Comovement in the CDS market

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Abstract

This paper extends the literature on comovement by exploring index-based comovement in the market for Credit Default Swaps (CDS). We exploit the inclusion of individual CDS contracts in the Markit CDX Investment Grade Index, a major credit derivative benchmark. We find that for single name CDS contracts, comovement increases after inclusion in the index. Comparing movements in the CDS spreads to movements of the bond spreads of the same issuers, the CDS spread comovement increases more than the bond spread comovement. Deletions from the Investment Grade index, which often occur due to downgrades, are followed by increases in the comovement of the bond spreads and no change in the comovement of the CDS spreads. This pattern of evidence is consistent with the excess comovement in equity markets documented by Barberis et al (2005) and others.

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1 Introduction

Economic theory suggests that in a frictionless economy with rational investors, securities' prices should at all times reflect their fundamental values. In this idealized setting, comovement in the securities' values and returns should reflect only comovement in underlying fundamentals. Recent research, however, documents comovement in securities' returns that appears to exceed fundamental comovement. This research includes work on US equity markets by Barberis, Shleifer, and Wurgler (2005), analysis of Japanese equity markets by Greenwood and Sosner (2007), and earlier work by Vijh (1994).

Research on comovement in equity markets has often used inclusion in and deletion from benchmark indexes as part of the research design. Many mutual funds and exchange traded funds are explicitly tied to these benchmark indexes. The flow of investors' money into and out of these funds induces correlation in trading activity across the index constituents. In a frictionless market this correlated trading would have no effect on prices or returns. But frictions and illiquidity, even among relatively liquid equity securities, appear to induce excessive index-based comovement in American and international equity markets.

This paper extends the existing literature by exploring index-based comovement in the market for Credit Default Swaps (CDS). CDS contracts are derivative contracts whose cashflows are tied to credit events at underlying bond issuers. An investor who has sold protection on an issuer using a CDS contract has taken on that issuers' credit risk, similar to the purchaser of the issuers' bonds. Like equity markets, CDS markets have several benchmark indexes. These indexes are used both as barometers for market activity and as trading instruments in their own right. We use the most liquid CDS index benchmark: the Markit North American Investment Grade CDX index (CDX.NA.IG hereafter). The index's constituents are updated biannually, providing a large sample of inclusion and deletion events for our analysis.

Because bonds and CDS contracts both offer investors economic exposure to an issuers' credit risk, exploring comovement in the two markets jointly allows us to control for fundamentals-based comovement. This approach for controlling for underlying fundamentals has not been available to researchers analyzing comovement in equity markets. With index inclusions, we find that comovement of CDS spreads with the other issuers in the index increases significantly around the inclusion date CDX. The mean beta against the index rises 0.284 after inclusion. The difference in differences of mean betas from CDS spreads and bonds is a statistically significant 0.301 after inclusion. This evidence supports the hypothesis that the bond and CDS markets are at least somewhat segmented. Index inclusion appears to change the comovement patterns of CDS spreads in a way that is not matched by the comovement patterns of the underlying bonds.

To better understand the source of this non-fundamental comovement, we also estimate Dimson (1979) betas. We find that our results are very strong even using Dimson betas, which suggests that the origin of this shift in comovement is not an information diffusion channel, but rather a category based explanation for non-fundamental comovement. Many investors buy protection in baskets, buy the index, however they do not buy individual CDS. This clientele effect is translated into an excess comovement of those CDS that are part of the index.

Though most of our analysis is focused on additions to the index, we also show that deletions from the index see no statistically significant change in the mean beta of the CDS on the index. The betas are high prior to deletions because issuers being deleted from the CDX Investment Grade index are often being removed because they lose their investment grade status: as firms approach distress their bonds begin to take on a larger share of the company's risk. On net, these results indicate that index-based comovement is a characteristic of CDS markets as well as equity markets.

The paper proceeds in five sections. Sections I and II review in more detail the relevant literatures on comovement and on CDS markets. Section III and IV describe the empirical design and the data used in the study. Results are presented and discussed in Section V. A brief final section concludes.

2 Related literature on comovement

A number of researchers have investigated patterns of comovement in equity prices. Research has focused on whether patterns of comovement reflect joint movement in expected returns and rational discount rates, or rather are driven by commonality of trading activity across different securities. Pindyck and Rotemberg (1993) focus on US equity securities, estimate a factor model of stock price returns similar to Chen, Roll, and Ross (1986), and find comovement across the residuals from this regression. They show that comovement is particularly large among stocks held by institutional investors, which they interpret as indicating that these investors' flows drive securities away from fundamental value.

Vijh (1994) looked at the betas of securities included and excluded from the S&P 500, showing that securities in the S&P 500 have higher betas. Vijh estimates that 8.5 percent of the total variance of daily returns of the market portfolio is based on flow-related price pressure. Barberis, Shleifer, and Wurgler (2005) also focus on the S&P 500 index inclusions and deletions and find evidence of comovement in excess of what can be explained with fundamentals.

Greenwood (2005) focuses on Japan, and exploits the fact that the Nikkei 225 index is equally weighted, rather than value-weighted. Some stocks in the index are thus overweighted by a factor of ten or more relative to other stocks in the index. Thus, when investor demand for the Nikkei 225 index rises, investors have to purchase significantly more of some stocks (relative to value) than they would if the index were value-weighted. In particular, firms with small market capitalizations have larger demand shocks, relative to size. Greenwood and Sosner (2007) also focus on Japan, on the April 2000 redefinition of the Nikkei 225 index. Daily index return betas of the additions rose by an average of 0.45; index return betas of the deleted stocks fell by an average of 0.63.

Antón and Polk (2009) have investigated comovement in a bottom-up framework, and find that stocks that are held by the same active fund managers and covered by the same analysts comove more than other stocks, controlling for other similarities between stocks. This effect is stronger when the stocks in the pair are small and common owners are experiencing strong inflows and outflows. A related paper by Greenwood and Thesmar (2009) develops and applies a measure of 'co-fragility' in US equity markets, that captures the correlation of the trading needs of two assets' owners: two assets are 'co-fragile' if they are held by investors with correlated inflows and outflows. Another related paper by Koch, Ruenzi, and Starks (2009) looks at comovement among stocks with high and low institutional ownership, and find that the stocks with high mutual fund ownership have comovement that is twice as pronounced as among stocks with minimal institutional ownership.

Evans and Lyons (2002) investigate trading-based price pressure in the currency market, and find that order flow explains a very significant share of daily movements in exchange rates. Evans and Lyons focus on the US Dollar-German Mark and US Dollar-Japanese Yen exchange rates for May 1-Aug 31, 1996, and find that order flow accounts for 60 percent of the daily changes in the German exchange rates and 40 percent of the changes in the Yen. Brandt and Kavajecz (2004) focus on the US Treasury market, finding an effect of flows on yields that is large and strongest when liquidity is low. Finally, Ambrose, Lee, and Peek (2007) explore comovement in the REIT (Real Estate Investment Trust) market, looking at an event study created when REITs were added to the S&P general indices. They find that not only do the REITs included in the S&P indices commove more strongly with those indices after inclusion, the non-included REITs also commove more strongly with the indices after inclusion as well.

In all of this literature there is a concern that index-based comovement in returns reflect fundamentals, rather than common trading-induced price pressure. Our research is somewhat difficult: the inclusion in and especially deletions from the CDX indexes are driven by corporate events in direct way. Downgrades in particular induce deletion from the CDX investment grade index, and changing patterns of comovement include some fundamental component. But the CDS market is also a derivative market based on the underlying bonds, and hence we are able to use the changes in spreads on these underlying bonds as a control from firm fundamentals. We find that CDS spread betas increase more than bond spread betas after inclusion, and viceversa after deletion. This finding provides strong evidence for non-fundamental-based comovement in the CDS market.

3 Related literature on bond and CDS markets

This paper is related to the growing literature on bond and CDS markets. Collin-Dufresne, Goldstein, and Martin (2001) investigate the patterns of credit spread changes. They show that, using proxies that measure changes in default probabilities and changes in recovery rates, they are able to explain about 25 percent of observed credit spread changes. They find that the residuals from these explanatory regressions are highly cross-correlated, and appear to be driven by a single common factor. One potential explanation for this common factor would be market flows into and out of credit markets. The authors' approach is different from ours: they focus on bonds, where we focus on CDS markets.

Longstaff et al (2005) use the market for CDS to estimate the default and non-default components of corporate bond spreads. Their research uses the CDS spread to construct the true default probability of a corporate issuer, and apply that estimated default probability to corporate bonds to parse out the default and non-default related parts of bond spreads. They find that their measures of 'default probability' explains that bulk of bond spreads, but that a sizable part remains unexplained. Exploring the unexplained component of bond yields, they find that bond liquidity is an important determinant. Our paper is starting from an entirely different point – in showing patterns of CDS comovement around the inclusion and deletion of CDS issuers from the major indices, we are showing evidence of a liquidity-based component in the movements of these spreads.

4 Empirical design: inclusion in and deletion from the CDX indexes

CDS contracts are bilateral contracts used to transfer the risk of a 'credit event' between market participants. The 'protection seller' sells insurance to the 'protection buyer.' For single-name CDS contracts, the risk transferred is the risk of a credit event, typically a default, by a single issuer. This issuer can be a corporate or sovereign issuer, or an ABS. By transferring the risk of a credit event, credit default swaps accomplish a function that parallels the purchase of a physical bond; just as the purchaser of a physical bond holds the risk that the bond will default, the seller of protection under a credit default swap contract takes on an economically similar exposure.

The seller of credit protection is compensated by the payment of a credit spread, measured as some percentage of the notional value. This credit spread has always been regarded as a pure measure of the credit risk of the underlying reference entity, unpolluted by interest rate risk.

The CDS market has grown explosively over the past 10 years, with the notional single-name CDS exposure now exceeding the total notional value of the corporate bond market. As CDS contracts are traded in over-the-counter (OTC) markets rather than on exchanges, the market centers around a handful of major dealers. Pricing, although somewhat opaque, is available from sources such as Markit and CMA. The first indices of credit derivatives were created in 2001, and by 2004 the major index administrators (Trac-x and iBoxx) had merged to create the CDX indexes for North American credit and the iTraxx indexes for Europe. Markit Partners acquired both sets of indices in 2007, and is currently the administrator for all of the major credit derivative indexes.

There are a variety of different indexes covering different market subsegments. The North American market is covered by the CDX indexes: the Investment Grade (IG) index, the HVol subindex of the IG universe (HVol), the Crossover index, and the High Yield index and subindexes, and the sector-based indexes. There are also CDX Emerging market indexes. The iTraxx indexes, also owned by Markit, include European, Asian, and Australian markets. Additional credit indexes cover asset backed securities (the ABX, CMBX, and TABX), loans (the LCDX and LevX), sovereign debt (the SovX), and municipal securities (the MCDX).

Table 1 describes the current outstanding single-name and index credit derivatives contracts that were outstanding and registered with the Depository Trust Clearing Corporation (DTCC) as of May 2010. The DTCC registers the vast majority of all CDS contracts traded. The table shows the gross notional and net notional outstanding, as well as the total number of contracts. Many firms have offsetting positions in underlying instruments: the net notional provides a picture aggregating institutions net exposure. The CDX North America Investment Grade indexes, alongside the similar index for Europe, have the highest total outstanding gross and notional amounts, with outstanding amounts that are many times the next nearest contracts. Other index products are the most heavily traded individual instruments. Among single-name CDS contracts, the most heavily traded instruments are contracts referencing sovereign bonds. In particular, Italy, Turkey, Brazil, and Russia have large notional amounts.

There appears to be a discontinuous jump in the trading activity in CDS contracts that are included in the index versus contracts that are not included in the index. Causation works in both ways here: the dealer poll that drives index inclusion is based on selecting the more liquid and active CDS contracts for the index. At the same time, inclusion in the index drives trading related to index flows and products. Table 2 and Table 3 show the magnitude of the activity discontinuity for names included in the index. Table 2 includes only the corporations among the top 1000 CDS reference entities in terms of trading activity, for a total of 442 firms. Trading activity is based on gross notional outstanding (columns 1-3), net notional outstanding (columns 4-6), and the number of contracts outstanding as of September 3, 2010.

There is a strong relationship between CDS trading activity and the amount of debt outstanding. Controlling for this relationship, though, inclusion in the CDX.IG index is associated with $9 Billion more gross outstanding in CDS contracts. Again, causation works both ways in this relationship, with inclusion in the index also being a reflection of underlying trading activity. Table 3 repeats the analysis of Table 2, but fitting Tobit regressions using the entire sample of Compustat firms, with a truncation point set to the minimum value of each activity measure observed among the top 1000 issuers. The results are qualitatively similar, but the much larger coefficients on the CDX inclusion dummy variables reflect the truncated nature of the sample used in Table 2.

Table 4 shows the constituents for the most recent series (Series 14) of the CDX North American Investment Grade index. The constituents are chosen every 6 months by a poll of dealers, and as the name suggests are required to be investment-grade firms domiciled in North America. Table 5 shows the index additions and deletions for the recent rolls of the index. Deletions from the investment grade index commonly occur because of downgrades, but also follow mergers. In the case of Wells Fargo, a merger with Wachovia made Wells Fargo a CDX market maker, hence not eligible for inclusion in the index.

We use these periodic rolls of the CDX index to investigate patterns of comovement in the CDS market. Our hypothesis is that on inclusion in the index, the CDS spreads of an issuer will commove more with the average spreads in the index, due to the impact of correlated trading in index-based products and correlated hedging of index exposures. Specifically, both the beta of the spread on the index, as well as the R-squared, will go up.

5 Data

The main sample consists of CDS spreads of corporate issuers available from Datastream, which sources CDS data from CMA. CMA is a major provider of OTC market data, and along with Markit is the dominant provider of data on CDS spreads. We consider CDS spreads of issuers that were added or deleted from the CDX North America Investment Grade Index (CDX.NA.IG hereafter) between September 2004 and March 2009. The index inclusion and deletion dates for individual issuers are based on the sequence of constituents of the different series of the CDX.NA.IG index. The constituents of each of the CDX Index series are provided by Markit.com.

CDS contracts are written for a variety of different maturities, with 1,3,5,7, and 10 year contracts being the most common. Among these, the 5 year contracts are generally the most active and liquid and often viewed as the benchmark contracts for the issuer. We use the Datastream-reported spreads on the 5 year contracts in the analysis that follows. Because there are two main sources of data, we also show that the results are robust to the use of the CDS data provided by Markit. Relevant literature in CDS uses both sources of data. Although Markit has been widely considered as a more accurate source for CDS data, recent papers use CMA as the main source (see Bongaerts, Driessen, and De Jong, 2011, and Giglio, 2011). A recent study by Mayordomo, Peña, and Schwartz (2010) compares the major sources of corporate CDS prices and concludes that CMA database quotes lead the price discovery process in comparison with the quotes provided by other databases.

Data on the bonds matched to the CDS reference entities also come from Datastream, with the asset swap spread used as the primary measure of the bond spread. The asset swap spread reflects the equivalent spread over a floating-rate benchmark of a bond whose cash flows have been swapped from fixed to floating. This spread benchmark removes the direct impact of interest rate movements and is conceptually the closest match to the reported spread on a CDS contract, which also primarily reflects credit risk rather than interest rate effects. CDS are matched to the underlying bonds, with an algorithm used to select a liquid bond closest to the 5-year point. Data on the time series of the CDX.NA.IG comes from Bloomberg.

The total number of issuers that were included or deleted from the index ascends to 120. For an issuer to be included in our sample it has to be added to or deleted from the CDX.NA.IG between September 2004 and March 2009, and we also require a minimum of 80% of trading days per regression estimated. The final sample of issuers after the screening amounts to 95. There are 51 additions and 54 deletions that match our criteria. There are 10 issures that are both added to and deleted from the index in different rolls of the index.

Table 6 and Table 7 provide some descriptive statistics for the sample used in the paper. Table 6 aggregates the period between 2004 and 2010, while Table 7 splits the sample into a pre-crisis and a post-crisis period.

6 Results

To test our hypothesis, we run two regressions for each CDS issuer that has been included or excluded from the index, one the year before the event (the 255 trading days before the event), and another one the year after the inclusion (255 trading days after the event). For each issuer we regress the change in CDS spread on the change in the CDX spread:

$$\Delta CDS_{i,t} = \alpha_i + \beta_{ci} \Delta CDX_t + \varepsilon_{i,t}$$

We then compute the difference between the beta after the event and beta before the event, and label it $\Delta\beta_{ci}$, where the subindex c denotes CDS and i the issuer. The hypothesis predicts that the average change in beta, $\overline{\Delta\beta_c}$ should be significantly positive after an inclusion in the index, as well as the average change in the $\overline{\Delta R^2}$.

As mentioned in our identification strategy, we need to control for fundamentals, and we do so by computing the change in betas for the Asset Swap Spread (ASP) of the underlying bonds identified as the specific reference obligations of the CDS contract:

$$\Delta ASP_{i,t} = \alpha_i + \beta_{bi} \Delta CDX_t + \varepsilon_{i,t}$$

Before showing the results, it is important to understand the distribution of our data. CDS contracts only are widely available since 2004, this is why our sample spams only for 6 years. Table 6, 7, and 8 show the summary statistics for our full sample, the pre-crisis sample, and the crisis sample, respectively.

If we have a closer look at table 6, panel A (all observations), three aspects are worth noticing. First, there is a lot of variability in the CDS spreads during the whole period, with an average CDS spread of 284 and a median of 110. The sample is skewed positively. Second, we observe a very similar average and summary statistics for the bonds underlying, except at the very tail of the distribution. This confirms the fact that both assets are tied to the same issuer and should reflect the same credit risk. Third, we see that the median for changes in spread at the daily and weekly frequency is zero. As a consequence, in panel B we show the summary statistics for the observations where the change in daily CDS spreads is not zero. The number of such cases is not negligible, however it does not compromise our analysis, because the results are robust to this subsample of observations. For the full sample, as we can see comparing the column "Obs" for observations in the two panels, there is a 12% of observations for which there is no change in daily CDS spreads.

Tables 7 and 8 show the same statistics for the pre-crisis and crisis subsamples. A clear manifestation of the crisis was the high levels of CDS spreads for many corporate issuers. It is therefore important to show how the distribution of the main variables change for the different subsamples. In short, the mean and median of CDS spreads for the pre-crisis period were 129.87 and 84.10 respectively. The average CDS spread was more than tripled during the crisis period, to 482.22, and the median CDS spread was doubled to 163.20. The distribution became more skewed during the crisis period.

6.1 Additions

Table 9 shows the first set of results of our tests. In panel A we show the results using daily spread changes. Average betas of CDS spread changes are significantly higher after the addition than before the addition. For the full sample we see that the average change in beta for CDS amounts to 0.211 and is significant at the 1% level. The asterisks in the table reflect significance at the 1%, 5%, and 10% for one-sided tests, where we test whether the change in beta is bigger than zero. Because some of the additions take place in the same date, the standard errors are robust to cross-sectional correlation within addition dates. The average R-Squared also rises significantly after the addition by 0.040. However, this change in beta could be a consequence of the selection by the dealers poll. To account for changes in fundamentals of the issuer, we repeat the same exercise for the underlying bonds. If the change in betas for the changes in CDS spreads carry some information on the credit quality of the issuers, then it should be reflected as well in the changes in betas for the underlying bonds, and the difference in differences should not be significantly different from zero. We however find that the difference in differences of beta changes is a significant 0.307 with a standard error of 0.080. The same can be observed with the R-Squared, that has a difference in differences of 0.05, significant at the 5% level.

An important question raises when considering the sample period we use: is this effect being driven by the large increase of CDS spreads during the recent crisis? We find that the answer to that question is no. The effect that we document does not hinge in the great variability of CDS spreads of corporations during the crisis, rather in the increased attention and trading patterns of CDS index products. Our results confirm that this is the case. We then divide the sample in two subsamples, labeled "pre-crisis" (2004-2006) and "crisis" (2008-2010). We avoid using additions for which we need data both before the crisis and during the crisis to better disentangle the effect. Specifically, additions that occurred in March 2007 and September 2007 are not included in the pre-crisis nor in the crisis period, because the beta estimated before the addition will mainly contain data before the crisis whereas the post-event beta will use crisis period data.

Interestingly, the pre-crisis subsample exhibits a bigger change in CDS beta than in the crisis subsample. The difference in differences in changes in bega for the pre-crisis period is 0.435 estimated accurately with a standard error of 0.134, whereas the difference in differences for the crisis period is 0.237 with a standard error of 0.145. The difference in difference is strong and significant in the pre-crisis sample because the change in betas for the underlying bonds was negative, while there is not a clear patter for the CDS change in beta. On the contrary, for the crisis sample, it is the beta in the CDS that is significantly positive and the underlying bond insignificant.

In panel B of the same table we show the results using weekly (Wednesday) spread changes, instead of daily, to mitigate the tradeoff between market microstructure effects when using high-frequency data and the statistical power of the tests. The change in betas for CDS spreads remains for the three sample periods, but the magnitude is bigger when using weekly data. The results are very robust to the use of weekly data, suggesting that the frequency with which we measure beta does not influence the results much.

These results point out at the clear existence of an excess-comovement triggered by the inclusion of a CDS into the CDX index that is not driven by fundamentals. The mechanisms underlying this comovement are discussed in the fourth subsection.

6.2 Robustness to sample of liquid observations

Although the companies that are included in the index tend to be very liquid, there are still companies for which there is no change in daily spread for more than one day. As explained above, there is a 12% of observations for which there is no change in the daily CDS spread. One could worry that the results might be driven by the lack of liquidity and the zero observations could affect this change in betas. To show that our results are not driven by this lack of variation in some instances, we repeat the analysis but using only observations for which there is a change different from zero in the daily CDS spread.

This results are shown in table 10. Results are by and large unchanged. Magnitudes are in line with thouse found in the benchmark specification. The difference in difference for the pre-crisis period is now 0.426 estimated accurately with a standard error of 0.196. The results are thus not driven by a lack of variation in CDS spreads, but rather remain strong and significant using a subsample of non-zero CDS spread changes.

6.3 Robustness to Markit database

It is important to test the robustness of the results with a different database, as Markit is the major vendor of CDS data. Markit has been widely considered as a more accurate source for CDS data, however recent papers use CMA as the main source (see Bongaerts, Driessen, and De Jong, 2011, and Giglio, 2011). A recent study by Mayordomo, Peña, and Schwartz (2010) compares the major sources of corporate CDS prices and concludes that CMA database quotes lead the price discovery process in comparison with the quotes provided by other databases.

In table 11 we show the results when using a different dataset for CDS spreads, Markit. Only 35 of the 38 benchmark additions could be matched with Markit database.All the results seem largely unchanged, with very small differences. Difference in differences for weekly returns are still very accurately estimated in the pre-crisis period, with a significance at the 1% level for both the full sample and the pre-crisis sample, confirming that the pre-crisis effect is dominant in magnitude and significance over the crisis sample. Table 12 we show the results only using observations for which there is a non-zero change in daily CDS spread, and the patterns are very similar to the ones in table 10.

6.4 Dimson betas

Previous research on comovement in the stock market attempts to dissentangle the sources of the observed change in comovement. According to Barberis, Shleifer, and Wurgler (2005), three are the possible sources of friction- or sentiment-based comovement, namely, category view, habitat view, and information diffusion. The category view, initially proposed by Barberis and Shleifer (2003), argues that investors tend tosimplify portfolio decisions by allocating funds at the category level, instead of at the asset level. In the presence of noise traders with correlated sentiment that can affect prices, there appears an excess comovement into each category by moving funds from one to another group. Habitat view reflects the fact that many investors have a limited investment universe (a preferred habitat), due to transaction costs, or lack of information. This creates a common factor in the returns of these assets that is non-fundamental. Finally, the information difussion predicts that, due to market frictions, the information is incorporated quicker into the prices of some stocks than others.

The use of Dimson (1979) betas allows us to test whether the excess comovement is just a change in speed at which information is incorporated (due to market frictions), or else comes from a more sentiment-driven explanation such as category view or habitat view. We can do so by including leads and lags of the index in the daily analysis, to see if individual CDS react with "less" delay after being included in the index. We specifically run the following regression before and after each inclusion or deletion event:

$$\Delta CDS_{i,t} = \alpha_i + \sum_{s=-5}^{5} \beta_{ci}^{(s)} \Delta CDX_{t+s} + \varepsilon_{i,t}$$

and then we compute the difference between the sum of Dimson betas after the event and the sum of Dimson betas before the event. We then average them clustering for cross-sectional correlation. Similarly, to control for fundamentals, we estimate the same regression for the changes in asset swap spread:

$$\Delta ASP_{i,t} = \alpha_i + \sum_{s=-5}^{5} \beta_{bi}^{(s)} \Delta CDX_{t+s} + \varepsilon_{i,t}$$

This difference will give us then the change in comovement that would happen if there were no information difussion effects. In other words, if the effect disappears, then the excess comovement found in the previous section comes from the information difussion channel. If, however, there still remains a significant change in comovement, that would be evidence of an effect coming from the two other channels.

Empirical evidence on the importance of the information diffusion channel is mixed. Using this Dimson betas approach, Barberis et al. find that most of the excess-comovement associated with an S&P 500 index inclusion comes from an information diffusion explanation. However, a recent study by Green and Hwang (2009) shows that the excess-comovement that arises after a stock-split not only comes from information diffusion but from a pure category or habitat based explanation.

Table 15 shows that in the CDS market, information difussion is not driving our results. Results actually become even stronger than when using a single beta, as in the previous section. In Panel A we show the differences in betas after addition, where the betas are not single betas, but the sum of the 11 Dimson betas (current, plus 5 leads and 5 lags). For the full-sample, we observe that the change in Dimson beta for CDS is a significant 0.515 (compared to the 0.211 from a single beta, in table 9), and once controlled for the change in the associated betas from the bonds, it still remains a significant 3.58 (compared to the 0.307 from table 9). Panel B shows the composition of Dimson betas, and helps understand the results from Panel A.

All the betas for CDS except two are positive, whereas five betas for the bonds are negative. The contemporaneous effect is very strong for the CDS and not for the bond. Table 16 shows that the results are by and large unchanged if we use the alternative Markit database.

These results strongly suggest that the category and preferred habitat channels play an important role in explaining the changes in comovement of CDS contracts added to the CDX index.

6.5 Deletions

In this subsection we comment on the results that come from deletions from the CDX index. Deletions from the index are in most cases a consequence of a downgrade in the underlying bond, or a merger of the company with another one already in the index. However, because we do test jointhly changes in betas for CDS spreads as well as the underlying bonds, these results are also relevant for our study.

Table 13 shows three main findings related to deletions using the full sample. First, changes in betas for CDS spreads are slightly negative, but not significantly different from zero. Second, there is a positive change in beta for the underlying bonds, especially using weekly spread changes. The intuition for this result is as follows. When the downgrade is announced, CDS spreads become more sensitive to changes in the CDX Index spread, and hence the beta before deletion is already high. With the downgrade, firms approach distress and their bonds begin to take on a larger share of the company's risk, so the underlying bonds beta also experience an increase. However, after deleltion, not-belonging to the index causes the comovement of the CDS spreads of the downgraded company to drop more than that of the underlying bonds, which were not linked to the CDX index. For weekly returns is especially clear. The change in beta for CDS spreads is -0.075 poorly estimated with a standard error of 0.256, whereas the change in beta for the underlying bonds is 0.440 with a standard deviation of 0.156. The diference in diferences is however not significant.

7 Conclusion

By exploring additions and deletions of corporate CDS into the CDX Index we provide evidence of an excess co-movement in CDS markets not driven by fundamental reasons. Many mutual funds and exchange traded funds are explicitly tied to these benchmark indexes. The flow of investors' money into and out of these funds induces correlation in trading activity across the index constituents.

To control for fundamentals we propose the novel approach of comparing changes in betas of CDS around inclusions with changes in betas of the underlying bonds. Because bonds and CDS contracts both offer investors economic exposure to an issuers' credit risk, their variation in a frictionless and unsegmented market should be parallel. We find that average changes in betas for CDS exceed significantly average changes in beta for the underlying bonds. We estimate Dimson betas, and find that the excess-comovement is not driven by an information diffusion channel, but induced by a category and preferred habitat channel.

We also show that deletions from the index see no statistically significant change in the mean beta of the CDS on the index, whereas changes in betas for the underlying bonds do. The betas are high prior to deletions because issuers being deleted from the CDX Investment Grade index are often being removed because they lose their investment grade status.

In net these results suggest that the markets for CDS and their underlying bonds are somewhat segmented, and that there is an excess co-movement among the CDS spreads that belong to the major CDX Index, the North American Investment Grade.

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Table 1: **Index and Single-Name CDS contracts**

These are contracts registered with the Depository Trust & Clearing Corporation's Trade Information Warehouse (the 'DTCC Warehouse'), reported as of May 7, 2010. Gross notional and net notional amounts are in Billions of USD.

Indexes and Index tranches	Gross notional	Net notional	Contracts
CDX North American Investment Grade index	3,955	361	20,002
iTraxx Europe main index	3,362	424	11,033
CDX North American High Yield indexes	672	78	1,785
iTraxx Europe sector indexes	489	73	27
ITraxx Europe crossover index	390	36	547
CMBX indexes	194	35	28
iTraxx Europe HiVol index	182	37	113
iTraxx SovX indexes	181	13	1,328
Loan indexes	175	13	923
CDX.NA.IG.HVOL index	138	31	309
ABX and TABX indexes	137	28	60
CDX.EM index	108	18	461
iTraxx Asia ex-Japan Indexes	95	9	149
iTraxx Australia Index	94	8	623
iTraxx Japan index	65	10	53
CDX.NA.XO index	32	6	68
MCDX index	11	3	44
Total index	10,280	1,182	37,553

Single-name CDS contracts	Gross notional	Net notional	Contracts
Republic of Italy	216	24	5,537
Republic of Turkey	173	5	11,576
Federative Republic of Brazil	147	13	11,120
Russian Federation	115	4	8,383
United Mexican States	104	6	8,715
Kingdom of Spain	101	14	4,240
JPMorgan Chase & Co	84	5	9,239
General Electric Capital	83	11	7,690
Bank of America Corporation	82	6	9,191
Hellenic Republic (Greece)	75	8	3,645
Total single name	14,637	1,220	2,152,319

Table 2: **Linear regressions of CDS trading activity, September 3, 2010**

The results of linear regressions of CDS trading activity on firm fundamentals and CDS contract index status. CDS trading activity based on DTCC list of top 1000 CDS contracts, September 3, 2010. Firm fundamentals reflect most recent annual totals avaiable from Compustat. Sample includes only corporations among top 1000 global CDS contracts. Standard erros are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. variable	Gross value of contracts outstanding ($M)			Net value of contracts outstanding ($M)			Contracts outstanding		
Indep. variable									
CDX.IG index	9,115.316***		9,171.626***	546.194***		473.305***	1,221.678***		1,271.235***
	(1,228.368)		(834.148)	(102.706)		(61.778)	(137.295)		(111.609)
CDX.HY index	1,456.137		2,970.352***	-130.087		-3.568	419.590***		559.357***
	(1,371.104)		(917.778)	(114.641)		(67.971)	(153.249)		(122.798)
CDX.XO index	7,442.850***		8,495.265***	376.646**		471.332***	1,317.704***		1,411.149***
	(2,037.349)		(1,355.593)	(170.347)		(100.396)	(227.716)		(181.378)
Accounts payable		0.001	0.011*		-0.002***	-0.002***		0.001	0.003***
		(0.007)	(0.006)		(0.000)	(0.000)		(0.001)	(0.001)
Long-term debt		0.245***	0.227***		0.027***	0.026***		0.020***	0.017***
		(0.020)	(0.017)		(0.001)	(0.001)		(0.003)	(0.002)
Sales		-0.001	-0.010		0.001*	0.001		-0.001	-0.002
		(0.011)	(0.010)		(0.001)	(0.001)		(0.001)	(0.001)
Constant	8,837.763***	9,469.731***	6,008.521***	790.916***	650.865***	507.335***	1,538.593***	1,840.312***	1,304.033***
	(719.173)	(459.795)	(518.257)	(60.132)	(31.793)	(38.383)	(80.382)	(63.335)	(69.343)
Observations	442	442	442	442	442	442	442	442	442
R-squared	0.127	0.484	0.617	0.077	0.627	0.682	0.195	0.277	0.494

Table 3: **Tobit regressions of CDS trading activity, September 3, 2010**

The results of tobit regressions of CDS trading activity on firm fundamentals and CDS contract index status. CDS trading activity based on DTCC list of top 1000 CDS contracts, September 3, 2010. Firm fundamentals reflect most recent annual totals avaiable from Compustat. Sample includes all corporations in Compustat with valid accounts payable, debt, and sales variables. Truncation point for tobit model set to minimum value among DTCC top 1000 list. Standard erros are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. variable	Gross value of contracts outstanding ($M)			Net value of contracts outstanding ($M)			Contracts outstanding		
Indep. variable									
CDX.IG index	47,755.5***		37,409.3***	4,005.8***		2,993.1***	6,729.3***		5,566.8***
	(1,988.3)		(1,575.1)	(176.6)		(135.8)	(277.4)		(235.3)
CDX.HY index	36,205.9***		30,355.2***	2,981.2***		2,398.6***	5,372.7***		4,793.2***
	(2,155.1)		(1,746.2)	(191.2)		(150.7)	(299.4)		(260.0)
CDX.XO index	26,075.6***		23,154.3***	2,044.9***		1,752.9***	3,973.5***		3,688.7***
	(3,042.3)		(2,486.8)	(269.4)		(214.3)	(419.1)		(366.5)
Accounts payable		-0.027***	0.005		-0.003***	-0.000		-0.005***	0.001
		(0.010)	(0.005)		(0.001)	(0.000)		(0.002)	(0.001)
Long-term debt		0.251***	0.150***		0.021***	0.014***		0.034***	0.017***
		(0.028)	(0.016)		(0.002)	(0.001)		(0.005)	(0.002)
Sales		0.293***	0.115***		0.023***	0.011***		0.047***	0.017***
		(0.022)	(0.013)		(0.002)	(0.001)		(0.004)	(0.002)
Constant	-29,802.4***	-37,879.0***	-25,242.3***	-2,668.7***	-2,924.8***	-2,206.0***	-3,969.0***	-6,006.0***	-3,579.9***
	(1,333.3)	(1,763.6)	(1,103.9)	(118.9)	(134.2)	(95.8)	(189.2)	(291.2)	(168.9)
Observations	9685	9685	9685	9685	9685	9685	9685	9685	9685

Table 4: **Markit CDX North American Investment Grade index constituents, Series 14**

Table shows issuer, average credit rating of bonds issued by entity, and industry classification.

ACE Ltd / A / Fin	Duke Energy / A / Ut	Ryder Sys Inc / A / Ind
Aetna Inc. / A / Fin	E I du Pont / A / Mats	Safeway Inc / BBB / Cons Stable
Alcoa Inc. / BBB / Mats	Eastman Chem Co / BBB / Mats	Sara Lee Corp / BBB / Cons Stable
Altria Gp Inc / BBB / Cons Stable	ERP Oper Ltd Pship / A / Fin	Sempra Engy / A / Ut
Amern Elec Pwr Co Inc / BBB / Ut	FirstEnergy Corp / BBB / Ut	Simon Ppty Gp L P / A / Fin
Amern Express Co / A / Fin	Fortune Brds / BBB / Cons Stable	SLM Corp / BBB / Fin
Amern Intl Gp Inc / BBB / Fin	Freeport McMoran / BBB / Mats	Southwest / BBB / Cons Cyc
Amgen Inc. / A / Cons Stable	G A T X Corp / BBB / Ind	Staples Inc / BBB / Cons Cyc
Anadarko / BBB / Energy	Gen Elec Cap Corp / AA / Fin	Target Corp / A / Cons Cyc
Arrow Electrs Inc / BBB / Ind	Gen Mls Inc / BBB / Cons Stable	Allstate Corp / BBB / Fin
AT&T Inc / A / Comm+Tech	Goodrich Corp / BBB / Ind	Black&Decker Corp / A / Ind
AT&T Mobility / A / Comm+Tech	Halliburton Co / A / Energy	Chubb Corp / A / Fin
Autozone Inc / BBB / Cons Cyc	Hewlett Pckd / A / Comm+Tech	Dow Chem Co / BBB / Mats
Avnet, Inc. / BBB / Ind	Honeywell Intl Inc / A / Ind	Hartford Finl / BBB / Fin
Barrick Gold Corp / BBB / Mats	Ingersoll Rand Co / A / Ind	Home Depot Inc / BBB / Cons Cyc
Baxter Intl Inc / A / Cons Stable	IBM Corp / A / Comm+Tech	The Kroger Co. / BBB / Cons Stable
Boeing Cap Corp / A / Fin	Intl Paper Co / BBB / Mats	Sherwin Williams Co / A / Cons Cyc
Boston Pptys / BBB / Not given	Johnson Ctls Inc / BBB / Ind	TJX Cos Inc / A / Cons Cyc
Bristol Myers / A / Cons Stable	Kinder Morgan / BBB / Energy	Walt Disney Co / A / Cons Cyc
Burlington Nthn / BBB / Ind	Kohls Corp / BBB / Cons Cyc	TIME WARNER CABLE / BBB / Not given
Campbell Soup / A / Cons Stable	Kraft / BBB / Cons Stable	Time Warner Inc / BBB / Comm+Tech
Cdn Nat Res Ltd / BBB / Energy	Lockheed Martin Corp / A / Ind	Toll Bros Inc / BBB / Cons Cyc
Cap One / A / Fin	Loews Corp / A / Cons Stable	Transocean Inc / BBB / Energy
Cardinal Hlth/ BBB / Cons Cyc	Lowes Cos Inc / A / Cons Cyc	Un Pac Corp / BBB / Ind
Carnival Corp / A / Ind	M D C Hldgs Inc / BBB / Cons Cyc	Utd Parcel Svc Inc / AA / Ind
Caterpillar Inc / A / Cons Cyc	Marriott Intl Inc / BBB / Cons Cyc	UnitedHealth Gp Inc / A / Fin
CBS Corp / BBB / Cons Cyc	Marsh&Mclenn / BBB / Fin	Unvl Health / BBB / Cons Stable
CenturyTel / BBB / Comm+Tech	McDonalds Corp / A / Cons Cyc	Valero Energy Corp / BBB / Energy
Cigna Corp / BBB / Fin	McKesson Corp / BBB / Cons Cyc	Verizon / A / Comm+Tech
Cisco Sys Inc / A / Comm+Tech	MetLife Inc / A / Fin	Viacom / BBB / Not given
Comcast / BBB / Comm+Tech	Motorola Inc / BBB / Ind	Vornado Rlty LP / BBB / Fin
Comp Sci / BBB / Comm+Tech	NRUC / A / Ut	Wal Mart / AA / Cons Cyc
ConAgra / BBB / Cons Cyc	Newell Rubbmd. / BBB / Ind	Whirlpool Corp / BBB / Cons Cyc
ConocoPhillips / A / Energy	News Am / BBB / Comm+Tech	Xerox Corp / BBB / Cons Cyc
Const Engy Gp / BBB / Ut	Nordstrom Inc / A / Cons Cyc	XL Cap Ltd / BBB / Fin
Cox / BBB / Comm+Tech	Norfolk Sthn Corp / BBB / Ind	XTO Engy Inc / BBB / Energy
CSX Corp / BBB / Ind	Northrop Grumm / BBB / Ind	YUM Brands Inc / BBB / Cons Cyc
CVS / BBB / Cons Cyc	Omnicom Gp Inc / A / Comm+Tech	
Darden Rest / BBB / Cons Cyc	Pfizer Inc / AA / Cons Stable	
Deere&Co / A / Cons Cyc	Progress Engy Inc / BBB / Ut	
Dell Inc / A / Comm+Tech	Quest Diagnostics Inc / BBB / Ind	
Devon Engy Corp / BBB / Energy	R R Donnelley / BBB / Comm+Tech	
DIRECTV / BBB / Comm+Tech	Raytheon Co / A / Ind	
Dominion Res Inc / BBB / Ut	Reynolds Amern Inc / BBB / Cons Stable	

Table 5: **Additions to and deletions from Markit CDX, Series 12-14**

This table shows the additions to and deletions from Markit CDX for series 12 to 14, as well as the reason for removal.

Series	Announc date	Removed	Reason for removal	Added
14	Mar-10	International Lease Finance Corporation	Downgrade	Freeport-McMoRan Copper and Gold Inc.
		Wells Fargo and Company	Merger with Wachovia*	SLM Corporation
13	Sep-09	CIT Group Inc.	Downgrade/Bankruptcy	DIRECTV HOLDINGS LLC
		J. C. Penney Company, Inc.	Downgrade	GATX CORPORATION
		Macy's, Inc.	Downgrade	JOHNSON CONTROLS, INC.
		Masco Corporation		KINDER MORGAN ENERGY PARTNERS, L.P.
		Textron Financial Corporation	Downgrade	REYNOLDS AMERICAN INC.
		Weyerhaeuser Company		UnitedHealth Group Incorporated
12	Mar-09	Gannett	Downgrade	Avnet
		iStar Financial	Downgrade	Boston Properties
		Limited Brands	Downgrade	Canadian Natural Resources
		The New York Times	Downgrade	Cisco Systems
		MBIA Insurance	Downgrade	Dell
		Mohawk Industries	Downgrade	Lowe's
		Starwood Hotels&Resorts	Downgrade	Pfizer
		Wyeth	Merger with Pfizer	TJX Co.
		Embarq	Merger with CenturyTel	Vornado Realty

Table 6: **Descriptive statistics on CDS and bond returns, full sample period**

This table shows the descriptive statistics on CDS and bond returns for the full period of our sample: January 2004 to March 2010. Panel A displays the summary statistics of CDS and bond returns for all observations, whereas Panel B shows only summary statistics of those observations for which the change in daily CDS spread is not zero.

PANEL A: ALL OBSERVATIONS (Full sample period: January 2004 to March 2010)

CDS	Frequency	Obs	Mean	SD	Min	1th ptile	5th	25th	50th	75th	95th	99th	Max
Spread	Daily	56151	283.99	685.49	9.50	20.00	31.55	62.50	110.00	234.70	858.30	4019.03	12660.70
Change in spread	Daily	56087	0.54	76.10	-5678.20	-56.95	-13.79	-1.85	0.00	2.00	15.92	67.50	6527.20
Change in spread	Weekly	56043	2.81	139.44	-5145.80	-165.20	-41.40	-5.20	0.00	6.80	49.20	207.50	6907.70

Bonds	Frequency	Obs	Mean	SD	Min	1th ptile	5th ptile	25th	50th	75th	95th	99th	Max
Spread	Daily	46845	291.13	380.80	-54.40	16.60	47.00	94.80	165.00	344.90	901.80	2141.20	4062.20
Change in spread	Daily	46819	0.45	21.12	-646.80	-47.00	-14.10	-3.30	0.10	3.40	15.70	53.70	968.20
Change in spread	Weekly	46715	2.26	47.87	-670.90	-123.70	-39.90	-6.40	0.20	7.70	48.80	167.80	953.60

PANEL A: NON-ZERO SPREAD CHANGES (Full sample period: January 2004 to March 2010)

CDS	Frequency	Obs	Mean	SD	Min	1th ptile	5th	25th	50th	75th	95th	99th	Max
Spread	Daily	49517	270.22	588.27	9.50	20.10	35.30	66.70	115.70	246.14	835.00	3434.60	12660.70
Change in spread	Daily	49453	0.62	81.05	-5678.20	-64.20	-15.45	-2.30	-0.01	2.60	17.91	73.80	6527.20
Change in spread	Weekly	49425	3.15	144.60	-5145.80	-179.40	-44.88	-6.00	0.20	8.00	53.55	227.50	6907.70

Bonds	Frequency	Obs	Mean	SD	Min	1th ptile	5th ptile	25th	50th	75th	95th	99th	Max
Spread	Daily	41751	298.48	389.35	-51.50	18.10	48.10	97.90	171.80	352.60	911.80	2203.90	4062.20
Change in spread	Daily	41726	0.50	21.62	-646.80	-48.60	-14.50	-3.40	0.10	3.50	16.40	55.90	968.20
Change in spread	Weekly	41637	2.51	48.86	-670.90	-124.60	-40.20	-6.60	0.30	8.00	50.70	171.20	953.60

Table 7: **Descriptive statistics on CDS and bond returns, pre-crisis period**

This table shows the descriptive statistics on CDS and bond returns for the pre-crisis period: January 2004 to July 2007. Panel A displays the summary statistics of CDS and bond returns for all observations, whereas Panel B shows only summary statistics of those observations for which the change in daily CDS spread is not zero.

PANEL A: ALL OBSERVATIONS (Pre-crisis sample period: January 2004 to July 2007)

CDS	Frequency	N	Mean	SD	Min	1th ptile	5th	25th	50th	75th	95th	99th	Max
Spread	Daily	27177	129.87	176.53	9.50	18.60	25.90	53.00	84.10	134.50	375.70	647.50	2607.40
Change in spread	Daily	27147	0.27	12.91	-731.80	-20.70	-6.80	-1.30	0.00	1.20	8.20	27.50	741.00
Change in spread	Weekly	27103	1.34	27.47	-704.70	-55.00	-17.50	-3.50	0.00	3.80	24.00	75.30	959.40

Bonds	Frequency	N	Mean	SD	Min	1th ptile	5th ptile	25th	50th	75th	95th	99th	Max
Spread	Daily	22228	132.32	93.83	-54.40	5.00	35.80	72.50	105.70	154.55	344.30	439.50	689.90
Change in spread	Daily	22206	0.14	7.89	-143.80	-19.70	-8.40	-2.60	0.00	2.40	9.00	23.60	199.80
Change in spread	Weekly	22118	0.70	16.91	-221.70	-43.10	-17.90	-4.60	-0.20	4.40	21.50	62.00	258.10

PANEL A: NON-ZERO SPREAD CHANGES (Pre-crisis sample period: January 2004 to July 2007)

CDS	Frequency	N	Mean	SD	Min	1th ptile	5th	25th	50th	75th	95th	99th	Max
Spread	Daily	23359	127.18	135.34	9.50	18.90	27.30	55.70	87.50	138.50	380.80	578.30	2607.40
Change in spread	Daily	23329	0.31	13.93	-731.80	-23.00	-7.50	-1.70	-0.20	1.70	9.40	30.00	741.00
Change in spread	Weekly	23296	1.74	28.46	-704.70	-56.10	-18.30	-4.00	0.00	4.60	26.50	82.30	959.40

Bonds	Frequency	N	Mean	SD	Min	1th ptile	5th ptile	25th	50th	75th	95th	99th	Max
Spread	Daily	19019	135.23	96.17	-51.50	6.70	36.20	72.80	107.10	158.40	349.40	442.80	689.90
Change in spread	Daily	18998	0.16	8.14	-143.80	-20.30	-8.60	-2.70	0.00	2.50	9.40	24.50	199.80
Change in spread	Weekly	18922	0.89	17.41	-221.70	-43.20	-18.20	-4.60	-0.10	4.50	23.00	65.80	258.10

Table 8: **Descriptive statistics on CDS and bond returns, crisis period**

This table shows the descriptive statistics on CDS and bond returns for the crisis period: August 2007 to March 2010. Panel A displays the summary statistics of CDS and bond returns for all observations, whereas Panel B shows only summary statistics of those observations for which the change in daily CDS spread is not zero.

PANEL A: ALL OBSERVATIONS (Crisis sample period: August 2007 to March 2010)

CDS	Frequency	N	Mean	SD	Min	1th ptile	5th	25th	50th	75th	95th	99th	Max
Spread	Daily	29015	428.22	914.98	13.50	26.80	37.50	80.00	163.20	361.20	1828.70	6055.40	12660.70
Change in spread	Daily	28981	0.79	105.14	-5678.20	-103.10	-21.70	-2.90	0.00	3.34	24.17	117.70	6527.20
Change in spread	Weekly	28981	4.22	192.08	-5145.80	-339.50	-65.00	-8.80	0.03	11.24	75.00	377.30	6907.70

Bonds	Frequency	N	Mean	SD	Min	1th ptile	5th ptile	25th	50th	75th	95th	99th	Max
Spread	Daily	24655	434.13	473.76	-45.10	43.70	76.80	164.00	273.10	527.50	1282.20	2621.10	4062.20
Change in spread	Daily	24651	0.72	28.12	-646.80	-71.70	-19.80	-4.50	0.20	5.00	22.70	79.90	968.20
Change in spread	Weekly	24635	3.70	63.93	-670.90	-179.60	-63.30	-9.70	1.10	12.90	80.50	231.70	953.60

PANEL A: NON-ZERO SPREAD CHANGES (Crisis sample period: August 2007 to March 2010)

CDS	Frequency	N	Mean	SD	Min	1th ptile	5th	25th	50th	75th	95th	99th	Max
Spread	Daily	26198	397.66	776.74	13.50	26.80	41.94	87.95	170.17	365.20	1553.60	4162.59	12660.70
Change in spread	Daily	26164	0.88	110.65	-5678.20	-114.66	-23.68	-3.50	0.20	4.10	26.70	126.90	6527.20
Change in spread	Weekly	26169	4.44	196.91	-5145.80	-368.92	-68.70	-10.00	0.85	12.70	82.50	404.00	6907.70

Bonds	Frequency	N	Mean	SD	Min	1th ptile	5th ptile	25th	50th	75th	95th	99th	Max
Spread	Daily	22769	434.64	479.08	-45.10	44.30	79.30	165.70	272.00	523.80	1291.50	2649.00	4062.20
Change in spread	Daily	22765	0.78	28.31	-646.80	-72.20	-20.10	-4.50	0.30	5.10	23.10	81.40	968.20
Change in spread	Weekly	22752	3.89	64.14	-670.90	-178.30	-62.70	-9.70	1.20	13.00	80.50	231.90	953.60

Table 9: **Changes in betas and R-Squares in CDS after addition to CDX**

This table shows the average changes in estimated betas for changes in CDS spreads before and after the inclusion in the CDX.NA.IG Index. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Panel A reports results from the regressions using daily data, whereas Panel B shows results using weekly (Wednesday) data. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DAILY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	0.211***	0.040*	-.096	-.010	0.307***	0.050**
2004-2010		(0.081)	(0.027)	(0.074)	(0.005)	(0.080)	(0.027)
Pre-crisis	11	0.082	-.002	-.353	-.008	0.435***	0.006
2004-2006		(0.144)	(0.062)	(0.071)	(0.001)	(0.134)	(0.060)
Crisis	21	0.180**	0.049**	-.057	-.015	0.237*	0.064**
2008-2010		(0.094)	(0.028)	(0.071)	(0.010)	(0.145)	(0.029)

PANEL B: WEEKLY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	0.320***	0.040	0.054	-.009	0.266**	0.049
2004-2010		(0.133)	(0.042)	(0.161)	(0.009)	(0.158)	(0.043)
Pre-crisis	11	0.074	-.066	-.498	-.031	0.572***	-.035
2004-2006		(0.280)	(0.052)	(0.247)	(0.010)	(0.076)	(0.059)
Crisis	21	0.253**	0.049	0.175	0.004	0.078	0.045
2008-2010		(0.139)	(0.039)	(0.173)	(0.010)	(0.250)	(0.048)

Table 10: **Changes in betas and R-Squares in CDS after addition to CDX, only non-zero daily spread changes**

This table shows the average changes in estimated betas for changes in CDS spreads before and after the inclusion in the CDX.NA.IG Index, using only the observations for which the daily change in CDS spread is different from zero. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Panel A reports results from the regressions using daily data, whereas Panel B shows results using weekly (Wednesday) data. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DAILY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	0.168**	0.039*	-.121	-.011	0.290***	0.050**
2004-2010		(0.102)	(0.027)	(0.089)	(0.006)	(0.091)	(0.028)
Pre-crisis	11	-.031	0.003	-.457	-.006	0.426**	0.009
2004-2006		(0.192)	(0.064)	(0.068)	(0.001)	(0.218)	(0.065)
Crisis	21	0.167*	0.046*	-.056	-.017	0.224*	0.063**
2008-2010		(0.106)	(0.030)	(0.067)	(0.010)	(0.157)	(0.031)

PANEL B: WEEKLY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	0.279**	0.039	0.050	-.004	0.229*	0.043
2004-2010		(0.139)	(0.038)	(0.167)	(0.010)	(0.148)	(0.045)
Pre-crisis	11	-.017	-.046	-.541	-.019	0.524***	-.028
2004-2006		(0.227)	(0.050)	(0.228)	(0.020)	(0.116)	(0.068)
Crisis	21	0.211**	0.032	0.181	0.009	0.031	0.023
2008-2010		(0.126)	(0.041)	(0.170)	(0.014)	(0.226)	(0.054)

Table 11: **Changes in betas and R-Squares in CDS after addition to CDX, with Markit data**

This table shows the average changes in estimated betas for changes in CDS spreads before and after the inclusion in the CDX.NA.IG Index, using a different source of data for CDS: Markit. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Panel A reports results from the regressions using daily data, whereas Panel B shows results using weekly (Wednesday) data. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DAILY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	35	0.204**	0.027	-.062	-.010	0.266***	0.037
2004-2010		(0.090)	(0.034)	(0.066)	(0.006)	(0.099)	(0.035)
Pre-crisis	8	0.073	0.003	-.302	-.004	0.376**	0.008
2004-2006		(0.175)	(0.057)	(0.126)	(0.001)	(0.178)	(0.058)
Crisis	21	0.170*	-.006	-.057	-.015	0.227*	0.009
2008-2010		(0.132)	(0.038)	(0.071)	(0.010)	(0.175)	(0.047)

PANEL B: WEEKLY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	35	0.305**	0.055	0.116	-.005	0.189	0.060
2004-2010		(0.152)	(0.049)	(0.153)	(0.009)	(0.177)	(0.054)
Pre-crisis	8	0.050	-.023	-.429	-.020	0.479***	-.003
2004-2006		(0.366)	(0.030)	(0.383)	(0.020)	(0.171)	(0.043)
Crisis	21	0.228	0.010	0.175	0.004	0.054	0.006
2008-2010		(0.188)	(0.058)	(0.173)	(0.010)	(0.290)	(0.068)

Table 12: **Changes in betas and R-Squares in CDS after addition to CDX, with Markit data, only non-zero daily spread changes**

This table shows the average changes in estimated betas for changes in CDS spreads before and after the inclusion in the CDX.NA.IG Index, using a different source of data for CDS: Markit. We only use here the observations for which the daily change in CDS spread is different from zero. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Panel A reports results from the regressions using daily data, whereas Panel B shows results using weekly (Wednesday) data. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DAILY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	35	0.227***	0.033	-.093	-.010	0.320***	0.044*
2004-2010		(0.087)	(0.032)	(0.080)	(0.006)	(0.108)	(0.033)
Pre-crisis	8	0.162	0.026	-.459	-.002	0.621***	0.028
2004-2006		(0.177)	(0.051)	(0.092)	(0.005)	(0.148)	(0.055)
Crisis	21	0.176*	-.003	-.056	-.017	0.232*	0.014
2008-2010		(0.131)	(0.036)	(0.067)	(0.010)	(0.171)	(0.045)

PANEL B: WEEKLY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	35	0.305**	0.055	0.117	-.005	0.188	0.060
2004-2010		(0.152)	(0.049)	(0.153)	(0.009)	(0.177)	(0.054)
Pre-crisis	8	0.049	-.023	-.430	-.020	0.478***	-.003
2004-2006		(0.366)	(0.030)	(0.383)	(0.021)	(0.171)	(0.044)
Crisis	21	0.228	0.010	0.174	0.004	0.055	0.006
2008-2010		(0.188)	(0.058)	(0.172)	(0.010)	(0.291)	(0.068)

Table 13: **Changes in betas and R-Squares in CDS after deletion from the CDX**

This table shows the average changes in estimated betas for changes in CDS spreads before and after the deletion from the CDX.NA.IG Index. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Panel A reports results from the regressions using daily data, whereas Panel B shows results using weekly (Wednesday) data. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DAILY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	-.076	0.003	0.177	0.009	-.252	-.007
2004-2010		(0.187)	(0.030)	(0.148)	(0.015)	(0.248)	(0.026)
Pre-crisis	9	0.123	0.009	-.250	-.019	0.373***	0.028
2004-2006		(0.288)	(0.076)	(0.413)	(0.035)	(0.125)	(0.043)
Crisis	18	-.204	-.026	0.118*	-.009	-.322	-.019
2008-2010		(0.391)	(0.057)	(0.089)	(0.010)	(0.468)	(0.059)

PANEL B: WEEKLY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	-.093	-.044	0.424***	0.026***	-.517	-.070
2004-2010		(0.284)	(0.081)	(0.129)	(0.011)	(0.374)	(0.078)
Pre-crisis	9	-.239	-.008	0.509**	0.008	-.747	-.016
2004-2006		(0.231)	(0.093)	(0.278)	(0.029)	(0.495)	(0.068)
Crisis	18	-.173	-.124	0.406*	0.023**	-.579	-.146
2008-2010		(0.664)	(0.117)	(0.289)	(0.012)	(0.864)	(0.131)

Table 14: **Changes in betas and R-Squares in CDS after deletion from the CDX, only non-zero daily spread changes**

This table shows the average changes in estimated betas for changes in CDS spreads before and after the deletion from the CDX.NA.IG Index, using only the observations for which the daily change in CDS spread is different from zero. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Panel A reports results from the regressions using daily data, whereas Panel B shows results using weekly (Wednesday) data. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DAILY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	-.114	-.002	0.198*	0.012	-.312	-.014
2004-2010		(0.190)	(0.031)	(0.138)	(0.015)	(0.259)	(0.028)
Pre-crisis	9	0.118	0.007	-.242	-.021	0.359***	0.027
2004-2006		(0.280)	(0.079)	(0.339)	(0.035)	(0.060)	(0.045)
Crisis	18	-.240	-.031	0.169*	-.001	-.409	-.029
2008-2010		(0.376)	(0.057)	(0.104)	(0.014)	(0.463)	(0.063)

PANEL B: WEEKLY SPREAD CHANGES

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	-.075	-.047	0.440***	0.023**	-.516	-.070
2004-2010		(0.256)	(0.077)	(0.156)	(0.013)	(0.359)	(0.074)
Pre-crisis	9	-.144	-.000	0.530**	-.004	-.674	0.004
2004-2006		(0.223)	(0.083)	(0.228)	(0.030)	(0.410)	(0.058)
Crisis	18	-.139	-.127	0.461	0.020*	-.599	-.147
2008-2010		(0.625)	(0.112)	(0.370)	(0.016)	(0.861)	(0.126)

Table 15: **Changes in Dimson betas and R-Squares in CDS after addition to the CDX**

In Panel A we show the average changes in the sum of up five leads and lags of estimated betas (Dimson betas) before and after the deletion from the CDX.NA.IG Index. In Panel B we show each of the components of the Dimson betas. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DIMSON BETA

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	38	0.515**	0.036	0.117	-.012	0.398***	0.048**
Jan'04-Mar'10		(0.225)	(0.039)	(0.229)	(0.016)	(0.170)	(0.027)
Pre-crisis	11	0.174	-.058	-.577	-.050	0.752***	-.008
Jan'04-Jul'07		(0.469)	(0.084)	(0.158)	(0.028)	(0.312)	(0.064)
Crisis	21	0.569*	0.067***	0.397	0.004	0.172**	0.062***
Jul'07-Mar'10		(0.362)	(0.014)	(0.320)	(0.013)	(0.104)	(0.003)

PANEL B: COMPONENTS OF DIMSON BETA

Full sample	$t-5$	0.064	0.114***	-.050
Jan'04-Mar'10		(0.067)	(0.041)	(0.063)
	$t-4$	0.006	0.083	-.078
		(0.032)	(0.077)	(0.061)
	$t-3$	-.051	-.133	0.082
		(0.105)	(0.138)	(0.077)
	$t-2$	0.051	0.135***	-.084
		(0.068)	(0.054)	(0.055)
	$t-1$	0.041	-.034	0.075
		(0.075)	(0.061)	(0.070)
	t	0.241***	-.078	0.320***
		(0.084)	(0.061)	(0.086)
	$t+1$	0.030	0.121***	-.091
		(0.067)	(0.051)	(0.063)
	$t+2$	-.048	-.050	0.002
		(0.021)	(0.063)	(0.054)
	$t+3$	0.017	0.117*	-.100
		(0.046)	(0.090)	(0.110)
	$t+4$	0.126**	0.018	0.108***
		(0.067)	(0.070)	(0.040)
	$t+5$	0.038*	-.176	0.214*
		(0.026)	(0.137)	(0.144)

Table 16: **Changes in Dimson betas and R-Squares in CDS after addition to the CDX, markit database**

In Panel A we show the average changes in the sum of up five leads and lags of estimated betas (Dimson betas) before and after the deletion from the CDX.NA.IG Index, for the Markit database. In Panel B we show each of the components of the Dimson betas. Reported coefficients show changes in betas and changes in R-Squares from 1 year estimation windows. Standard erros (in parenthesis) are robust to cross-setional correlation within cluster of additions. * significant at 10%; ** significant at 5%; *** significant at 1%, for one-sided tests, where the test is whether the coefficient is greater than zero.

PANEL A: DIMSON BETA

		CDS		Underlying Bond		Difference	
	N	$\Delta\beta_c$	ΔR_c	$\Delta\beta_b$	ΔR_b	$\Delta\Delta\beta$	$\Delta\Delta R$
Full sample	35	0.536***	0.020	0.146	-.003	0.390**	0.023
Jan'04-Mar'10		(0.210)	(0.031)	(0.233)	(0.011)	(0.171)	(0.032)
Pre-crisis	8	0.258	-.044	-.713	-.025	0.971***	-.020
Jan'04-Jul'07		(0.535)	(0.044)	(0.160)	(0.026)	(0.414)	(0.039)
Crisis	21	0.537**	-.002	0.397	0.004	0.140***	-.006
Jul'07-Mar'10		(0.317)	(0.013)	(0.320)	(0.013)	(0.042)	(0.014)

PANEL B: COMPONENTS OF DIMSON BETA

		CDS	Underlying Bond	Difference
Full sample	$t-5$	0.077*	0.116***	-.039
Jan'04-Mar'10		(0.054)	(0.046)	(0.057)
	$t-4$	0.010	0.049	-.039
		(0.025)	(0.076)	(0.078)
	$t-3$	-.004	-.067	0.063
		(0.036)	(0.103)	(0.090)
	$t-2$	-.015	0.117**	-.131
		(0.033)	(0.051)	(0.051)
	$t-1$	0.102**	-.011	0.112**
		(0.050)	(0.045)	(0.060)
	t	0.218***	-.061	0.278***
		(0.087)	(0.062)	(0.093)
	$t+1$	0.043	0.137***	-.093
		(0.057)	(0.057)	(0.058)
	$t+2$	-.037	-.022	-.014
		(0.027)	(0.059)	(0.056)
	$t+3$	0.032	0.057	-.026
		(0.041)	(0.054)	(0.081)
	$t+4$	0.063*	-.036	0.098**
		(0.042)	(0.050)	(0.048)
	$t+5$	0.047**	-.133	0.180*
		(0.024)	(0.109)	(0.113)