisis period, respectively. Examining the post-Small Bang period, we find that monthly changes in upfront fees increase spread changes for all individual industry sectors except financials, providing further support to our previous results from Table 5.[34] Moreover, this alleviates concerns that the results presented in Table 5 are due to lower number of financial entities, compared to non-financials. Upon further inspection of columns (2) and (3), we find that the result concerning financial companies is driven by the period between the Small Bang date and the end of the European debt crisis, period during which, interestingly, we also find no significant positive effect of fee changes on spread changes for companies in the Telecommunications, Media & Technology sector. We note that this result may be partly driven by the fact that in the period between the Small Bang and the end of the European Debt Crisis, financial entities and companies operating in the Telecommunications, Media & Technology sector display the lowest ratio of the upfront fee as a percentage of the CDS spread. Hence, for these companies the upfront fee represents a lesser proportion of the CDS spread, compared to entities operating in other industries. We also show that the relationship between changes in upfront fee and CDS spread changes is significant and coefficients of the terms $\Delta Fee_{i,t} \times I_{sector_k}$ are larger in magnitude in the post-European debt crisis period for all industry sectors, including financials.

An implication of this result may be that the standardization benefits of the Small Bang reforms outweigh the downside of the need for increased capital to engage in CDS transactions in the case of trading CDSs written on financial entities. This result may also suggest a market expectation that CDS dealers would not fail, even if large financial firms become distressed (Arora et al., 2012).

5. Robustness checks

5.1. Do spreads increase due to the upfront fees at the market level?

Having documented that CDS spreads widen as a result of the introduction of upfront fees at the company level, we now turn our attention to replicating our main findings at the market level, by using cross-sectional averages of our dependent and independent

[34] See figure 1A in the appendix for a graphical representation of the interaction effects across industries.

Table 6
Impact of the upfront fee on CDS spreads - Differences across industry sectors. Table 6 presents the impact of the upfront fees brought about by the CDS Small Bang on CDS spreads across five different industry sectors, using the specification presented in Eq. (6). Column (1) presents results of the effect of the upfront fee on CDS spreads in the post-Small Bang sample (June 2009 – December 2019). Column (2) presents results of the effect of the upfront fee between the Small Bang event and the end of the European Debt Crisis (June 2009 – July 2012). Column (3) presents results of the effect of the upfront fee after the European Debt Crisis (August 2012 – December 2019). The dependent variable in all models is the first difference of CDS spreads (Δ*CDS spread*). Estimations use independent variables in first differences (monthly changes). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All estimations are carried out using firm fixed effects and standard errors clustered by firm and time. Standard errors are presented in parentheses. Data is collected from Bloomberg.

Sample:	Post-Small Bang	Small Bang – Debt Crisis	Post-Debt Crisis
Period	June09-Dec19	June09-July12	Aug12-Dec19
	(1)	(2)	(3)
Constant	-0.18	1.66	-0.80
	(0.61)	(1.20)	(0.64)
Return	-0.82***	-0.93***	-0.72***
	(0.14)	(0.23)	(0.14)
Δ*Stock volatility*	0.14**	0.09	0.15***
	(0.05)	(0.09)	(0.06)
Δ*CDS volatility*	0.10***	0.13**	0.07***
	(0.03)	(0.06)	(0.03)
Δ*Stock bid-ask*	-31.38	-121.41	-24.36
	(21.28)	(154.61)	(18.17)
Δ*CDS bid-ask*	2.26***	2.35***	2.43***
	(0.48)	(0.56)	(0.79)
Δ*Leverage*	1.46***	1.90***	0.63***
	(0.47)	(0.69)	(0.22)
Δ*Risk-free rate*	-5.24	1.58	0.43
	(5.91)	(7.23)	(11.57)
Δ*Slope yield*	1.67	-2.75	0.28
	(8.07)	(9.07)	(14.10)
Δ*VSTOXX*	0.67***	1.24***	0.33*
	(0.17)	(0.34)	(0.19)
$\Delta Fee \times I_{Automobile\ \&\ Industrials}$	**30.46*** **	**22.15***	**65.74** **
	(10.62)	**(11.41)**	**(27.38)**
$\Delta Fee \times I_{Consumer\ Products}$	**43.75*** **	**32.86*** **	**78.38*** **
	(7.10)	**(7.02)**	**(14.34)**
$\Delta Fee \times I_{Energy}$	**32.32*** **	**26.95*** **	**51.97** **
	(10.05)	**(10.16)**	**(25.25)**
$\Delta Fee \times I_{Financials}$	**5.82**	**-2.98**	**71.96*** **
	(13.29)	**(13.02)**	**(15.01)**
$\Delta Fee \times I_{Telecoms,\ Media\ \&Tech}$	**24.73** **	**14.40**	**58.70** **
	(10.88)	**(14.47)**	**(27.90)**
Observations:	11436	3790	7646
Number of companies:	103	102	103
Adj. R-squared:	0.42	0.46	0.40

variables, respectively. Hence, we estimate the regression presented in (7).

$$\Delta MarketCDS_t = c + \beta_1 \Delta MarketFee_t + \gamma_1 \Delta X_t + \varepsilon_t \tag{7}$$

In (7), $\Delta MarketCDS_t$ is the first difference of the average market-wide CDS spread in month t, c_t is a constant, $\Delta MarketFee_t$ is the first difference of the average market-wide upfront fee in month t, and ΔX_t represents first differences of the set of market-wide control variables described in section 3.2.2. In Table 1A of the Online Appendix we find compelling evidence supporting our previous firm level results. Changes in upfront fees significantly increase CDS spread changes in the post-Small Bang period, as evidenced by the positive and significant coefficient of $\Delta MarketFee_t$, which has a value of 45.52. Moreover, analyzing post-Small Bang subsamples, we find that the coefficient of $\Delta MarketFee_t$ is more than two times larger in the period following the European debt crisis.

5.2. Are our findings driven by changes in illiquidity?

In this section, we test whether the relationship between changes in upfront fees and CDS spread changes is driven by changes in the reference entity's CDS illiquidity. To do so, we run the model presented in (8).

$$\Delta CDS_{i,t} = c_i + \beta_1 \Delta Fee_{i,t} + \beta_2 (\Delta Fee_{i,t} \times \Delta CDSbid - ask_{i,t}) + \gamma_1 \Delta X_{i,t} + \gamma_2 \Delta Y_t + u_i + \varepsilon_{i,t} \tag{8}$$

In Table 2A of the Appendix we find that the coefficient of the fee is statistically significant and has a positive relation with CDS spreads in all estimations. At the same time, we find that the coefficient of the interaction term $(\Delta Fee_{i,t} \times \Delta CDSbid - ask_{i,t})$ is insignificant in all estimations. This result provides further support for a funding channel of the transmission of upfront fees on CDS spreads which is not driven by the illiquidity of the reference entity's spreads.

5.3. Using only CDS Big Bang fixed coupons in the calculation of the upfront fee

An important difference between the CDS Small Bang and CDS Big Bang reforms is that, in Europe, the Small Bang introduced four fixed coupons (25bps, 100bps, 500bps and 1000bps), while in the US only two fixed coupons (100bps and 500bps) have been adopted. However, reports suggest that the European CDS market has shifted towards using the 100bps and 500bps coupons almost exclusively, with corporate investment grade swaps likely trading at 100bps, while high yield credits trade with a 500bps strike, further indicating a general move towards greater standardization in the CDS market (ECB, 2009).

To check whether our results are robust to the use of only the 100bps and 500bps coupons when transacting CDS contracts, we compute $DIS_{BB_{i,t}}$ as the minimum value of the absolute difference between one of the two fixed coupons and the CDS spread of firm *i* in month *t,* as shown in (9):

$$DIS_{BB_{i,t}} = \min\left(\left|CDS_{i,t} - 100\right|, \left|CDS_{i,t} - 500\right|\right) \tag{9}$$

As in the main analysis, the fee ($Fee_{BB_{i,t}}$) is computed as the product between the $DIS_{BB_{i,t}}$ and the European TED spread measure. We then proceed to re-estimate the model presented in (3) using $Fee_{BB_{i,t}}$ as the measure of upfront fees. Results are presented in Table 3A of the Online Appendix. We confirm that changes in upfront fees increase CDS spread changes when using the two-coupon specification. In the post-Small Bang period, the point estimate of the coefficient of the term $\Delta Fee_{BB_{i,t}}$ is 26.27, significant at the 1% significance level, and similar in magnitude to the coefficient of $\Delta Fee_{i,t}$ from the Table 3. On the one hand, this result lends further to support to our central finding that spreads increase with upfront fees. On the other hand, this suggests that the inclusion of the additional two coupons in the European market has little effect on the relationship between changes in upfront fees and CDS spread changes for corporate single name CDSs included in the iTraxx index.

5.4. The ISDA master agreement and Deutsche Bank's exit from the CDS market

Two events affecting the CDS market occurred in the latter part of 2014, the introduction of the 2014 ISDA Master Agreement (MA henceforth) in September 2014 and the exit of Deutsche Bank from the single-name CDS market. First, the ISDA MA represents a standardized contract that is most widely used by participants in the derivatives market (Borowicz, 2021). Even though contractual standardization introduced through the 2014 ISDA MA has brought some economic benefits such as reductions in transaction costs, scholars have pointed out that the MA may have led to increased systemic risk and created transactional precedents potentially affecting market integrity (Borowicz, 2021). Secondly, Deutsche Bank's exit from the single-name CDS market, which began in September 2014, when a large CDS portfolio has been sold to Citibank, and was reported in the media as completed in November 2014, deteriorated market making capacity in the CDS market and led dealers to operate closer to their funding constraints (Wang et al., 2021).

As these two events largely coincide in terms of the date of their occurrence, it is difficult to disentangle their individual impact. Thus, we control for them jointly by setting the event date to September 2014 and explore whether the effect of changes in the fee on CDS spread changes, as well as the asymmetric effect of the buyer paying the upfront fee, differs in the period following these events, compared to the period preceding it. Results are reported in Table 4A of the Appendix. We note changes in upfront fees increase spread changes in both periods, with the magnitude of the coefficient of $\Delta Fee_{i,t}$ being approximately 1.5 times larger following the introduction of the ISDA MA and the exit of Deutsche Bank from the CDS market. We also find that the effect of the protection buyer paying the upfront fee is significant in both periods, with the magnitude of the coefficient of $\Delta Fee_{i,t} \times Buyer_{i,t}$ being approximately 2.3 times larger in the period following these events.

5.5. Using the US TED spread to capture funding costs

In the main analysis we have computed the upfront fee using the European TED spread measure, following the findings of Cerutti et al. (2017) indicating that the European TED spread measure is a better measure capturing cross-border bank flows outside of the GFC, compared to its US based measures. However, much of the funding of global banks, including non-US global banks, is obtained in US dollars (Aldasoro et al., 2022). Consequently, we re-estimate our results from section 4 using the US TED spread, measured as the difference between the 3-month USD Libor rate and the 3-month US Treasury yield.

Results are presented in the appendix in Tables 6A – 9A. We find qualitatively similar results to the prior analysis, with the statistical significance generally improving, and with estimates of the point coefficients of the variables capturing the effect of changes in upfront fee on CDS spread changes being up to three times larger in some specifications. In conclusion, we document that CDS spreads increase with the fee irrespective of the funding currency, and that the relationship between upfront fee changes and spread changes is generally more sensitive to US funding conditions.

5.6. Alternative specifications

In this section, we explore the inclusion of two different control variables in our model presented in (3).

Firstly, an important determinant of spread changes is the distance to default which is an indicator of the credit quality of a reference entity (Coro et al. 2013). Noting a correlation of 0.45 between monthly stock returns and changes in distance to default, we re-estimate (3) replacing the stock return variable with changes in distance to default. Results are presented in Table 10A of the appendix. We find a negative relationship between changes in distance to default and spread changes, indicating that improvements in credit quality result in lower spreads. The effect of changes in fees on spread changes remains qualitatively similar to results presented in Table 3.

Secondly, we recognise that the European Debt Crisis as well as the related national fiscal stimulus packages may have affected countries to varying degrees, and therefore also the companies headquartered in different European countries in our sample. Hence, we re-estimate (3) replacing the variable capturing changes in the yield on the Euro-Area 10-year government bond ($\Delta Risk - freerate_t$) with a variable measuring changes in the yield on the 10-year government bond of the country in which each of the entities is headquartered ($\Delta Countryrisk - freerate_t$). Estimation results are presented in Table 11A of the appendix. We find a positive relationship between changes in the country specific 10-year yield and spread changes, indicating that higher borrowing costs lead to increased default risk (see Coro et al. 2013). Separately, the effect of fee changes on spread changes remains qualitatively similar to Table 3 results.

5.7. Estimations using balance sheet variables

In this section, we explore whether changes in upfront fees influence spread changes after accounting for changes in balance sheet variables. Given the availability of the data on balance sheet variables, we conduct this analysis on our sample of firms at the semi-annual frequency. Therefore, we augment (3) by controlling for profitability, tangibility, and capital using the return on assets, property, plant and equipment divided by total assets, and total capital divided by total assets, respectively. Results are presented in Table 12A of the appendix. We find that the effect of changes in upfront fees on spread changes remains positive and significant after the inclusion of balance sheet variables, while the impact of balance sheet variables on spreads is statistically insignificant.

5.8. GMM estimation

Following work such as Benbouzid et al. (2017) in the CDS literature, we also estimate a version of our benchmark model in Table 3 (but at a semi-annual frequency, as in subsection 5.7, to ensure $N > T$) using a difference Generalized Method-of-Moments (GMM) dynamic panel model to address any remaining endogeneity concerns after the series of robustness tests above. Given this approach estimates a version of (3), with an additional lagged dependent term on the right-hand side, we employ lagged differences of $\Delta CDS_{i,t-i}$ (from $i = 2$ onwards) as instruments. The results are shown in Table 13A and once again, suggest that the fee is significant and positive. Given the Arellano and Bond (1991) recommendation that consistency is checked via the Hansen test for the joint validity of the instruments (i.e., the J-statistic) and, in our case, there is no second-order serial correlation, the approach appears appropriate.

6. Conclusions

The CDS Small Bang reforms were introduced in June 2009 to improve standardization in the European CDS market. While in the short term the average CDS spread levels fell, taking a long-term view indicates that cross-sectional average levels of CDS spreads have been higher than the average pre-Small Bang level, after accounting for subsequent crisis episodes. A specific feature of the reforms included the introduction of standardized coupons whereby, in order to standardize the cash flow of CDS contracts, an upfront fee needs to be exchanged between market participants that engage in transacting CDS contracts. We document that the adoption of this new rule created unintended consequences. Using data on single-name investment grade constituents of the Markit iTraxx Europe index between January 2006 and December 2019, we show that the introduction of upfront fees created a market trading environment that is more capital intensive. This, in turn, has had the effect of widening CDS spreads. Moreover, we document that this effect is asymmetric and we find that CDS spreads increase when the protection buyer pays the upfront fee.

By bringing a longer-term perspective to the literature on the impact of the CDS standardization reforms, we complement the shorter-term empirical evidence presented in the current literature. We highlight how the introduction of the fee has been associated with higher trading frictions in CDS, resulting in an average higher cost of insurance via CDS.

What are the implications of our work for policy makers and practitioners? The additional capital charge affects dealers' ability to engage in market making activity in CDS and it certainly makes CDS trading more expensive and consequently less attractive for intermediaries. This can potentially disrupt the role that CDS markets play in risk management and hedging strategies, posing potential threats to financial stability. Indeed, episodes of liquidity fragility and price dislocation in key financial markets have highlighted the importance of dealers for the smooth and efficient operation of financial markets. Moreover, the increased cost of CDS trading may have contributed to greater concentration among dealers in the CDS market. With large CDS dealers dominating the market, systemic risks may be exacerbated due to credit risk being shared between fewer market participants providing a further potential explanation for the heightened levels of CDS spreads observed in the long-run post-Small Bang period compared to the period prior to the GFC.[35] Finally, the introduction of the upfront fee may act as a long-term barrier to trading in the CDS market which drives the cost of insurance using CDS upwards. Hence, even if we consider that standardization reforms may have reduced credit risk in CDS markets, the

[35] The gross market exposure of CDS dealers reporting to the BIS amounts to $2.36 trillion at the end of our sample period in 2019 (BIS OTC Triennial Report).

question remains as to whether risk has shifted to other segments of the financial system, or else, importantly, has remained unhedged.

Limitations on data availability have precluded us from observing dealers' positions to explore the role of the introduction of the upfront fee on their inventory management and their trend towards consolidation. Future research extending our work could look into the dynamics of dealers' inventory and how their ability to make the market in CDS has affected their ability to stand ready and provide liquidity at low cost to market participants.

CRediT authorship contribution statement

Radu-Dragomir Manac: Writing – original draft, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Chiara Banti:** . **Neil Kellard:** Writing – original draft, Supervision, Project administration, Methodology, Investigation, Conceptualization.

Data availability

Data will be made available on request.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.intfin.2024.102043.

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