Excess comovement in credit default swap markets: Evidence from the CDX indices

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ABSTRACT

We provide evidence of excess comovement in the credit default swap (CDS) market following inclusions to and exclusions from investment grade and high yield CDX indices during the 2003-2016 period. We find that when a name joins an index, its return tends to covary more with the returns of that index and conversely when it is excluded from an index, its return tends to covary less with it. We use univariate regressions and a difference-in-difference approach to show that the CDS market is impacted by indexation. This excess comovement indicates a departure from fundamental-based pricing and provides support in favour of style investing.

Keywords: Credit default swaps, Excess comovement, CDX indices, Credit ratings.
JEL classification: C20, G14, G24.

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1. Introduction

According to traditional finance theory, excess comovement relates to the comovement in asset prices that cannot be explained by changes in their fundamental values. The explanation of excess comovement relates primarily to a correlated demand for a particular asset class that is associated with investor behaviour. Investors use categorization to simplify decision making (Mullainathan, 2002), choose assets based on style (Barberis and Shleifer, 2003) or choose asset held by others as they care more about relative wealth (DeMarzo et al., 2004). Institutional investors in particular may care more about their performance relative to an index, hence purchasing assets that are in an index (Basak and Pavlova, 2013).

Empirical evidence of excess comovement has mainly been found on the equity market. In particular, indexation has proved a popular event to demonstrate the existence of excess comovement. Indexation is believed to have little effect on the fundamentals of firms, hence the hypothesis is to show that stocks added to an index comove more with the stocks in that index. Usually, the evidence is demonstrated through a difference between coefficients in two regressions conducted before and after the indexation event. For example, Barberis et al. (2005) demonstrate that stocks added to the S&P 500 Index comove with the index. Boyer (2011) documents excess comovement in stocks by exploiting the mechanical rules that govern membership changes to the S&P/Barra Value and Growth indices. Greenwood and Sosner (2007) and Greenwood (2008) investigate changes in the Nikkei 225 Index and changes in the Nikkei 225 Index weights respectively, whereas Mase (2008) looks at the changes in U.K indices. Claessens and Yafeh (2012) investigate additions to many national indices. Evidence of excess comovement in equity markets is not conclusive, however. Von Drathen (2014), Kasch and Sarkar (2014), and Chen et al. (2016) refute the existence of excess comovement in the FTSE 100 and S&P 500 and link it to changes in fundamentals. Chen et al. (2016), using matched control samples and robust univariate regressions, find that excess comovement effects tend to disappear. They show that the apparent excess comovement in the data is actually driven by changes in loadings on the fundamental component of returns, not by asset class effects.

We investigate the presence of excess comovement in the credit default swap (CDS) market by exploiting Markit indexation rules for the investment grade (CDX.IG) and high yield (CDX.HY) indices. One of the eligibility rules for indexation is mainly governed by an economically meaningful observable characteristic: the investment grade (IG) or high yield (HY) rating classification of the issuer. By controlling for changes in this characteristic, we demonstrate that the indexation process in the CDS market generates excess comovement in spreads. To be included in an index, a CDS must have a qualifying rating, but a change in rating does not automatically result in an indexation event. To be excluded from an index, the issuer has to undergo a rating classification change. Indexation events could also be due to other factors apart from rating changes.

We begin our empirical investigation by examining comovement following all inclusions and exclusions to both CDX indices using a univariate regression approach. We find that names added to both IG and HY indices tend to move more with these indices while names excluded tend to move less with these indices. This initial result offers no indication on what might be generating the increase or decrease in comovement around indexation events, however. In a next step, we control for inclusions and exclusions following rating changes. The idea is to be able to separate the effects of indexation from changes in fundamental rating shocks and fundamental common shocks on comovement. We consider three cases: (1) inclusions and exclusions that do not follow a rating change; (2) exclusions due to a rating change that are followed by immediate re-indexations; and (3) exclusions from an index due to a rating change without these exclusions leading to immediate re-indexations. Hence with the latter two cases, we are able to compare the returns of names excluded from the CDX. IG (CDX.HY) index due to a rating change and immediately included in the CDX.HY (CDX.IG) index to names that were excluded from the CDX.IG (CDX.HY) index due to a similar rating change but not subsequently included in the CDX.HY (CDX.IG) index. If changes are not primarily driven by indexation, the names not immediately included in the index should exhibit similar behaviour to those that were. By adopting a difference-in-difference approach, we are able to examine the differences in comovement before and after inclusion events across both cases. We find, by comparing the original sample of indexed names and a matched sample of non-indexed names, a strong evidence of excess comovement. It is not the changes in the properties of the group returns that are driving this finding. The matched names do not exhibit similar patterns in their regression coefficient and excess co-movement seems to be driven by an indexation effect.

We also assess whether thin-trading plays a role in our results. For this purpose, we consider the depth in the CDS market. The depth represents the number of contributors who provide quotes to Markit in order to trade the underlying single name CDSs. More depth suggests a higher demand for the CDS names, as well as better liquidity conditions. We do not find that changes in depth explain the changes in betas we observe upon indexation to the CDX.IG or CDX.HY indices. Alternatively, we also control for zero observation days before and after indexation and show that our results are not driven by thin-trading.

To the best of our knowledge, we are the first to present evidence of indexation-based excess comovement in the credit market. By exploiting the unique features of the CDS market, we are able to present some evidence in favour of the style investing theory. Investment grade and high yield are well defined asset styles.[1] The CDX.IG and CDX.HY allows "style investors" to take aggregate exposure to a representative portfolio of CDSs. The trading behavior of style investors at the index level generates excess comovement in the CDS spreads of constituent issuers. Our study adds to the growing body of literature that documents excess comovement and style-related effects in capital markets. Froot and Dabora (1999) find that the prices of identical stocks traded on different exchanges do not move in tandem but rather comove with their respective exchanges. Wahal and Yavuz (2013) show that style investing causes return

[1]For instance, credit hedge funds as well as bond mutual funds typically specialize in either investment grade or high yield debt or reference the investment grade boundary with respect to permissible asset concentrations.

predictability. Chen and De Bondt (2004) document style-related trends in equity returns. Kumar and Lee (2006) show that patterns of comovement in stock returns can be related to correlated trades of retail investors. Raffestin (2017) finds that bonds that join a new rating class comove more with the bonds in that class.

The remainder of this paper is organized as follows. In Section 2, we describe the CDX indexation process, Markit's eligibility rules, the data we employ, and summary statistics. Our discussion in Section 3 provides motivation for CDS comovement in relation to unconditional CDX assignment and presents a simple model to help generate predictions and interpret the results. In Section 4, we summarize the conditional empirical findings. Section 5 presents the robustness tests and in Section 6 we provide concluding remarks.

2. Data

In this section we summarize the CDX indices' eligibility rules and provide a detailed description of our dataset.

2.1. The CDX indices and eligibility rules

Synthetic credit indices originated in 2001 when JPMorgan launched the JECI and Hydi indices, and Morgan Stanley launched Synthetic TRACERS. The firms merged their indices under the Trac-X name in 2003. During the same period, iBoxx launched credit derivatives indices. In 2004, Trac-X and iBoxx merged to form the CDX in North America and the iTraxx in Europe and Asia. After being the administrator for the CDX and calculation agent for iTraxx, Markit acquired both families of indices in November 2007. In this paper, we focus on North American corporate CDS indices, namely CDX.IG and CDX.HY. Every year, the new CDX.IG series is rolled on March 20 and September 20, and every new CDX.HY series is rolled on March 27 and September 27. The CDX.IG is issued in 1-,2-,3-,5-,7-, and 10- year maturities and the CDX.HY is issued in 3-,5-,7-, and 10- year maturities. Markit initiates a process to determine the constituents issuers of a new index series in the weeks leading up to the ”roll-date”. Index series constituents, inclusions, and exclusions are governed by Markit's 2007 and 2015 CDX eligibility rules. We discuss the rules below.

Following the 2007 Markit rule, in the lead-up to the announcement of a new series, Markit polls 14 major index dealers to determine index constituents.[2] Ten days before the roll date, these dealers are invited to submit a list of issuers to exclude from the current series. To be eligible, an issuer has to fulfill one of three criteria: (1) ineligibility due to rating classification changes; (2) ineligibility due to corporate actions; (3) a material decrease in the issuer's CDS liquidity. Issuers nominated by three or more dealers are subject to an exclusion vote. Nine days before the roll date, the dealers also nominate and vote new issuers to replace those excluded. With respect to this liquidity rule, this

[2]The major dealers are not eligible for inclusion in the CDX indices.

selection process changed in 2011. Currently, the constituent candidates are selected based on the six-month Analysis Top 1,000 Single Names report published by the Depository Trust & Clearing Corporation (DTCC). This is known as the 2015 rule. To be eligible, an issuer must have an eligible rating and sufficient CDS liquidity. For inclusions in the CDX.IG, an issuer needs two investment grade ratings from either Moody's, S&P, or Fitch, or one if rated by two or less agencies. For the CDX.HY, an issuer needs two high yield ratings from either Moody's, S&P, or Fitch, or one if rated by two or less of these agencies.

Three days before the roll date, the dealers submit the fixed rate spread payable for each index at each maturity. Payments from an index protection buyer to the protection seller are made on a quarterly basis (March 20, June 20, September 20, and December 20). Markit publishes the constituents of the new series the day before the roll date and trading begins on the following day.

Index constituents can also be deleted from the indices due to qualifying credit events, such as bankruptcy or failure to pay. The triggering of contractual agreements in the underlying single name CDS results in a payment from the index protection seller to the protection buyer. Meanwhile, the defaulted issuer is removed from the index immediately. Markit releases a new version of current index series by setting the defaulted issuer's weight at zero. On the other hand, if an issuer experiences a rating change, which renders it ineligible before the roll date, it will remain in the current index series until the new roll date. At the roll date, it will be excluded from the "on-the-run" index series.[3]

Our dataset includes Markit CDX.IG and CDX.HY composite and contributor-level data. The corresponding issuer-level credit ratings are obtained from Moody's Default and Recovery Database.

2.2. CDS data

The raw data set is provided by Markit Group Limited (IHS Markit). The Markit CDS data are originally sourced from more than a million CDS quotes provided by more than 30 major market participants on a daily basis, including market makers' official books of record, live quotes, and clearing houses' submissions and results.[4] For the publication of prices at 5pm Eastern Standard time, a minimum of two contributing members must submit quotes from three distinct sell-side sources. Contributed quotes are validated, processed, and aggregated using rigorous automated cleaning tests. The price would be missing if there are insufficient quotes.

The data set covers the period September 19, 2003 to March 25, 2016 and contains the daily five-year end-of-day spread quotes of 261 issuers for CDX.IG and 283 issuers for CDX.HY. In total, we have 433 North America corporate

[3]However, this issuer remains in the "off-the-run" series.

[4]Mayordomo et al. (2014) compare the six major sources of corporate CDS prices: GFI, Fenics, Reuters EOD, CMA, Markit and JP Morgan. They suggest that Markit is one of the most widely employed datasets. It has been used byZhu (2006), Micu et al. (2006), Jorion and Zhang (2007), Cao et al. (2010).

issuers as 111 names coexist in both indices. Five-year spreads are the benchmark maturity in CDS markets and all reference obligations are senior unsecured debt. There are 831,345 firm-day observations (656,398 observations for CDX.IG, 607,466 observations for CDX.HY, and 432,519 observations coexist in both indices). We use end-of-day spreads and all premia are expressed as annualized spreads, in basis points (bps), on U.S. dollar-denominated notional amounts. To avoid introducing model dependencies, we define CDS ”returns” as log-differences in daily end-of-day CDS spreads. This is in line with the definition of CDS returns used in the work of Longstaff et al. (2011) and Hilscher et al. (2015), amongst others.[5] We append each issuer's CDS data with their credit ratings from Moody's.[6] An issuer's estimated senior rating is set equal to its senior unsecured debt rating or if there is none by implying it on the basis of rated subordinated or secured debt. We define ”rating change” as a reclassification between investment grade and high yield.

2.3. Index assignments

We match the CDS data with Markit's CDX.IG and CDX.HY index series constituent lists. The CDS data covers series 1-25 of the CDX.IG and CDX.HY. Table 1 presents the coverage of the CDS data across these series and the matched inclusion and exclusion events. In total, there are 147 exclusion/inclusion pairs in the CDX.IG and 197 exclusion/inclusion pairs in the CDX.HY. On average, there are approximately six exclusion/inclusion pairs per series for both indices.[7]

We deleted all issuers that experienced credit events that led to their immediate exclusion form the indices. In Table 2 we list all those issuers, the credit event date, the index series number and corresponding version, and index type. The majority of defaults occur in late 2008 to mid-to-late 2009. Also worth noting is that prior to their default and deletion from the indices, CIT Group Inc., Lear Corp., Visteon Corp., Residential Capital LLC, and RadioShack Corp. resided in both CDX.IG and CDX.HY, but in different series. This is due to the structure of CDX indices.

2.4. Investment grade and high yield index factors

We create factors to mimic the CDX.IG and CDX.HY indices. For each series, we select all the current ”on-the-run” series' constituents names, with the exception of the CDSs that are being added or dropped to or from the series. We then calculate the index factor as their daily cross-sectional median spread.[8] We utilize the median rather than the

[5]This definition does not correspond directly to the dollar return on a CDS position given a change in spread. Our CDS data are in the form of newly-issued at-market spreads and the calculation of actual returns requires a pricing model.

[6]The investment grade and high yield classification of an issuer under Markit's rules is determined by a consensus of ratings ascribed by Moody's, S&P, and Fitch. In our data, we observe that Moody's ratings were sufficient to infer exclusions and inclusions related to rating changes.

[7]This in turn suggests that more than 90% of issuers are the same between consecutive series of the same index.

[8]An alternative choice of securities when forming the index factor may only include the issuers that remain stable across all the series. This, however, rejects more transient CDSs and may introduce forward bias in the index. Results using this alternative definition of the factors are still in line with our findings and are available on request.

mean spread because it provides a better measure of central tendency given the dramatic spread behavior of some indexed issuers during the 2007-2009 financial crisis.[9] These factors aim to capture the behavior of the on-the-run CDX series through time. The returns of CDX.IG or CDX.HY are defined as the returns of the above factors.

In Figure 1, we plot the time-series evolution of the indices. As a relative consideration, the CDX.HY is unconditionally more expensive to insure. On average, it has 6.6 times the spread level of the CDX.IG, ranging from 4-6 times in 2004 up to 14 times during the financial crisis. Over the full sample, the CDX.IG has an average spread of 60 bps, ranging from a minimum of 15 bps in February 2007 to a maximum of 194 bps in December 2008. The CDX.HY factor has a mean spread of 402 bps, ranging from 171 bps in February 2007 to approximately 1560 bps in March 2009.

3. CDS comovement

Using an event study, we test the hypothesis of changes in comovement around CDX.IG and CDX.HY exclusions and inclusions. The daily CDS spread of event issuer i, denoted as CDS_i, is mapped to event time τ, where $\tau = 0$ are the roll dates of the index series. On average, they are 130 trading-days apart. We therefore define the pre- and post-event windows as 120-day periods, where the pre-event window ends at $\tau - 5$ and the post-event window begins at $\tau + 5$. This set-up accommodates event-day uncertainty; some markets participants may know the changes in index membership before a new series becomes active.[10] The windows lie within six calendar months of successive index series. We regress the issuer's CDS returns on CDX.IG returns for CDX.IG exclusions and inclusions, in both event windows. Similarly, we regress the issuer's CDS returns on CDX.HY returns for CDX.HY exclusions and inclusions. To distinguish between cases when a name is an index constituent or not, we use a superscript "$\prime$" to denote the case when a name is not included in an index (e.g., before inclusion and after exclusion):

$$r_{it} = \alpha_i + \beta_i^j r_{jt} + \xi_{it} \qquad j \in \{IG, HY\} \tag{1}$$

$$r_{it}' = \alpha_i' + \beta_i^{j'} r_{jt} + \xi_{it}' \qquad j \in \{IG, HY\}, \tag{2}$$

where r_{it} and r_{it}' are the daily log-differences in the event issuers' CDS_i spreads when they are an index constituent, and when they are not an index constituent, respectively. r_{jt} are the daily log-differences in the index CDX.IG or CDX.HY factors described in Section 2 and β_i^j ($\beta_i^{j'}$) are the respective factor loadings for $j = \{IG, HY\}$. ξ_{it} (ξ_{it}') are i.i.d error terms.

[9] For robustness, results with the mean spread are reported in Table 11.

[10] Markit state that the index 'annex' list is published the day before the roll date. However, major index dealers may find out the membership changes a calendar week before the new series becomes public.

We determine average changes in comovement around indexation events as the cross-sectional mean change in loadings on the relevant index factor:

$$\Delta\overline{\beta}^{j,Inclusion} = \sum_{i=1}^{n}(\beta_i^j - \beta_i^{j\prime})/n \quad (3)$$

$$\Delta\overline{\beta}^{j,Exclusion} = \sum_{i=1}^{n}(\beta_i^{j\prime} - \beta_i^{j})/n, \quad (4)$$

where the parameters are estimated in the pre-event and post-event window. n is the sample size conditional on having the required CDS observations.

We first test the hypothesis of no comovement in the CDS market following CDX.IG and CDX.HY exclusions and inclusions, $H_0 : \Delta\overline{\beta}^{j=IG} = 0$ and $H_0 : \Delta\overline{\beta}^{j=HY} = 0$. The alternative hypothesis presented below supports an excess comovement pattern around event times.

	CDX.IG	CDX.HY
Inclusion	$\Delta\overline{\beta}^{j=IG} > 0$	$\Delta\overline{\beta}^{j=HY} > 0$
Exclusion	$\Delta\overline{\beta}^{j=IG} < 0$	$\Delta\overline{\beta}^{j=HY} < 0$

3.1. Unconditional results

We list all indexation events and their cause in the Appendix.[11] We exclude index deletions resulting from credit events in Table 2. Furthermore, we drop names that have less than 100 observations over the corresponding event window. The final sample contains 139 CDX.IG inclusions, 109 CDX.IG exclusions, 171 CDX.HY inclusions, and 114 CDX.HY exclusions.

For the 109 exclusions from the CDX.IG, 63% are due to rating downgrades and 28% are due to corporate actions, mergers and acquisitions, or name changes during the sample period. For the 114 exclusions from the CDX.HY, 34% are due to rating upgrades, and 53% are related to corporate actions, including mergers, buy-outs, and accounting irregularities.

For the 139 issuers included in the CDX.IG, 6% are rendered eligible due to a rating change from HY to IG during the six months prior to the event (in between roll dates). 66% were rated investment grade for at least six months before their inclusion. For the 171 issuers included in the CDX.HY, 26% are rendered eligible due to a rating change from IG to HY during the six months prior to the event, 30% became eligible due to corporate actions, and 45% were rated high yield for at least six months before the inclusion. We observe from the Appendix that the distribution of events across index series is reasonably balanced, although index turnover was higher during the later series.

[11] Markit informed us that they did not keep records of this information. We therefore investigate each index assignment change case by case using Moody's ratings, Markit's website and press releases around the time of the indexation event.

In addition to analyzing CDX exclusions and inclusions over the full period of the data, we split the samples based on the NBER Business Cycle Expansions and Contractions. According to NBER, the 1/2008-6/2009 credit crisis is the trough contraction period. However, since our event windows depend on the Markit series release schedule, we cannot cut off the dates in perfect alignment with the NBER cycle. As a result, we use CDX series 1 to 8, from 3/2009 to 9/2007, for the pre-crisis period, series 9 to 11, from 10/2007 to 09/2009, for the financial crisis, and series 12 to 25, from 10/2009 to 03/2016, for the post-crisis period.

In Table 3, we summarize the results of our estimation based on equations (1) and (2). All CDX.IG and CDX.HY inclusion and exclusion events have the expected signs. The null hypothesis of no excess comovement in the CDS market is rejected at the 1% significance level for both the CDX.IG and CDX.HY inclusion cases, and at the 5% significance level for the CDX.HY exclusion events. For the CDX.IG exclusion events, although not significant, the negative sign is in line with our expectation.

In the full sample, the average issuer included in either the CDX.IG or CDX.HY experiences a significant increase in comovement with the index. When an issuer is included in the CDX.IG, on average its beta increases by 0.085 from 0.576 to 0.661. Similarly, when an issuer is added to the CDX.HY, its beta increases by 0.135 from 0.476 to 0.661. Approximately 60% and 68% of the cross-sectional beta changes across CDX.IG and CDX.HY are positive. All of these results are significant at the 1% level. With reference to the sub-periods, mean beta is highest during the crisis period for CDX.HY. This is consistent with a market-wide increase in spread correlations. In particular, high yield CDSs may have higher sensitivity to economic, credit, or liquidity risk factors. Negative fundamental shocks may also increase the level of risk aversion of investors, causing them to shift their exposure from risky assets to safer assets, which might explain the increase in comovement of CDX.IG during the crisis period, by approximately 30% from 0.536 to 0.692.

The average issuer excluded from the CDX.IG does not experience significant changes in comovement with the index. Mean changes in beta between the six-month event windows in the full sample are -0.025 and approximately 56% of the cross-sectional changes in beta are negative. Although there are no significant changes in betas in the crisis and post-crisis periods, a decrease of 0.093 is observed in the pre-crisis period. Approximately 63% of the cross-sectional beta changes in the pre-crisis period are negative and significant at the 10% level by the *t*-test and non-parametric test. By contrast, the average issuers excluded from the CDX.HY experience a significant decrease in comovement with the index. In the full sample, mean betas decrease by 0.089, which is significant at the 5% level by both statistical tests. Approximately 60% of the cross-sectional changes are negative. Furthermore, a strong negative decrease in comovement following CDX.HY exclusion events persists over the crisis and post-crisis periods.

3.2. Motivation and model set up

Previous results support the idea that excess comovement may follow indexation events in the CDS market. In order to provide insight on what might be driving these results, we present a simple model in line with Barberis et al. (2005) and Chen et al. (2016).[12] In setting up the model, we take into consideration the main indexation rules of the CDS market: the rating categories of IG and HY. Our aim is that by controlling for fundamental effects, we are able to isolate a pure indexation effect.

Consider a CDS i with rating category k, denoted as CDS_{ik}. Its return is given by the following general reduced-form factor model:

$$r_{ik} = a_{ik}F + b_{ik}F_k + \varepsilon_i \qquad k \in \{IG, HY\}, \tag{5}$$

where r_{ik} represents the log difference in spreads for CDS_{ik}, $k \in \{IG, HY\}$, and ε_i represents the idiosyncratic noise specific to name i. F represents a fundamental common shock across all CDSs and F_k represents a specific fundamental rating shock. a_{ik} and b_{ik} are the loadings of CDS_{ik}'s exposure to F and F_k, respectively. For identification purposes, we assume $Cov(F_{IG}, F_{HY}) = 0, Cov(F, F_{IG}) = Cov(F, F_{HY}) = 0$ and $Cov(\varepsilon_i, F_{IG}) = Cov(\varepsilon_i, F_{HY}) = 0$ for all i. That is, fundamental rating-specific factors are assumed to be uncorrelated across categories: the fundamental common factor is uncorrelated with the other shocks and the idiosyncratic and fundamental common shocks are uncorrelated with the rating specific shocks.

As a result, the return of an index r_k that contains CDS names within the same exogenously defined rating category k follows:

$$r_k = a_k F + b_k F_k + \varepsilon_I^k \qquad k \in \{IG, HY\},$$

where a_k and b_k are the average exposures of CDSs that belong to the rating category k on the common factor F and the rating factor F_k, respectively. These loadings are given by $a_k = \sum_{i=1}^{n} a_{ik}/n, b_k = \sum_{i=1}^{n} b_{ik}/n$. ε_I^k is the index-specific noise that is uncorrelated with F and F_k. For simplicity, we set $\varepsilon_I^{IG} = \varepsilon_I^{HY} = \varepsilon_I$. Hence, we assume there is a specific shock to CDS names that are included in the index, irrespective of the rating category. By assumption, any fundamental shock and rating-specific shock is captured by F and F_k, respectively. It follows that the idiosyncratic shock of a CDS_{ik} has two components: a non-fundamental index shock ε_I that is independent of fundamental or rating related shocks and an idiosyncratic shock ε_i^* specific to CDS_{ik}. Hence $\varepsilon_i = \varepsilon_I + \varepsilon_i^*$, where in a frictionless world, ε_I

[12] As in Barberis et al. (2005) and Chen et al. (2016), our goal is not to fully capture reality but to generate predictions.

and ε_i are i.i.d. Equation (6) represents the return for CDS_{ik} when it is a CDX.k index constituent, and equation (7) represents the return when it is not:

$$r_{ik} = a_{ik}F + b_{ik}F_k + \varepsilon_I + \varepsilon_i^* \tag{6}$$

$$r_{ik}{}' = a'_{ik}F + b'_{ik}F_k + \varepsilon_i^{*\prime}. \tag{7}$$

Following from equations (6) and (7), we derive β_{ik}^j in order to capture the comovement between the return of CDS_{ik} with the return of CDX.j, when CDS_{ik} is included in either of the CDX indices.[13] We also derive $\beta_{ik}^{j\,\prime}$ to capture the comovement between the return of CDS_{ik} and the return of CDX.j, when the CDS_{ik} is not included in neither. The β coefficients are given in the table below.[14]

	$j = k$	$j \neq k$
β_{ik}^j	$\frac{Cov(r_{ik},r_k)}{Var(r_k)} = \frac{a_{ik}a_k\sigma_F^2 + b_{ik}b_k\sigma_K^2}{\sigma_{r_k}^2} + \frac{\sigma_I^2}{\sigma_{r_k}^2}$	$\frac{Cov(r_{ik},r_j)}{Var(r_j)} = \frac{a_{ik}a_j\sigma_F^2}{\sigma_{r_j}^2} + \frac{\sigma_I^2}{\sigma_{r_j}^2}$
$\beta_{ik}^{j\,\prime}$	$\frac{Cov(r_{ik}{}',r_k)}{Var(r_k)} = \frac{a'_{ik}a_k\sigma_F^2 + b'_{ik}b_k\sigma_K^2}{\sigma_{r_k}^2}$	$\frac{Cov(r_{ik}{}',r_j)}{Var(r_j)} = \frac{a'_{ik}a_j\sigma_F^2}{\sigma_{r_j}^2}$

We consider three cases: (1) the Baseline Case covers all inclusions and exclusions without a category rating change; (2) Case 1 includes simultaneous exclusions from an index and inclusions in a new index following a rating change and (3) Case 2 includes exclusions from an index that are due to a rating change but are not however followed by immediate inclusions in an new index.[15] We outline the Baseline Case, Case 1 and Case 2 below.

3.3. The Baseline Case: No rating change

In the Baseline Case, we consider the impact of indexation when it is not caused by a rating change in the six months pre-event window (i.e., we consider inclusions or exclusions that have not been accompanied by a rating change). We denote by β_{ik}^k the measure of comovement of the return of CDS_{ik}, with the return of CDX.k after it is included in it and $\beta_{ik}^{k\,\prime}$ after it is excluded from it. Similarly, we denote by β_{ik}^j and $\beta_{ik}^{j\,\prime}$ the measures of comovement of the return CDS_{ik} with the return of CDX.j after its inclusion or exclusion from CDX.k, respectively.

[13] We use superscripts to denote the index rating classification, and subscripts to denote the rating classification of CDS_i.

[14] σ_F^2 and σ_K^2 are the variance of the fundamental common factor and rating factor respectively. σ_I^2 is the variance of the indexation shock. $\sigma_{r_k}^2$ and $\sigma_{r_j}^2$ are the variances of index k and j's returns, respectively. When $j = k$, β_{ik}^j is the comovement between CDS_{ik} and the index with the same rating category. When $j \neq k$, β_{ik}^j is the comovement between CDS_{ik} and the index with the other rating category.

[15] Immediate refers to simultaneous series roll exclusion and inclusion.

The change in the beta of CDS_{ik} included in index CDX.k is given by:

$$\Delta\beta_{ik}^{k,Inclusion} = \beta_{ik}^{k} - \beta_{ik}^{k\,\prime} = \frac{(a_{ik} - a'_{ik})a_k\sigma_F^2 + (b_{ik} - b'_{ik})b_k\sigma_k^2}{\sigma_{r_k}^2} + \frac{\sigma_I^2}{\sigma_{r_k}^2}. \tag{8}$$

Conversely, the change in the beta of CDS_{ik} excluded from index CDX.k is given by:

$$\Delta\beta_{ik}^{k,Exclusion} = \beta_{ik}^{k\,\prime} - \beta_{ik}^{k} = \frac{(a'_{ik} - a_{ik})a_k\sigma_F^2 + (b'_{ik} - b_{ik})b_k\sigma_k^2}{\sigma_{r_k}^2} - \frac{\sigma_I^2}{\sigma_{r_k}^2}, \tag{9}$$

where $\frac{(a_{ik}-a'_{ik})a_k\sigma_F^2+(b_{ik}-b'_{ik})b_k\sigma_{F_k}^2}{\sigma_{r_k}^2}$ and $\frac{(a'_{ik}-a_{ik})a_k\sigma_F^2+(b'_{ik}-b_{ik})b_k\sigma_k^2}{\sigma_{r_k}^2}$ represent the fundamental components in each case and $\frac{\sigma_I^2}{\sigma_{r_k}^2}$ represents the indexation component. The indexation component has a positive sign in the inclusion case and a negative sign in the exclusion case. For these changes in betas, we assume that inclusions and exclusions are not accompanied by a rating change. Hence, we assume that the loadings on the fundamental rating factor and the loadings on the fundamental common factor do not change following inclusion in or exclusion from index k, which implies that $a_{ik} = a'_{ik}$ and $b_{ik} = b'_{ik}$. Therefore, changes in beta capturing the comovement with index k following inclusion to or exclusion from index k, equations (8) and (9) respectively, can be simplified to:

$$\Delta\beta_{ik}^{k,Inclusion} = \frac{\sigma_I^2}{\sigma_{r_k}^2} \tag{10}$$

$$\Delta\beta_{ik}^{k,Exclusion} = -\frac{\sigma_I^2}{\sigma_{r_k}^2}. \tag{11}$$

Similarly, the changes in beta of CDS_{ik} when it is included in or excluded from index j simplify to:

$$\begin{aligned}\Delta\beta_{ik}^{j,Inclusion} &= \beta_{ik}^{j} - \beta_{ik}^{j\,\prime} = \frac{(a_{ik} - a'_{ik})a_j\sigma_F^2}{\sigma_{r_j}^2} + \frac{\sigma_I^2}{\sigma_{r_j}^2} \\ &= \frac{\sigma_I^2}{\sigma_{r_j}^2}, \end{aligned} \tag{12}$$

$$\begin{aligned}\Delta\beta_{ik}^{j,Exclusion} &= \beta_{ik}^{j\,\prime} - \beta_{ik}^{j} = \frac{(a'_{ik} - a_{ik})a_j\sigma_F^2}{\sigma_{r_j}^2} - \frac{\sigma_I^2}{\sigma_{r_j}^2} \\ &= -\frac{\sigma_I^2}{\sigma_{r_j}^2}. \end{aligned} \tag{13}$$

For all scenarios covered in this Baseline Case, the fundamental components cancel out and we are able to isolate the indexation component. In that respect, equations (8) and (12), together with equations (9) and (13) are important in highlighting some of the contributions of our model. Following an indexation event, an individual name will comove more (less) not only with their corresponding rating index, but also with the other non-category rating index.

However, we focus only on inclusion events hereafter as non-rating related exclusion events are often due to corporate actions, which may not be relevant to the purpose of this study. Our baseline case predicts that following inclusions in an index, comovement will increase with both indices.

Hypothesis 1: $\mathbf{\Delta\beta^{j}_{ik} > 0 \quad j,k \in \{IG, HY\}}$ **for inclusions not due to rating changes.**

3.4. Cases 1 and 2: Rating changes

In contrast to the literature on comovment in the equity and bond markets, which either focus on indexation (Barberis et al. (2005), Chen et al. (2016)) or rating changes (Raffestin (2017)), the CDS market allows us to control for both. Let us consider for example a CDS constituent of the CDX.IG index that experienced a rating change from IG to HY. This CDS could either be included in the subsequent CDX.HY index series or in a later series. Alternatively, it may also never be included in any new index series. Therefore, we can isolate the impact of indexation by comparing the change in the betas of names excluded from an index following a rating change that were immediately included in subsequent index series to the betas of names excluded from an index following a similar rating change but were not assigned immediately to a new index.

3.4.1. Case 1: Rating change & new indexation

Case 1 captures the scenario where exclusion events following rating changes lead to immediate inclusions. That is, a CDS_{ik} excluded from CDX.k due to a rating change from k to j is immediately included in the subsequent CDX.j series.

$$Pre : r_{ik} = a_{ik}F + b_{ik}F_k + \varepsilon_I + \varepsilon^*_i$$

$$Post : r_{ij} = a_{ij}F + b_{ij}F_j + \varepsilon_I + \varepsilon^*_i.$$

The comovements of the return of CDS_{ik} with the return of both indices before exclusion are represented by β^k_{ik} and β^j_{ik} and after inclusion by β^k_{ij} and β^j_{ij}. These are summarized as below.

Case 1: Rating Change & New Indexation

	CDX.k	CDX.j
Pre:	$\beta^k_{ik} = \frac{Cov(r_{ik},r_k)}{Var(r_k)} = \frac{a_{ik}a_k\sigma^2_F + b_{ik}b_k\sigma^2_k}{\sigma^2_{r_k}} + \frac{\sigma^2_I}{\sigma^2_{r_k}}$	$\beta^j_{ik} = \frac{Cov(r_{ik},r_j)}{Var(r_j)} = \frac{a_{ik}a_j\sigma^2_F}{\sigma^2_{r_j}} + \frac{\sigma^2_I}{\sigma^2_{r_j}}$
Post:	$\beta^k_{ij} = \frac{Cov(r_{ij},r_k)}{Var(r_k)} = \frac{a_{ij}a_k\sigma^2_F}{\sigma^2_{r_k}} + \frac{\sigma^2_I}{\sigma^2_{r_k}}$	$\beta^j_{ij} = \frac{Cov(r_{ij},r_j)}{Var(r_j)} = \frac{a_{ij}a_j\sigma^2_F + b_{ij}b_j\sigma^2_j}{\sigma^2_{r_j}} + \frac{\sigma^2_I}{\sigma^2_{r_j}}$
Difference:	$\Delta\beta^k_i = \beta^k_{ij} - \beta^k_{ik} = \frac{(a_{ij}-a_{ik})a_k\sigma^2_F}{\sigma^2_{r_k}} - \frac{b_{ik}b_k\sigma^2_k}{\sigma^2_{r_k}}$	$\Delta\beta^j_i = \beta^j_{ij} - \beta^j_{ik} = \frac{(a_{ij}-a_{ik})a_j\sigma^2_F}{\sigma^2_{r_j}} + \frac{b_{ij}b_j\sigma^2_j}{\sigma^2_{r_j}}$

Note that after the rating change, the loading on the fundamental factor changes from a_{ik} to a_{ij}. The loading on the rating factor changes from b_{ik} on F_k to b_{ij} on F_j.

As Case 1 represents the sample of issuers that are excluded from one CDX index due to rating changes but are immediately included in the other CDX index, we are not able to capture the impact of indexation (ε_I). Issuers would still be in an index after the event. As shown in the above Case 1 table, changes in betas depend on changes in the loading of exposure to fundamental shocks ($a_{ij} - a_{ik}$), and the rating shock, which impacts negatively on the index (i.e., the old rating) the issuer is excluded from, and positively on the index (i.e., the new rating) the issuer is included in. The overall sign of $\Delta\beta^j_i$ depends on which component dominates. In particular, if the change of the loading of the fundamental shocks is larger, the change in the coefficient relative to the old index $\Delta\beta^{j=k}_i$ would be positive. This, in turn, would lead to a positive change in the coefficient relative to the new index $\Delta\beta^j_i$.

3.4.2. Case 2: Rating change & no new indexation

Case 2 refers to exclusion events following rating changes that are not followed by immediate inclusions. That is, a CDS_{ik} that is excluded from CDX.k due to a rating change from k to j; however, this time it is not immediately included in a subsequent CDX.j series:

$$Pre : r_{ik} = a_{ik}F + b_{ik}F_k + \varepsilon_I + \varepsilon^*_i$$
$$Post : r'_{ij} = a'_{ij}F + b'_{ij}F_j + \varepsilon'^*_i.$$

The comovements of the return of CDS_{ik} with the return of both CDX indices before exclusion are represented by β^k_{ik} and β^j_{ik} and after exclusion by $\beta^{k\,\prime}_{ij}$ and $\beta^{j\,\prime}_{ij}$. These are summarized in the below Case 2 table.

Case 2: Rating Change & No New Indexation		
	CDX.k	CDX.j
Pre:	$\beta_{ik}^{k} = \frac{Cov(r_{ik},r_k)}{Var(r_k)} = \frac{a_{ik}a_k\sigma_F^2 + b_{ik}b_k\sigma_k^2}{\sigma_{r_k}^2} + \frac{\sigma_I^2}{\sigma_{r_k}^2}$	$\beta_{ik}^{j} = \frac{Cov(r_{ik},r_j)}{Var(r_j)} = \frac{a_{ik}a_j\sigma_F^2}{\sigma_{r_j}^2} + \frac{\sigma_I^2}{\sigma_{r_j}^2}$
Post:	$\beta_{ij}^{k\,\prime} = \frac{Cov(r'_{ij},r_k)}{Var(r_k)} = \frac{a'_{ij}a_k\sigma_F^2}{\sigma_{r_k}^2}$	$\beta_{ij}^{j\,\prime} = \frac{Cov(r'_{ij},r_j)}{Var(r_j)} = \frac{a'_{ij}a_j\sigma_F^2 + b'_{ij}b_j\sigma_j^2}{\sigma_{r_j}^2}$
Difference:	$\Delta\beta_i^{k\prime} = \beta_{ij}^{k\,\prime} - \beta_{ik}^{k} = \frac{(a'_{ij}-a_{ik})a_k\sigma_F^2}{\sigma_{r_k}^2} - \frac{b_{ik}b_k\sigma_k^2}{\sigma_{r_k}^2} - \frac{\sigma_I^2}{\sigma_{r_k}^2}$	$\Delta\beta_i^{j\prime} = \beta_{ij}^{j\,\prime} - \beta_{ik}^{j} = \frac{(a'_{ij}-a_{ik})a_j\sigma_F^2}{\sigma_{r_j}^2} + \frac{b'_{ij}b_j\sigma_j^2}{\sigma_{r_j}^2} - \frac{\sigma_I^2}{\sigma_{r_j}^2}$

The indexation component has a negative sign and if large enough we would expect it to impact both indices negatively. In this case, excess comovement would need to satisfy the following hypothesis:

Hypothesis 2: $\Delta\beta_{ik}^{j} < 0 \quad j,k \in \{IG, HY\}$ for Case 2 issuers that experience a rating-driven index exclusion without a new indexation.

3.4.3. Difference-in-difference

We next compare the change in the betas of Case 1 with the change in the betas of Case 2. In both cases, CDS names have experienced the same fundamental rating change. However, the names in Case 1 were immediately included in a new index, while the names in Case 2 were not. Hence, the names in Case 2 represent the counter-factual (control group) for the names in Case 1 (treatment group). Furthermore, in the post-event window, r_{ij} in Case 1 and r'_{ij} in Case 2, share the same rating; hence, we can assume that $a'_{ij} = a_{ij}$ and $b'_{ij} = b_{ij}$. The difference-in-difference of the betas before and after the exclusion events, and between Case 1 and Case 2, are derived below.

Difference-in-difference of Betas: $k \rightarrow j$		
	CDX.k	CDX.j
Case 1 - Case 2:	$\Delta\beta_i^k - \Delta\beta_i^{k\prime} = \frac{\sigma_I^2}{\sigma_{r_k}^2} > 0$	$\Delta\beta_i^j - \Delta\beta_i^{j\prime} = \frac{\sigma_I^2}{\sigma_{r_j}^2} > 0$

If beta changes are not driven primarily by indexation, the names not immediately included in the index should exhibit similar changes to those added to the index. By adopting this difference-in-difference approach, we are able to examine the differences in the changes of the betas before and after exclusion events across both cases and isolate the impact of indexation. This leads to the following excess comovement hypothesis:

Hypothesis 3: $\Delta\beta_i^j - \Delta\beta_i^{j'} > 0 \quad j \in \{IG, HY\}$**. The difference-in-difference in betas before and after the indexation, between the treatment and control groups is positive, for both CDX indices, and for both rating change sequences.** .

4. Results

To test our model, we construct relevant samples for the three cases; the Baseline Case, Case 1, and Case 2.

4.1. Samples construction

For the Baseline Case, we use the sample of CDSs that are classified as IG (HY) for at least six months before their inclusion in the CDX.IG (CDX.HY) and control for any corporate action events during that period. In total, there are 92 CDX.IG and 77 CDX.HY inclusions. We run univariate regressions specified in equations (1) and (2), and the event study described previously and calculate the change in betas. Our Baseline Case predicts that following inclusions in an index, comovement will increase with both indices.

We also consider issuers that were excluded from the CDX.IG (CDX.HY) as a result of rating downgrades (upgrades). In our sample, there are 68 rating-driven CDX.IG exclusions with 30 issuers joining the CDX.HY immediately and 39 rating-driven CDX.HY exclusion with 8 joining the CDX.IG immediately. We label this group, Case 1. For Case 2, we focus on the 38 remaining issuers that are excluded from CDX.IG due rating changes but do not join the CDX.HY immediately or do so after more than six months, and the remaining 31 CDX.HY issuers that are excluded from that index due to rating change and that do not join the CDX.IG immediately or do so after more than six months.

Using Case 1 as the treatment group and Case 2 as the control group, we are able to form matched samples and calculate difference-in-difference of coefficients before and after indexation events. We match Case 1 issuers with Case 2 issuers from the same series. For example, using series 4, there were 9 exclusion events from the CDX.IG, 8 of these exclusions were driven by rating changes, 2 names were dropped due to a lack of data, 3 of the remaining 6 exclusions issuers were added immediately to the CDX.HY series 5 (Eastman Kodak, Liberty Media, and Lear Corp). We match these names with the other 3 names that did not get included in the CDX.HY. We match the event series for two reasons. Firstly, the limited event sample size does not offer us much flexibility to match for other characteristics. Secondly, matching the exclusion index series controls for series fixed effects and other time-related fixed effects. Overall, for ratings changes from IG to HY, we match 23 names from Case 1 with 24 names from Case 2, over 9 different series. For rating changes from HY to IG, we match 5 names from Case 1 to 9 names in Case 2, over 5 different series.[16]

For the matched names, we first run univariate regressions and then perform a *t*-test on the change of change of the betas between the treatment and control group. Second, we also perform a simple difference-in-difference regression of the changes in beta $\Delta\beta_i^j$ using the following specification:

$$\Delta\beta_i^j = u_i^j + \eta D_{Treatment} + \omega_i^j \qquad j \in \{IG, HY\}, \tag{14}$$

where D is a dummy variable equal to one for the treatment group and equal to zero for the control group.

4.2. Univariate regressions and difference-in-difference results

Table 4 reports the univariate regression results for the Baseline Case (columns (1)-(2)), Case 1 (columns (3)-(4)) and Case 2 (columns (5)-(6)). For Cases 1 and 2, panel A displays the statistics for issuers that have experienced a rating change from IG to HY, while panel B displays the statistics for issuers that have experienced a rating change from HY to IG. Columns (1),(3), and (5) correspond to $\Delta\overline{\beta}^{IG}$ and columns (2),(4), and (6) correspond to $\Delta\overline{\beta}^{HY}$.

For the Baseline Case (columns (1)-(2)), both $\Delta\overline{\beta}^{IG}$ and $\Delta\overline{\beta}^{HY}$ have a positive and significant sign for CDX.HY and CDX.IG inclusions. In particular, the inclusion indexation effect is more pronounced for the HY index, in comparison to the IG index. For a name included in the CDX.HY, the comovement with CDX.IG increases on average by 0.354 and by 0.285 with CDX.HY. Both results are statistically significant at the 1% level. For a name included in the CDX.IG, the comovment with CDX.IG increases on average by 0.086, significant at the 5% level, and by 0.078 with the CDX.HY, significance at the 10% level using a non-parametric test. These findings are in line with the predictions of our model and Hypothesis 1. Inclusions increase comovement of indexed names with both indices. Furthermore, $\Delta\overline{\beta}^{IG}$ shows a larger magnitude in comparison to $\Delta\overline{\beta}^{HY}$.[17]

For Case 1 (columns (3)-(4)), excess comovement for the names excluded from IG and included in HY (panel A) $\Delta\overline{\beta}^{IG}$ is 0.076 but not statistically significant; however $\Delta\overline{\beta}^{HY}$ at 0.128 is both economically and statistically significant using both tests. For the names excluded from HY and included in IG (panel B), we also observe positive changes in the coefficients relative to both the old and new indices, suggesting that changes in the loadings on the fundamental factors are important. The magnitudes of the coefficients also align with the predictions of our model; $\Delta\overline{\beta}^{IG}$ of the new index is 0.111, while the $\Delta\overline{\beta}^{HY}$ of the old index is 0.063. That is, the comovement with the new index is economically

[16]There may be unobserved heterogeneity between these names.

[17]This is not surprising considering the CDX.HY is more expensive to insure and is more volatile, which implies $\sigma_{r_{IG}} < \sigma_{r_{HY}}$ and hence $\overline{\beta}^{IG} > \overline{\beta}^{HY}$.

larger than the comovment with the old index. However with only 8 observations for the HY to IG, we have relatively high standard errors and no significance.

For Case 2 (columns (5)-(6)), we report the results for exclusions from the CDX.IG and CDX.HY indices due to rating changes. These exclusions are not followed by an assignment to a new index. Rating changes from IG to HY are in panel A and HY to IG in panel B. For names excluded from the CDX.IG due to a rating change, their comovement with the CDX.IG index decreases by 0.079 from 0.636 to 0.557. This result is statistical significant at the 5% level using both tests. The issuers excluded from CDX.IG and now rated HY, also decrease in comovement with the CDX.HY by 0.055 from 0.659 to 0.604. The names excluded from the CDX.HY due to a rating change comove less with the CDX.HY and the CDX.IG by 0.102 and 0.007, respectively. These findings confirm the excess comovement story as predicted by our simple model. Exclusion from an index due to a rating change reduces the event issuers comovement not only with the index it is excluded from, but also with the index that it now shares the same rating with.[18]

Table 5 presents the results for the difference-in-difference regressions. Panel A depicts the summary statistics of the univariate regression results, the difference-in-difference of the betas and the corresponding *t*-test. Panel B depicts the difference-in-difference regression results. Columns (1)-(2) correspond to a rating change from IG to HY, while columns (3)-(4) correspond to a rating change from HY to IG. Columns (1) and (3) report changes in coefficients related to the CDX.IG factor, and columns (2) and (4) report changes in coefficient related to the CDX.HY factor.

First, we observe uniformly positive changes in betas for the treatment group (Case 1), highlighting the importance of the changes in the loading on the fundamental shock. Second, changes in betas for the control group (Case 2) are all negative, which is consistent with our model prediction; there is a negative impact resulting from exclusion from an index. Third, for both rating change sequences, and for both CDX indices, we observe positive difference-in-difference betas. In particular, the comovement of the 23 issuers that have experienced exclusion from CDX.IG and inclusion in CDX.HY following a rating changes, increased by 0.083 with the CDX.IG and by 0.102 with the CDX.HY. In comparison, the comovement of the 24 issuers in the control group that experienced an exclusion from CDX.IG following rating changes but not a subsequent inclusion in the CDX.HY index decreased by -0.075 with the CDX.IG and by -1.161 with the CDX.HY. The difference-in-difference between the betas with respect to the CDX.IG and CDX.HY factor are statistically significant at the 10% and 5% levels, respectively.

Furthermore, in the difference-in-difference regression, the treatment dummy has a positive impact on the changes in the betas, which suggests a positive impact of indexation. For a rating change from IG to HY, the treatment dummies have a *t*-statistic of 1.944 for the CDX.IG factor, and of 2.343 for the CDX.HY factor, both statistically significant at the 10% and 5% levels, respectively. For a rating change from HY to IG, the difference-in-difference in the betas has the correct positive sign for both the IG and HY factors; the same applies for the difference-in-

[18]These findings are robust to different specifications of the event evaluation windows. The results are available upon request.

difference regression. However, for this scenario, we have a very small sample of 5 names in the treatment group and 9 names in the control group, which may limit any inference and explain the lack of statistical significance. Overall the difference-in-difference regressions confirm the positive and significant impact of inclusion events in an index on excess comovement.

5. Robustness of the results

In the following, we perform robustness checks using bivariate regressions and control for liquidity effects. We also present results using the cross-section mean spread for the index factor.

5.1. Bivariate regression

The primary evidence of comovement in the literature is usually captured by the difference between the coefficients in a bivariate regression conducted before and after the indexation event (Barberis et al. (2005), Greenwood (2008)). The use of this methodology has been, however, questioned by Chen et al. (2016), amongst others. For completeness, we only use this method as a robustness check in order to complement our univariate results. We run bivariate regressions for the three cases outlined above, as follows:

$$r_{ikt} = \alpha_{ik} + \beta_{ik}^{IG} r_{IG,t} + \beta_{ik}^{HY} r_{HY,t} + \xi_{ikt} \qquad k \in \{IG, HY\}. \tag{15}$$

Table 6 presents the results, where the panel A corresponds to rating change from IG to HY and panel B corresponds to rating change from HY to IG for Cases 1 and 2. The results are consistent with the univariate regression findings. Column (1) reports the Baseline Case (inclusions not due to a rating change). The difference in the coefficients after and before the events are all positive and significant, except for the $\Delta\overline{\beta}^{HY}$. The loss of significance could be caused by the high correlation (0.6) between r_{IG} and r_{HY} over the full sample. For Case 1 (indexation followed by re-indexation), the results are reported in column (2), and all the coefficients are positive. This positive comovement is stronger and more significant for the new index that the event issuer is included in. For example, a CDX.IG excluded issuer that is immediately included in the CDX.HY increases its comovement with CDX.HY on average by 0.155, from 0.341 to 0.496, at the 5% significance level, as indicated by the *t*-test. A CDX.HY excluded issuer that immediately joins the CDX.IG increases it comovement with CDX.IG by 0.061, from 0.391 to 0.452, at the 10% significance level by the non-parametric test. In column (3), the changes in betas for Case 2 show consistent negative signs. However, $\Delta\overline{\beta}^{IG}$ is no longer significant in comparison with the univariate result.

5.2. Liquidity

5.2.1. Depth

It is possible that thin-trading plays a role in our empirical findings. The CDX indices represent issuers who have an eligible credit rating and the most liquid CDS spreads. If, upon inclusion, an issuer's CDS spread is more frequently traded and incorporates market-wide news more rapidly, this may suggest some downward bias in our pre- inclusion betas. Conversely, if, upon exclusion, an issuer's CDS spread is less frequently traded and is slower in incorporating market-wide news, this may suggest some downward bias in our post-exclusion betas. To test this alternative explanation, we adopt a test similar to the one suggested by Vijh (1994) and Barberis et al. (2005). However, instead of using the bid-ask spreads, we use a liquidity measure provided by Markit, the "depth." Depth represents the number of contributors who provide quotes to Markit to trade the CDSs. More depth suggests higher demand for the CDS names, as well as better liquidity conditions. Empirically, we first calculate the daily average depth during the same 120-day pre- and post-event windows for all issuers included in and excluded from the CDX.IG or CDX.HY. We then split the sample by issuers who became more or less liquid following an indexation event. This is measured by an increase or decrease in the six-month average daily depth. If our results are driven by thin-trading, we should expect to see the issuers whose contributor depth's increases (decreases) upon inclusion (exclusion) to exhibit a significant increase (decrease) in their beta. The results are presented in Table 7.

We do not observe that depth increases for the average name included in the CDX.IG; only 47% of issuers experience an increase in their six-month average depths. The observed drop of the contributor depth is on average approximately 1 contributor, from 7.6 to 6.6 contributors. Mean beta changes are 0.075 and 0.104 for the more and less liquid sub-samples, respectively. Both tests are statistically significant for the less liquid case, while for the more liquid case the beta change is only significant at the 10% level, as shown by the *t*-test. For CDX.IG exclusions, we observe a positive increase in the number of contributors in trading after the exclusion event. For this case, the changes in betas are negative and insignificant for both groups. In summary, thin-trading does not appear to play a role in explaining the excess comovement for CDX.IG.

Approximately 60% of issuers included in CDX.HY experience an increase in the contributor depth. The average increase across the sample is 0.228. Beta changes are significantly positive in both sub-samples; they are more statistically significant for the issuers that became more liquid. The results are significant at the 1% level. Furthermore, the average issuer excluded from the CDX.HY experiences a 0.133 drop in liquidity after the event. The changes in betas are positive for the more liquid group but are not significant. The less liquid group displays negative changes in betas with statistical significance at the 1% level. These results suggest that thin-trading may affect our results following CDX.HY exclusions.

To assess whether the negative changes in betas following CDX.HY exclusions result from changes in liquidity, we perform the following exercises. First, we orthogonalize the changes in betas across the indexation events to the changes in liquidity for each event issuer by running the following regression:

$$\Delta\beta^j_{ik} = u^j + \eta^j \Delta Depth_{ik} + \varepsilon_{\beta^j_{ik}}. \tag{16}$$

The residual of the orthogonalization would represent the changes in betas that are not explained by the changes in contributor's depth. Second, we perform an unconditional *t*-test and a non-parametric test on the residuals. If thin-trading is indeed the primary cause for the changes in beta, we would observe a loss of significance in both tests. Table 8 reports the summary statistics for the residual changes in betas after orthogonalizing the liquidity. We observe similar coefficients scales and statistical significance to the full sample unconditional results shown in Table 3. In particular, for the CDX.HY exclusion events, the changes in betas as still significant at the 1% level using the non-parametric test and at the 5% level using the *t*-test.

In summary, CDX.IG and CDX.HY inclusions (exclusions) result in an increase (decrease) in comovement in their underlying spreads that cannot be fully explained by liquidity changes and the indexation effect persists. We interpret our results as being consistent with the excess comovement story.

5.2.2. Zero-returns

Markit data consist of daily trading quotes, instead of actual transaction prices. It is therefore likely that for some days there is no change in quotes, causing various zero-return observations in our dataset. In turn, our findings could be affected by the low covariance resulting from a large proportion of zero-return days. To deal with this problem we adopt a simple approach and remove any zero-return observation days and re-run our unconditional regressions. We also remove the top-and bottom-1 percentile outliers from the cross-sectional distribution.[19]

Table 9 reports the fraction of zero-return days before and after the indexation events. The proportion of of zero-returns is smaller following both inclusion and exclusion events irrespective of rating. In particular, the reductions in zero-return are statistically significant for both CDX.IG and CDX.HY inclusions. This suggests that there are more quotes available after an indexation event irrespective of its nature and indicates more activity around a CDS name in the post-event period. However, as we can see in Table 10 even after controlling for zero-return days and outliers, the effect of indexation remains.

[19] Even though our sample period has a time length of 13 years, the sample size is relatively small. This would make our results sensitive to outliers.

5.3. Mean

We opt for the cross-sectional median spread for our index factor construction as outliers may skew the mean, especially during the financial crisis period. For completeness we re-run the unconditional regressions using the cross-section mean spread. We report the results in Table 11. All sign and results remain fairly similar to the ones reported using the median see Table 3. For the CDX.HY inclusion sub-sample we loose some significance in the pre-and post-crisis periods. This may be due to CDX.HY names being more volatile and sensitive to outliers.

6. Conclusion

We examine the effects of indexation on comovement dynamics in the CDS market. The CDX.IG and CDX.HY indices, administered by Markit, were introduced in 2003 and represent the CDS spreads of the most liquid North American corporate issuers. They allow market participants to take aggregate exposures to diversified portfolios of credit risk. Index membership is governed mainly by an issuer's rating classification as either investment grade or high yield. We use a simple model to motivate our results. We exploit the CDX eligibility rules, to control for category rating changes and isolate the impact of indexation. Our univariate regressions and difference-in-difference approach provide consistent evidence of excess comovement in the CDS spreads of CDX indexed issuers. Our results cannot be explained by thin-trading. These findings provide support in favour of style investing in the CDS credit market.

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Figure 1: The times series of index factors

The figure displays the investment grade (CDX.IG) and high yield (CDX.HY) index factors between September 19, 2003 and March 29, 2016. Each is expressed as a daily (annualized) spread in bps, taken as median from the cross-section of issuers. These issuers are constituents of each series of the CDX.HY and CDX.IG that are not included or excluded in that series.

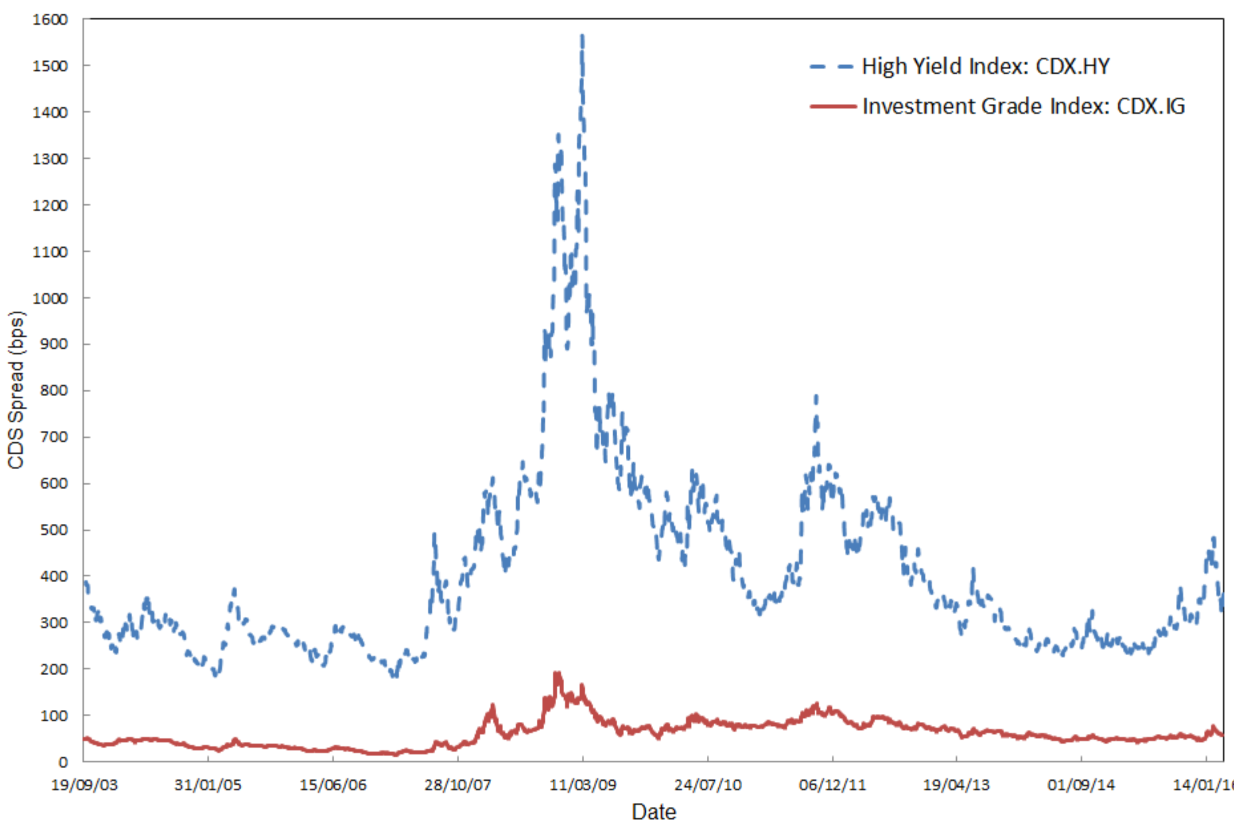

Table 1: **Index assignments**

This table reports the coverage of the CDS data across series 1 to 25 of the CDX.IG and CDX.HY indices. Date is the month and year (mm/yy) of the index series release. # is the total number of issuers of the index according to Markit Annexes, Samp. is the number of those issuers included in our CDS data set. Excs. and Incs. gives the distribution of matched inclusion and exclusion events across these issuers.

Series	Date (mm/yy)	#.	Samp	Excs	Incs	#.	Samp	Excs	Incs
		CDX.IG				CDX.HY			
1	10/03	125	124	6		100	87	11	
2	03/04	125	125	5	6	100	99	8	12
3	09/04	125	125	3	5	100	100	11	10
4	03/05	125	125	9	3	100	97	7	8
5	09/05	125	122	10	9	100	95	11	7
6	03/06	125	125	8	10	100	99	9	11
7	09/06	125	125	10	8	100	99	11	9
8	03/07	125	125	10	10	100	100	8	11
9	09/07	125	125	9	10	100	100	7	9
10	03/08	125	125	11	9	100	100	6	6
11	09/08	125	125	9	11	100	94	9	6
12	03/09	125	124	6	9	100	94	8	9
13	09/09	125	124	2	6	100	100	6	8
14	03/10	125	123	3	2	100	100	3	6
15	09/10	125	124	7	3	100	100	11	3
16	03/11	125	125	7	7	100	100	12	11
17	09/11	125	124	4	7	100	98	8	12
18	03/12	125	124	4	4	100	98	5	8
19	09/12	125	124	3	4	100	99	6	5
20	03/13	125	125	4	3	100	99	8	6
21	09/13	125	125	4	4	100	99	5	8
22	03/14	125	125	6	4	100	100	5	5
23	09/14	125	125	4	6	100	99	7	5
24	03/15	125	125	3	4	100	100	15	7
25	09/15	125	123		3	100	98		15

Table 2: **Credit default events**

This table reports the list of issuers deleted from the CDX indices due to credit events. We use the Markit's CDX Index Annexes and the Auction Settlement Summaries to determine the time and nature of the credit event experienced. The Event Date (dd/mm/yyyy) is when the new version of the on-the-run index series is released due to the corresponding credit events. Series-Version at Event (s#-v#) is the on-the-run series and version when the event happens. CDX Index is the affected CDX index.

Issuer Name	**Event Date** (dd/mm/yyyy)	**Series - Version at Event** (s#-v#)	**CDX Index**
Collins & Aikman Product Co.	17/05/2005	s4-v1	CDX HY
Delphi Corporation	08/10/2005	s5-v1	CDX HY
Calphine Corporation	20/12/2005	s5-v2	CDX HY
DANA CORPORATION	02/03/2006	s5-v3	CDX HY
Dura Operating Corp	30/10/2006	s6-v1	CDX HY
Washington Mutul	08/09/2008	s10-v1	CDX IG
Tribune Company	10/12/2008	s11-v1	CDX HY
Nortel Networks Corporation	14/01/2009	s11-v2	CDX HY
Smurfit-Stone Container Enterprises Inc	26/01/2009	s11-v3	CDX HY
STATION CASINOS, INC	04/03/2009	s11-v4	CDX HY
Chemtura Corporation	19/03/2009	s11-v5	CDX HY
ABITIBI-CONSOLIDATED INC	27/03/2009	s11-v6	CDX HY
CHARTER COMMUNICATIONS HOLDINGS, LLC	27/03/2009	s11-v6	CDX HY
Idearc Inc	31/03/2009	s12-v1	CDX HY
R.H. Donnelley Corporation	18/05/2009	s12-v2	CDX HY
Visteon Corporation	29/05/2009	s12-v3	CDX HY
GENERAL MOTORS CORPORATION	01/06/2009	s12-v4	CDX HY
Six Flags Inc	16/06/2009	s12-v5	CDX HY
Lear Corporation	06/07/2009	s12-v6	CDX HY
CIT Group Inc	03/11/2009	s13-v1	CDX HY
Dynegy Holdings, LLC	09/11/2011	s17-v1	CDX HY
The PMI Group Inc	29/11/2011	s17-v2	CDX HY
Eastman Kodak Company	23/01/2012	s17-v3	CDX HY
Residential Capital LLC	15/05/2012	s18-v1	CDX HY
Caesars Entertainment Operating Company, Inc.	21/01/2015	s23-v1	CDX HY
RadioShack Corporation	11/02/2015	s23-v2	CDX HY
Sabine Oil & Gas Corporation	03/06/2015	s24-v1	CDX HY

Table 3: **Empirical regression: Unconditional index assignment**

This table presents the univariate regressions results of issuers' daily CDS returns on CDX.IG and CDX.HY index returns around index assignments. The Full Sample results cover the period 9/2003-3/2016, assignments from series 1-25 of the CDX.IG and CDX.HY. We use the NBER Business Cycle Dates to separate the sample period. The Pre-Crisis, Crisis, and Post-Crisis results cover the periods 9/2003-9/2007, 10/2007-9/2009, and 10/2009-3/2016, respectively. The corresponding assignments are from series 2-8, 9-12, and 13-25 of the CDX.IG and CDX.HY, respectively. $\Delta\overline{\beta}$ is the cross-sectional mean change in loading on the relevant index factor between the pre- and post-event windows as defined in equations (3) and (4). Std. Err is the standard error. $\overline{\beta}_1$ is the cross-sectional mean beta in the pre-event window. $\Delta\beta_i > 0$ (%) is the percentage of changes in beta in the cross-section that are positive. t-stat gives the results of a cross-sectional t-test and p-value is ascribed by the Wilcoxon signed-rank test. Significance at 1% is denoted by $(***)$, 5% $(**)$ and 10% $(*)$. N is the sample size.

CDX.IG								
	INCLUSION				EXCLUSION			
	Full Sample	Pre-Crisis	Crisis	Post-Crisis	Full Sample	Pre-Crisis	Crisis	Post-Crisis
$\Delta\overline{\beta}$	0.085	0.024	0.156	0.091	-0.025	-0.093	-0.032	0.070
Std. Err	0.032	0.055	0.041	0.041	0.033	0.038	0.048	0.036
$\overline{\beta}_1$	0.576	0.539	0.536	0.635	0.619	0.585	0.677	0.613
$\Delta\overline{\beta}_i > 0$ (%)	59.71	60.42	64.86	55.56	44.04	37.78	34.48	60.00
t-stat	2.624***	0.349	3.478***	1.912*	-0.735	-1.962*	-0.406	1.360
p-value	0.000***	0.351	0.001***	0.061*	0.452	0.056*	0.524	0.164
N	139	48	37	54	109	45	29	35

CDX.HY								
	INCLUSION				EXCLUSION			
	Full Sample	Pre-Crisis	Crisis	Post-Crisis	Full Sample	Pre-Crisis	Crisis	Post-Crisis
$\Delta\overline{\beta}$	0.135	0.241	0.061	0.088	-0.089	-0.053	-0.196	-0.103
Std. Err	0.032	0.056	0.057	0.030	0.035	0.047	0.129	0.041
$\overline{\beta}_1$	0.476	0.377	0.610	0.496	0.539	0.427	0.610	0.642
$\Delta\overline{\beta}_i > 0$ (%)	68.42	75.86	56.67	67.47	41.23	41.51	33.33	42.86
t-stat	4.197***	3.404***	0.967	2.403**	-2.583**	-0.989	-1.808*	-2.078**
p-value	0.000***	0.000***	0.165	0.010***	0.019**	0.408	0.092*	0.071*
N	171	58	30	83	114	53	12	49

Table 4: **Univariate regression: Cases**

This table depicts the results from univariate regressions of issuers' daily CDS returns on CDX.IG and CDX.HY index returns around CDX assignment. Panel A corresponds to rating change from IG to HY and panel B corresponds to rating change from HY to IG. Columns (1),(3),(5) report statistics of $\Delta\bar{\beta}^{IG}$ and columns (2),(4),(6) report statistics of $\Delta\bar{\beta}^{HY}$ for the three different cases. The baseline case in columns (1)-(2) corresponds to inclusion issuers with eligible rating for at least six months. Case 1 columns (3)-(4) panel A corresponds to issuers demoted from CDX.IG and included into a successive CDX.HY due to rating downgrades. Case 1 columns (3)-(4) panel B corresponds to issuers removed from CDX.HY and included into a successive CDX.IG due to rating upgrades. Case 2 columns (5)-(6) panel A (B) corresponds to issuers excluded from CDX.IG (CDX.HY) due to rating downgrades (upgrades) but which were not included in the other CDX.HY (CDX.IG) for at least six months. $\Delta\bar{\beta}$ is the cross-sectional mean change in loading on the relevant index factor between the pre- and post-event windows. Std. Err is the standard error. $\bar{\beta}_1$ is the cross-sectional mean beta in the pre-event window. $\Delta\beta_i > 0$ (%) is the percentage of changes in beta in the cross-section that are positive. t-stat results from a cross-sectional t-test and p-value is ascribed by the Wilcoxon signed-rank test. Significance at 1% is denoted by $(***)$, 5% $(**)$ and 10% $(*)$. N is the sample size.

Panel A: IG to HY

	Baseline HY Inclusion		Case 1 IG/HY Demotions		Case 2 IG Exclusion	
	IG	HY	IG	HY	IG	HY
$\Delta\bar{\beta}^j$	0.354	0.285	0.076	0.128	-0.079	-0.055
Std. Err	0.160	0.074	0.081	0.084	0.047	0.080
$\bar{\beta}_1^j$	0.164	0.313	0.584	0.601	0.636	0.659
$\Delta\bar{\beta}_i^j > 0$ (%)	0.636	0.740	0.633	0.633	0.342	0.500
t-stat	2.217**	3.864***	0.929	1.523*	-1.696**	-0.688
p-value	0.001***	0.000***	0.165	0.091*	0.046**	0.369
N	77		30		38	

Panel B: HY to IG

	Baseline IG Inclusion		Case 1 HY/IG Demotions		Case 2 HY Exclusion	
	IG	HY	IG	HY	IG	HY
$\Delta\bar{\beta}^j$	0.086	0.078	0.111	0.063	-0.007	-0.102
Std. Err	0.043	0.054	0.144	0.112	0.007	0.069
$\bar{\beta}_1^j$	0.579	0.599	0.621	0.659	0.020	0.567
$\Delta\bar{\beta}_i^j > 0$ (%)	0.587	0.565	0.500	0.625	0.484	0.355
t-stat	1.996**	1.446*	0.771	0.561	-1.095	-1.465*
p-value	0.008***	0.125	0.727	0.422	0.118	0.114
N	92		8		31	

Table 5: **Empirical regression: Difference-in-difference**

This table depicts the empirical investigation of the matched issuers in Case 1 and Case 2. The treatment group corresponds to Case 1 issuers demoted from and included in a successive series of another CDX index due to rating changes. The control group corresponds to Case 2 issuers excluded from the same series of CDX index as the treatment group, but were not successively included in the other CDX index for at least six months. Panel A reports the mean changes in betas from the event study for the treatment ($\Delta\overline{\beta}^{j}$) and control groups ($\Delta\overline{\beta}^{j'}$) respectively, and the corresponding observations in each group. Diff. of Diff represents the difference-in-difference between the treatment group and the control group ($\Delta\overline{\beta}^{j} - \Delta\overline{\beta}^{j'}$). We also report the corresponding t-test statistics. Panel B reports the results of difference-in-difference regression, where $D_{Treatment}$ is dummy variable equal to 1 for issuers in the treatment group and 0 for issuers in the control group. Standard errors are clustered at the series level. t-statistics of the estimations are reported in parentheses. Significance at 1% is denoted by ($***$), 5% ($**$) and 10% ($*$). N is the sample size.

Panel A: Changes in betas based on event study

	IG to HY		HY to IG	
	IG	HY	IG	HY
Treatment ($\Delta\overline{\beta}^{j}$)	0.083	0.102	0.107	0.063
N	23	23	5	5
Contol ($\Delta\overline{\beta}^{j'}$)	-0.075	-0.161	-0.010	-0.003
N	24	24	9	9
Diff. of Diff	0.158	0.263	0.978	0.066
t-stat	1.372*	1.948**	0.710	0.319

Panel B: Difference-in-Difference regression

	IG to HY		HY to IG	
	IG	HY	IG	HY
$D_{Treatment}$	0.158	0.263	0.117	0.066
	(1.944*)	(2.343**)	(0.682)	(0.484)
Constant	-0.075	-0.161	-0.010	-0.003
	(-1.062)	(-0.991)	(-0.541)	(-0.046)
R^2	0.041	0.077	0.074	0.008
N	47		14	
Cluster S.E.	Yes		Yes	

Table 6: **Bivariate regression: Cases**

This table depicts the results from bivariate regressions of issuers' daily CDS returns on CDX.IG and CDX.HY index returns around CDX assignment, conditional on rating changes. Panel A corresponds to rating changes from IG to HY and Panel B corresponds to rating changes from HY to IG. The Baseline Case corresponds to inclusion of issuers with eligible rating for at least six months. Case 1 corresponds to issuers demoted from CDX.IG (CDX.HY) and included into a successive CDX.HY (CDX.IG) due to rating downgrades (upgrades). Case 2 corresponds to issuers excluded from CDX.IG, (CDX.HY) due to rating downgrades (upgrades) but which were not included in the CDX.HY (CDX.IG) for at least six months. $\Delta\overline{\beta}$ is the cross-sectional mean change in loading on the relevant index factor between the pre- and post-event windows. Std. Err is the standard error. $\overline{\beta}_1$ is the cross-sectional mean beta in the pre-event window. $\Delta\beta_i > 0$ (%) is the percentage of changes in beta in the cross-section that are positive. t-stat gives the results of a cross-sectional t-test and p-value is ascribed by the Wilcoxon signed-rank test. Significance at 1% is denoted by ($***$), 5% ($**$) and 10% ($*$). N is the sample size.

Panel A: IG to HY

	Baseline HY Inclusion	Case 1 IG/HY Demotions	Case 2 IG Exclusion
$\Delta\overline{\beta}^{IG}$	0.257	0.007	-0.033
Std. Err	0.157	0.101	0.046
$\overline{\beta}_1^{IG}$	0.035	0.401	0.421
$\Delta\overline{\beta}_i^{IG} > 0$ (%)	0.597	0.633	0.421
t-stat	1.638*	0.070	-0.721
p-value	0.042**	0.318	0.184
$\Delta\overline{\beta}^{HY}$	0.174	0.155	-0.057
Std. Err	0.038	0.090	0.075
$\overline{\beta}_1^{HY}$	0.246	0.341	0.415
$\Delta\overline{\beta}_i^{HY} > 0$ (%)	0.766	0.600	0.342
t-stat	4.567***	1.713**	-0.763
p-value	0.000***	0.091*	0.213
N	77	30	38

Panel B: HY to IG

	Baseline IG Inclusion	Case 1 HY/IG Demotions	Case 2 HY Exclusion
$\Delta\overline{\beta}^{IG}$	0.065	0.061	-0.004
Std. Err	0.044	0.078	0.007
$\overline{\beta}_1^{IG}$	0.398	0.391	0.014
$\Delta\overline{\beta}_i^{IG} > 0$ (%)	0.630	0.750	0.419
t-stat	1.470*	0.781	-0.605
p-value	0.007***	0.098*	0.247
$\Delta\overline{\beta}^{HY}$	0.040	0.052	-0.101
Std. Err	0.050	0.109	0.071
$\overline{\beta}_1^{HY}$	0.349	0.412	0.566
$\Delta\overline{\beta}_i^{HY} > 0$ (%)	0.522	0.500	0.355
t-stat	0.808	0.477	-1.432*
p-value	0.454	0.670	0.126
N	92	8	31

Table 7: **Univariate regression: Conditional on liquidity**

This table reports the univariate regressions results of issuers' daily CDS returns on CDX.IG and CDX.HY index returns conditioned on liquidity changes. The sample covers period 9/2003-3/2016, assignments from series 1-25 of the CDX.IG and CDX.HY. $\Delta Depth$ is the cross-sectional mean change in average daily number of contributors, who quote to trade the underlying CDS, between the pre- and post-event windows. $Depth_1$ is the cross-sectional mean of average daily number of contributors in the pre-event window. $\Delta Depth > 0(\%)$ is the percentage of average depth changes in the cross-section that are positive. $\Delta\overline{\beta}$ is the cross-sectional mean change in loading on the relevant index factor between the pre- and post-event windows. t-stat gives the results of a cross-sectional t-test and p-value is ascribed by the Wilcoxon signed-rank test. Significance at 1% is denoted by $(***)$, 5% $(**)$ and 10% $(*)$. N is the sample size.

	CDX.IG			
	INCLUSION		EXCLUSION	
$\Delta Depth$	-0.944		0.083	
$Depth_1$	7.613		7.792	
$\Delta Depth_i > 0$	47.06		48.60	
N	136		107	
	More Liquid	Less Liquid	More Liquid	Less Liquid
$\Delta\overline{\beta}$	0.075	0.104	-0.017	-0.022
Std. Err	0.044	0.04	0.046	0.04
t-stat	1.7*	2.601**	-0.363	-0.551
p-value	0.231	0.003***	0.689	0.519
N	64	72	52	55

	CDX.HY			
	INCLUSION		EXCLUSION	
$\Delta Depth$	0.228		-0.133	
$Depth_1$	6.111		6.604	
$\Delta Depth_i > 0(\%)$	59.76		47.32	
N	169		112	
	More Liquid	Less Liquid	More Liquid	Less Liquid
$\Delta\overline{\beta}$	0.155	0.110	0.057	-0.217
Std. Err	0.036	0.053	0.036	0.049
t-stat	4.307***	2.067**	1.564	-4.409***
p-value	0.000***	0.056*	0.210	0.000***
N	101	68	53	59

Table 8: **Univariate regression: Orthogonalization on Liquidity**

This table reports the orthogonalized univariate regressions results of issuers' daily CDS returns on CDX.IG and CDX.HY index returns. The sample covers period 9/2003-3/2016, assignments from series 1-25 of the CDX.IG and CDX.HY. $\Delta\bar{\varepsilon}_\beta$ is the cross-sectional mean change in the residual of betas of the relevant index factor after orthogonalizing the liquidity factor, between the pre- and post-event windows. *t*-stat gives the results of a cross-sectional *t*-test and *p*-value is ascribed by the Wilcoxon signed-rank test. Significance at 1% is denoted by ($***$), 5% ($**$) and 10% ($*$). *N* is the sample size.

	CDX.IG		CDX.HY	
	INCLUSION	EXCLUSION	INCLUSION	EXCLUSION
$\Delta\bar{\varepsilon}_\beta$	0.066	-0.021	0.134	-0.077
Std. Err	0.029	0.031	0.030	0.032
t-stat	2.251**	-0.677	4.438***	-2.411**
p-value	0.022**	0.421	0.000***	0.009***
N	136	107	169	112

Table 9: **Zero-return days summary**

This table depicts summary statistics of zero-return day observations in our data set. ret=0 % Pre and ret=0 % Post stands for the mean proportion of zero-return days in the pre- and post-event windows. Δ ret=0% the cross-sectional mean change in the proportion of zero-return days between the pre- and post-event windows as (ret=0 % Post - ret=0 % Pre). *t*-stat gives the results of a cross-sectional *t*-test. Significance at 1% is denoted by ($***$), 5% ($**$) and 10% ($*$). *N* is the sample size.

	CDX.IG		CDX.HY	
	INCLUSION	EXCLUSION	INCLUSION	EXCLUSION
ret=0 % Pre	4.33	1.71	5.97	6.18
ret=0 % Post	2.5	1.42	3.14	5.69
Δ ret=0%	-1.7	-0.28	-2.83	-0.48
t-stats	-2.99***	-1.4	-3.97***	-0.71
N	139	109	171	114

Table 10: **Robust regression: Unconditional index assignment**

This table reports the univariate regressions results of issuers' daily CDS returns on CDX.IG and CDX.HY index returns around index assignments, we use the median for the factors construction. Zero-return observations are removed. Furthermore, for each index assignment, outliers in the top and bottom 1 percentile of cross-sectional distribution are removed. The Full Sample results cover the period 9/2003-3/2016, assignments from series 1-25 of the CDX.IG and CDX.HY. We use the NBER Business Cycle Dates to separate the sample period. The Pre Crisis, Crisis and Post Crisis results cover the period 9/2003-9/2007, 10/2007-9/2009, and 10/2009-3/2016, respectively. The corresponding assignments are from series 2-8, 9-12, and 13-25 of the CDX.IG and CDX.HY. $\Delta\overline{\beta}$ is the cross-sectional mean change in loading on the relevant index factor between the pre- and post-event windows as defined in Equations (3) and (4). Std. Err is the standard error. $\overline{\beta}_1$ is the cross-sectional mean beta in the pre-event window. $\Delta\beta_i > 0$ (%) is the percentage of changes in beta in the cross-section that are positive. *t*-stat gives the results of a cross-sectional *t*-test and *p*-value is ascribed by the Wilcoxon signed-rank test. Significance at 1% is denoted by (∗∗∗), 5% (∗∗) and 10% (∗). *N* is the sample size.

CDX.IG

	INCLUSION				EXCLUSION			
	Full Sample	Pre-Crisis	Crisis	Post-Crisis	Full Sample	Pre-Crisis	Crisis	Post-Crisis
$\Delta\overline{\beta}$	0.091	0.038	0.156	0.091	-0.020	-0.093	0.016	0.048
Std. Err	0.030	0.058	0.045	0.047	0.031	0.048	0.064	0.048
$\overline{\beta}_1$	0.571	0.522	0.536	0.635	0.616	0.585	0.662	0.620
$\Delta\overline{\beta}_i > 0(\%)$	59.85	60.87	64.86	55.56	43.93	37.78	35.71	58.82
t-stat	3.061***	0.653	3.478***	1.912*	-0.643	-1.962*	0.254	1.005
p-value	0.003***	0.317	0.002***	0.061*	0.443	0.056*	0.733	0.248
N	137	46	37	54	107	45	28	34

CDX.HY

	INCLUSION				EXCLUSION			
	Full Sample	Pre-Crisis	Crisis	Post-Crisis	Full Sample	Pre-Crisis	Crisis	Post-Crisis
$\Delta\overline{\beta}$	0.137	0.249	0.061	0.088	-0.087	-0.053	-0.270	-0.084
Std. Err	0.030	0.063	0.063	0.037	0.034	0.054	0.087	0.047
$\overline{\beta}_1$	0.468	0.350	0.610	0.496	0.543	0.427	0.723	0.629
$\Delta\overline{\beta}_i > 0(\%)$	68.64	76.79	56.70	67.50	41.07	41.51	27.27	43.75
t-stat	4.519***	3.943***	0.967	2.403**	-2.600**	-0.989	-3.108**	1.796*
p-value	0.000***	0.000***	0.165	0.010***	0.018**	0.408	0.021**	0.079*
N	169	56	30	83	112	53	11	48

Table 11: **Empirical regression: Unconditional index assignment with mean**

This table reports the univariate regressions results of issuers' daily CDS returns on CDX.IG and CDX.HY index returns around index assignments. The CDX.IG and CDX.HY factors are constructed as the mean across the factor names in the series. The Full Sample results cover the period 9/2003-3/2016, assignments from series 1-25 of the CDX.IG and CDX.HY. We use the NBER Business Cycle Dates to separate the sample period. The Pre Crisis, Crisis and Post Crisis results cover the period 9/2003-9/2007, 10/2007-9/2009, and 10/2009-3/2016, respectively. The corresponding assignments are from series 2-8, 9-12, and 13-25 of the CDX.IG and CDX.HY. $\Delta\overline{\beta}$ is the cross-sectional mean change in loading on the relevant index factor between the pre- and post-event windows as defined in Equations (3) and (4). Std. Err is the standard error. $\overline{\beta}_1$ is the cross-sectional mean beta in the pre-event window. $\Delta\beta_i > 0$ (%) is the percentage of changes in beta in the cross-section that are positive. t-stat gives the results of a cross-sectional t-test and p-value is ascribed by the Wilcoxon signed-rank test. Significance at 1% is denoted by $(***)$, 5% $(**)$ and 10% $(*)$. N is the sample size.

CDX.IG

	INCLUSION				EXCLUSION			
	Full Sample	Pre-Crisis	Crisis	Post-Crisis	Full Sample	Pre-Crisis	Crisis	Post-Crisis
$\Delta\overline{\beta}$	0.114	0.089	0.172	0.095	-0.028	-0.047	0.001	-0.029
Std. Err	0.036	0.077	0.047	0.051	0.038	0.058	0.057	0.056
$\overline{\beta}_1$	0.802	0.871	0.625	0.863	0.856	0.884	0.814	0.855
$\Delta\overline{\beta}_i > 0$ (%)	59.71	52.08	78.38	53.70	41.28	35.56	48.28	42.86
t-stat	3.130***	1.055	3.865***	2.011**	-0.750	-0.694	0.015	-0.543
p-value	0.004***	0.532	0.000***	0.049**	0.144	0.189	0.905	0.342
N	139	48	37	54	109	45	29	35

CDX.HY

	INCLUSION				EXCLUSION			
	Full Sample	Pre-Crisis	Crisis	Post-Crisis	Full Sample	Pre-Crisis	Crisis	Post-Crisis
$\Delta\overline{\beta}$	0.108	0.145	0.121	0.078	-0.159	-0.044	-0.338	-0.240
Std. Err	0.052	0.088	0.064	0.037	0.049	0.060	0.150	0.048
$\overline{\beta}_1$	0.562	0.507	0.697	0.552	0.621	0.485	0.740	0.739
$\Delta\overline{\beta}_i > 0$ (%)	59.65	65.52	63.33	54.22	34.21	45.28	33.33	22.45
t-stat	2.096**	1.101	1.625	1.645	-3.217***	-0.499	-2.401**	-4.603***
p-value	0.001***	0.053*	0.063*	0.144	0.000***	0.574	0.052*	0.000***
N	171	58	30	83	114	53	12	49

Appendix: The CDX.IG and CDX.HY exclusion and inclusion event issuers

Ser. is the index series in which the event occurred. Res. denotes the reason for each. For exclusions: *RC*=Rating Change, *CA*=Corporate Action, *U*=Undetermined. For inclusions: *E*=Eligible for at least six months before the inclusion, EC_r=Rating Eligibility Change - A rating change occurred during the prior six months that rendered the issuer eligible, EC_c=Corporate Action Eligibility Change - A corporate action occurred during the prior six months that rendered the issuer eligible.

CDX.IG					
Exclusion			Inclusion		
Issuers	Ser.	Res.	Issuers	Ser.	Res.
Amerada Hess Corporation	1	RC	ALLTEL Corporation	2	E
AT&T Wireless Services, Inc.	1	CA	CenturyTel, Inc.	2	E
Computer Associates International, Inc.	1	RC	CVS Corporation	2	E
Sun Microsystems, Inc.	1	RC	Intelsat, Ltd.	2	E
TOYS ”R” US, INC.	1	RC	Kerr-McGee Corporation	2	E
Visteon Corporation	1	RC	SUPERVALU INC.	2	E
Bombardier Capital Inc.	2	RC	AutoZone, Inc.	3	E
Citizens Communications Company	2	RC	BOMBARDIER INC.	3	EC_c
Electronic Data Systems Corporation	2	RC	Cardinal Health, Inc.	3	E
Intelsat, Ltd.	2	RC	Lennar Corporation	3	E
AT&T Corp.	2	RC	McKesson Corporation	3	E
BOMBARDIER INC.	3	RC	American Axle & Manufacturing, Inc.	4	E
Delphi Corporation	3	RC	Hilton Hotels Corporation	4	EC_r
The May Department Stores Company	3	RC	Lear Corporation	4	E
Eastman Kodak Company	4	RC	THE GAP, INC.	5	EC_r
FORD MOTOR CREDIT COMPANY	4	RC	IAC/InterActiveCorp	5	E
General Motors Acceptance Corporation	4	RC	Knight-Ridder, Inc.	5	E
Kerr-McGee Corporation	4	RC	Limited Brands, Inc.	5	E
MBNA Corporation	4	CA	MARSH & McLENNAN COMPANIES, INC.	5	E
Liberty Media Corporation	4	RC	RadioShack Corporation	5	E
Lear Corporation	4	RC	Sara Lee Corporation	5	E
Maytag Corporation	4	RC	Toll Brothers, Inc.	5	EC_r
SEARS ROEBUCK ACCEPTANCE CORP.	4	RC	Sabre Holdings Corporation	5	E
Albertson’s, Inc.	5	CA	AT&T Inc.	6	EC_c
American Axle & Manufacturing, Inc.	5	RC	CBS Corporation	6	EC_c
BellSouth Corporation	5	CA	Harrah’s Operating Company, Inc.	6	EC_c
Sprint Corporation	5	CA	SPRINT NEXTEL CORPORATION	6	EC_c
Harrah’s Operating Company, Inc.	5	CA	The Sherwin-Williams Company	6	E
Hilton Hotels Corporation	5	RC	Temple-Inland Inc.	6	E
SBC Communications Inc.	5	CA	Tribune Company	6	E
Viacom Inc.	5	CA	Valero Energy Corporation	6	EC_c
Valero Energy Corporation	5	CA	Verizon Communications Inc.	6	EC_c
Verizon Global Funding Corp.	5	CA	Wendy’s International, Inc.	6	E
ALLTEL Corporation	6	CA	ALLTEL Corporation	7	EC_c
Cendant Corporation	6	RC	R.R. Donnelley & Sons Company	7	E
Duke Energy Corporation	6	CA	Duke Power Company LLC	7	EC_c
Knight-Ridder, Inc.	6	RC	Embarq Corporation	7	E
SUPERVALU INC.	6	RC	Expedia, Inc.	7	EC_c
Tribune Company	6	RC	Residential Capital Corporation	7	E
Tyson Foods, Inc.	6	RC	Starwood Hotels & Resorts Worldwide, Inc.	7	EC_r
Wendy’s International, Inc.	6	RC	Olin Corporation	7	E
Clear Channel Communications, Inc.	7	RC	AT&T Mobility LLC	8	EC_c
Cingular Wireless LLC	7	CA	Boston Scientific Corporation	8	E
Duke Power Company LLC	7	CA	Duke Energy Carolinas, LLC	8	EC_c
EOP Operating Limited Partnership	7	RC	First Data Corporation	8	E
Residential Capital Corporation	7	CA	Residential Capital, LLC	8	EC_c
THE GAP, INC.	7	RC	J. C. Penney Company, Inc.	8	E
Harrah’s Operating Company, Inc.	7	RC	Radian Group Inc.	8	E
RadioShack Corporation	7	RC	Tyson Foods, Inc.	8	E
Sabre Holdings Corporation	7	RC	Universal Health Services, Inc.	8	E
Verizon Communications Inc.	7	CA	Verizon Communications Inc.	8	EC_c
ALLTEL Corporation	8	RC	Belo Corp.	9	E
Boston Scientific Corporation	8	RC	CVS Caremark Corporation	9	EC_c
CVS Corporation	8	RC	Quest Diagnostics Incorporated	9	E
Expedia, Inc.	8	RC	Darden Restaurants, Inc.	9	E
Federated Department Stores, Inc.	8	CA	Fortune Brands, Inc.	9	E
First Data Corporation	8	RC	GANNETT CO., INC.	9	E
Residential Capital, LLC	8	RC	The Home Depot, Inc.	9	E
Olin Corporation	8	RC	Liz Claiborne, Inc.	9	E
Temple-Inland Inc.	8	RC	Macy’s, Inc.	9	EC_c
Tyson Foods, Inc.	8	RC	iStar Financial Inc.	9	E
Alcan Inc.	9	CA	BRUNSWICK CORPORATION	10	E
Belo Corp.	9	RC	The Black & Decker Corporation	10	E

CDX.IG					
Exclusion			Inclusion		
Issuers	**Ser.**	**Res.**	**Issuers**	**Ser.**	**Res.**
Countrywide Home Loans, Inc.	9	RC	Comcast Corporation	10	EC_c
Comcast Cable Communications, LLC	9	CA	Kohl's Corporation	10	E
CENTEX CORPORATION	9	RC	Masco Corporation	10	E
IAC/InterActiveCorp	9	CA	M.D.C. Holdings, Inc.	10	E
Jones Apparel Group, Inc.	9	RC	The New York Times Company	10	E
Lennar Corporation	9	RC	RIO TINTO ALCAN INC.	10	EC_c
Pulte Homes, Inc.	9	RC	Viacom Inc.	10	E
BRUNSWICK CORPORATION	10	RC	BARRICK GOLD CORPORATION	11	E
Capital One Bank	10	CA	Capital One Bank (USA), National Association	11	EC_c
Federal Home Loan Mortgage Corporation	10	CA	ERP Operating Limited Partnership	11	E
Federal National Mortgage Association	10	CA	Mohawk Industries, Inc.	11	E
Liz Claiborne, Inc.	10	RC	Ryder System, Inc.	11	E
MeadWestvaco Corporation	10	RC	Staples, Inc.	11	E
Radian Group Inc.	10	RC	Time Warner Cable Inc.	11	E
RIO TINTO ALCAN INC.	10	CA	United Parcel Service, Inc.	11	E
Rohm and Haas Company	10	CA	XEROX CORPORATION	11	E
SPRINT NEXTEL CORPORATION	10	RC	XTO Energy Inc.	11	E
Washington Mutual, Inc.	10	Default	YUM! Brands, Inc.	11	E
Embarq Corporation	11	CA	Avnet, Inc.	12	E
GANNETT CO., INC.	11	RC	Boston Properties Limited Partnership	12	E
Starwood Hotels & Resorts Worldwide, Inc.	11	RC	CANADIAN NATURAL RESOURCES LIMITED	12	E
Limited Brands, Inc.	11	RC	Cisco Systems, Inc.	12	E
MBIA Insurance Corporation	11	RC	Dell Inc.	12	E
Mohawk Industries, Inc.	11	RC	Lowe's Companies, Inc.	12	E
The New York Times Company	11	RC	Pfizer Inc.	12	EC_c
iStar Financial Inc.	11	RC	THE TJX COMPANIES, INC.	12	E
Wyeth	11	CA	Vornado Realty L.P.	12	E
CIT Group Inc.	12	RC	DIRECTV Holdings LLC	13	EC_r
J. C. Penney Company, Inc.	12	RC	GATX Corporation	13	E
Macy's, Inc.	12	RC	Johnson Controls, Inc.	13	E
Masco Corporation	12	RC	Kinder Morgan Energy Partners, L.P.	13	E
Textron Financial Corporation	12	RC	Reynolds American Inc.	13	E
Weyerhaeuser Company	12	RC	UnitedHealth Group Incorporated	13	E
INTERNATIONAL LEASE FINANCE CORPORATION	13	RC	Freeport-McMoRan Copper & Gold Inc.	14	E
Wells Fargo & Company	13	CA	SLM Corporation	14	E
Burlington Northern Santa Fe Corporation	14	CA	Burlington Northern Santa Fe, LLC	15	EC_c
CenturyTel, Inc.	14	CA	CA, Inc.	15	E
Universal Health Services, Inc.	14	RC	CenturyLink, Inc.	15	E
Boston Properties Limited Partnership	15	CA	Berkshire Hathaway Inc.	16	E
Burlington Northern Santa Fe, LLC	15	CA	Capital One Financial Corporation	16	EC_c
Capital One Bank (USA), National Association	15	CA	Expedia, Inc.	16	EC_c
MOTOROLA, INC.	15	CA	Motorola Solutions, Inc.	16	E
Staples, Inc.	15	CA	Pitney Bowes Inc.	16	E
XL CAPITAL LTD	15	CA	Tyson Foods, Inc.	16	EC_r
XTO Energy Inc.	15	CA	XL Group Ltd.	16	EC_c
AT&T Mobility LLC	16	CA	Boston Scientific Corporation	17	EC_c
Capital One Financial Corporation	16	RC	Capital One Bank (USA), National Association	17	EC_c
R.R. Donnelley & Sons Company	16	RC	THE GAP, INC.	17	E
Northrop Grumman Corporation	16	CA	H. J. HEINZ COMPANY	17	E
Progress Energy, Inc.	16	RC	Macy's, Inc.	17	EC_r
THE TJX COMPANIES, INC.	16	CA	Nabors Industries, Inc.	17	E
Toll Brothers, Inc.	16	RC	Northrop Grumman Corporation	17	EC_c
The Black & Decker Corporation	17	CA	Beam Inc.	18	EC_c
Constellation Energy Group, Inc.	17	CA	Exelon Corporation	18	EC_c
Fortune Brands, Inc.	17	CA	Starwood Hotels & Resorts Worldwide, Inc.	18	EC_r
XL Group Ltd.	17	CA	XLIT Ltd.	18	EC_c
CA, Inc.	18	CA	Ford Motor Company	19	EC_r
GATX Corporation	18	CA	MeadWestvaco Corporation	19	EC_r
Sara Lee Corporation	18	CA	Staples, Inc.	19	E
Vornado Realty L.P.	18	CA	The Hillshire Brands Company	19	EC_c
CenturyLink, Inc.	19	RC	Genworth Financial, Inc.	20	E
CANADIAN NATURAL RESOURCES LIMITED	19	CA	Block Financial LLC	20	E
Kraft Foods Inc.	19	CA	Mondelez International, Inc.	20	EC_c
Dell Inc.	20	RC	Avon Products, Inc.	21	E
Genworth Financial, Inc.	20	CA	ASSURED GUARANTY MUNICIPAL CORP.	21	E
H. J. HEINZ COMPANY	20	RC	Genworth Holdings, Inc.	21	EC_c
SLM Corporation	20	CA	Weatherford International Ltd.	21	E
CIGNA Corporation	21	CA	Newmont Mining Corporation	22	E
Cisco Systems, Inc.	21	CA	The Procter & Gamble Company	22	E
Goodrich Corporation	21	CA	21st Century Fox America, Inc.	22	EC_c
News America Incorporated	21	CA	Weyerhaeuser Company	22	EC_r
Alcoa Inc.	22	RC	THE BOEING COMPANY	23	EC_c
Boeing Capital Corporation	22	CA	Beam Suntory Inc.	23	EC_r
Beam Inc.	22	CA	CVS Health Corporation	23	EC_c
CVS Caremark Corporation	22	CA	Freeport-McMoRan Inc.	23	EC_c
Freeport-McMoRan Copper & Gold Inc.	22	CA	Prudential Financial, Inc.	23	E
The Hillshire Brands Company	22	CA	Teck Resources Limited	23	E
Avon Products, Inc.	23	RC	APACHE CORPORATION	24	E
Genworth Holdings, Inc.	23	RC	CANADIAN NATURAL RESOURCES LIMITED	24	E
M.D.C. Holdings, Inc.	23	RC	Domtar Corporation	24	E
Safeway Inc.	23	RC	Enbridge Inc.	24	E
Beam Suntory Inc.	24	CA	Best Buy Co., Inc.	25	E
DIRECTV Holdings LLC	24	CA	General Motors Company	25	EC_r
Transocean Inc.	24	RC	Kraft Heinz Foods Company	25	EC_c
147			147		

CDX.HY

Exclusion			Inclusion		
Issuers	**Ser.**	**Res.**	**Issuers**	**Ser.**	**Res.**
Avaya Inc.	1	CA	ABITIBI-CONSOLIDATED INC.	2	E
BE AEROSPACE, INC.	1	CA	HCA Inc.	2	E
DEX MEDIA WEST LLC	1	CA	Iron Mountain Incorporated	2	E
FAIRFAX FINANCIAL HOLDINGS LIMITED	1	RC	NOVA Chemicals Corporation	2	E
Hasbro, Inc.	1	RC	Nextel Communications, Inc.	2	E
Smurfit-Stone Container Enterprises, Inc.	1	CA	Stone Container Corporation	2	EC_c
THE GAP, INC.	1	RC	TOYS "R" US, INC.	2	EC_r
TYCO INTERNATIONAL GROUP S.A.	1	RC	Tesoro Petroleum Corporation	2	EC_c
Tesoro Corporation	1	CA	The Premcor Refining Group Inc.	2	E
The Interpublic Group of Companies, Inc.	1	RC	Triad Hospitals, Inc.	2	E
WINN-DIXIE STORES, INC.	1	CA	VINTAGE PETROLEUM, INC.	2	E
Delta Air Lines, Inc.	2	CA	iStar Financial Inc.	2	E
Dobson Communications Corporation	2	CA	ArvinMeritor, Inc.	3	EC_c
Equistar Chemicals, LP	2	CA	CELESTICA INC.	3	E
Juniper Networks, Inc.	2	CA	Case New Holland Inc.	3	E
LIN Television Corporation	2	CA	FAIRFAX FINANCIAL HOLDINGS LIMITED	3	EC_c
Mandalay Resort Group	2	CA	MCI, Inc.	3	E
Sanmina-SCI Corporation	2	CA	Nalco Company	3	E
THE SHAW GROUP INC.	2	CA	Smurfit-Stone Container Enterprises, Inc.	3	EC_c
Caesars Entertainment, Inc.	3	CA	Tesoro Corporation	3	EC_c
Hilton Hotels Corporation	3	RC	Triton PCS, Inc.	3	E
IMC Global Inc.	3	CA	UnumProvident Corporation	3	E
J. C. Penney Company, Inc.	3	RC	ADVANCED MICRO DEVICES, INC.	4	E
MCI, Inc.	3	CA	BOMBARDIER INC.	4	EC_r
MILLENNIUM AMERICA INC.	3	CA	Citizens Communications Company	4	E
Nextel Communications, Inc.	3	RC	Delphi Corporation	4	EC_r
Nextel Communications, Inc.	3	RC	Intelsat, Ltd.	4	E
Stone Container Corporation	3	RC	Mosaic Global Holdings Inc.	4	E
Tesoro Petroleum Corporation	3	CA	Texas Genco LLC	4	E
iStar Financial Inc.	3	RC	Visteon Corporation	4	E
Collins & Aikman Products Co.	4	Default	Eastman Kodak Company	5	EC_r
Corning Incorporated	4	RC	Ford Motor Company	5	EC_r
Crown Castle International Corp.	4	CA	GENERAL MOTORS CORPORATION	5	EC_r
Cummins Inc.	4	RC	Lear Corporation	5	EC_r
PANAMSAT CORPORATION	4	CA	Liberty Media Corporation	5	EC_r
The Premcor Refining Group Inc.	4	RC	SunCom Wireless, Inc.	5	EC_c
Triton PCS, Inc.	4	CA	SunGard Data Systems Inc.	5	E
AMERICAN TOWER CORPORATION	5	RC	American Axle & Manufacturing, Inc.	6	EC_r
AmerisourceBergen Corporation	5	RC	BEAZER HOMES USA, INC.	6	E
CROWN EUROPEAN HOLDINGS	5	RC	DOMTAR INC.	6	E
Calpine Corporation	5	Default	Hovnanian Enterprises, Inc.	6	E
D.R. Horton, Inc.	5	RC	Huntsman International LLC	6	EC_c
DANA CORPORATION	5	Default	Massey Energy Company	6	E
Delphi Corporation	5	Default	Mirant North America, LLC	6	E
Huntsman International LLC	5	RC	NRG Energy, Inc.	6	E
MeriStar Hospitality Corporation	5	CA	Quebecor World Inc.	6	EC_c
Texas Genco LLC	5	CA	THE HERTZ CORPORATION	6	EC_r
VINTAGE PETROLEUM, INC.	5	RC	The Neiman Marcus Group, Inc.	6	EC_c
Case New Holland Inc.	6	CA	Avis Budget Car Rental, LLC	7	E
Dura Operating Corp.	6	Default	Cooper Tire & Rubber Company	7	E
Host Marriott, L.P.	6	CA	Host Hotels & Resorts, L.P.	7	EC_c
Hovnanian Enterprises, Inc.	6	CA	K. Hovnanian Enterprises, Inc.	7	EC_c
Liberty Media Corporation	6	CA	Liberty Media LLC	7	EC_c
R.J. Reynolds Tobacco Holdings, Inc.	6	CA	R.H. Donnelley Corporation	7	E
SERVICE CORPORATION INTERNATIONAL	6	CA	Reynolds American Inc.	7	EC_c
Starwood Hotels & Resorts Worldwide, Inc.	6	RC	Sanmina-SCI Corporation	7	E
UnumProvident Corporation	6	RC	Windstream Corporation	7	E
BOWATER INCORPORATED	7	CA	ARAMARK Corporation	8	E
FelCor Lodging Limited Partnership	7	CA	Clear Channel Communications, Inc.	8	EC_r
Houghton Mifflin Company	7	CA	Freescale Semiconductor, Inc.	8	EC_c
Iron Mountain Incorporated	7	CA	Harrah's Operating Company, Inc.	8	EC_r
Mosaic Global Holdings Inc.	7	CA	Idearc Inc.	8	E
NAVISTAR INTERNATIONAL CORPORATION	7	CA	Iron Mountain Incorporated	8	EC_c
PRIMEDIA Inc.	7	CA	RadioShack Corporation	8	EC_r
SINCLAIR BROADCAST GROUP, INC.	7	CA	Sabre Holdings Corporation	8	EC_r
SunCom Wireless, Inc.	7	CA	TXU Corp.	8	E
UNITED STATES STEEL CORPORATION	7	RC	The Mosaic Company	8	EC_c
XEROX CORPORATION	7	RC	UNIVISION COMMUNICATIONS INC.	8	EC_r
ARAMARK Corporation	8	CA	ALLTEL Corporation	9	EC_r
Delhaize America, Inc.	8	RC	ARAMARK Corporation	9	EC_c
Huntsman International LLC	8	CA	Community Health Systems, Inc.	9	E
Lucent Technologies Inc.	8	CA	First Data Corporation	9	EC_r
Parker Drilling Company	8	CA	Freeport-McMoRan Copper & Gold Inc.	9	E
Reynolds American Inc.	8	RC	GEORGIA-PACIFIC LLC	9	EC_c
Solectron Corporation	8	CA	Realogy Corporation	9	EC_c
Triad Hospitals, Inc.	8	CA	Residential Capital, LLC	9	EC_r
DOMTAR INC.	9	CA	Tribune Company	9	E
Georgia-Pacific Corporation	9	CA	Chemtura Corporation	10	EC_r
Lyondell Chemical Company	9	CA	Constellation Brands, Inc.	10	E
Quebecor World Inc.	9	CA	DIRECTV Holdings LLC	10	E
TEMBEC INDUSTRIES INC.	9	RC	Domtar Corporation	10	EC_c
THE WILLIAMS COMPANIES, INC.	9	RC	Energy Future Holdings Corp.	10	E
TXU Corp.	9	CA	STATION CASINOS, INC.	10	EC_c

CDX.HY					
Exclusion			Inclusion		
Issuers	Ser.	Res.	Issuers	Ser.	Res.
ALLTEL Corporation	10	CA	Boyd Gaming Corporation	11	E
Allegheny Energy Supply Company, LLC	10	RC	FRONTIER COMMUNICATIONS CORPORATION	11	EC_c
Citizens Communications Company	10	CA	Louisiana-Pacific Corporation	11	E
Freeport-McMoRan Copper & Gold Inc.	10	RC	Radian Group Inc.	11	EC_r
IKON Office Solutions, Inc.	10	RC	SPRINT NEXTEL CORPORATION	11	EC_r
The Mosaic Company	10	RC	Tyson Foods, Inc.	11	E
ABITIBI-CONSOLIDATED INC.	11	Default	Belo Corp.	12	E
Allied Waste North America, Inc.	11	RC	DISH DBS Corporation	12	E
CHARTER COMMUNICATIONS HOLDINGS, LLC	11	Default	Dean Foods Company	12	E
Chemtura Corporation	11	Default	GANNETT CO., INC.	12	EC_r
EchoStar DBS Corporation	11	CA	Lennar Corporation	12	E
Nortel Networks Corporation	11	Default	Limited Brands, Inc.	12	EC_r
STATION CASINOS, INC.	11	Default	Starwood Hotels & Resorts Worldwide, Inc.	12	EC_r
Smurfit-Stone Container Enterprises, Inc.	11	Default	Temple-Inland Inc.	12	E
Tribune Company	11	Default	The New York Times Company	12	EC_r
DIRECTV Holdings LLC	12	RC	BRUNSWICK CORPORATION	13	E
GENERAL MOTORS CORPORATION	12	Default	CIT Group Inc.	13	EC_r
Idearc Inc.	12	Default	GMAC Inc.	13	E
Lear Corporation	12	Default	Liz Claiborne, Inc.	13	E
R.H. Donnelley Corporation	12	Default	Macy's, Inc.	13	EC_r
Reliant Energy, Inc.	12	CA	RRI Energy, Inc.	13	EC_c
Six Flags, Inc.	12	Default	THE McCLATCHY COMPANY	13	E
Visteon Corporation	12	Default	Textron Financial Corporation	13	EC_r
CELESTICA INC.	13	CA	CSC Holdings, LLC	14	EC_c
CIT Group Inc.	13	Default	INTELSAT S.A.	14	EC_c
CSC Holdings, Inc.	13	CA	INTERNATIONAL LEASE FINANCE CORPORATION	14	EC_r
FAIRFAX FINANCIAL HOLDINGS LIMITED	13	CA	MBIA Inc.	14	E
Intelsat, Ltd.	13	CA	Weyerhaeuser Company	14	E
L-3 Communications Corporation	13	CA	iStar Financial Inc.	14	E
GMAC Inc.	14	CA	Ally Financial Inc.	15	EC_c
MGM MIRAGE	14	CA	MGM Resorts International	15	EC_c
Mirant North America, LLC	14	RC	SUPERVALU INC.	15	E
AMR Corporation	15	CA	Alcatel-Lucent USA Inc.	16	EC_c
BEAZER HOMES USA, INC.	15	CA	Caesars Entertainment Operating Company, Inc.	16	EC_c
Constellation Brands, Inc.	15	RC	GenOn Energy, Inc.	16	EC_r
Dole Food Company, Inc.	15	RC	Kinder Morgan Kansas, Inc.	16	EC_c
FLEXTRONICS INTERNATIONAL LTD.	15	RC	MBIA Insurance Corporation	16	EC_c
Harrah's Operating Company, Inc.	15	CA	MGIC Investment Corporation	16	E
MBIA Inc.	15	CA	Olin Corporation	16	E
Massey Energy Company	15	CA	Parker Drilling Company	16	E
Pride International, Inc.	15	CA	Pioneer Natural Resources Company	16	E
RRI Energy, Inc.	15	CA	The PMI Group, Inc.	16	E
Tyson Foods, Inc.	15	RC	Universal Health Services, Inc.	16	E
ArvinMeritor, Inc.	16	CA	Avis Budget Group, Inc.	17	EC_c
Avis Budget Car Rental, LLC	16	CA	Bausch & Lomb Incorporated	17	E
Domtar Corporation	16	RC	DYNEGY HOLDINGS, LLC	17	EC_c
Dynegy Holdings Inc.	16	CA	Health Management Associates, Inc.	17	E
Energy Future Holdings Corp.	16	CA	Meritor, Inc.	17	EC_c
GEORGIA-PACIFIC LLC	16	RC	R.R. Donnelley & Sons Company	17	EC_r
MEDIACOM LLC	16	CA	SEARS ROEBUCK ACCEPTANCE CORP.	17	E
Macy's, Inc.	16	RC	Seagate Technology HDD Holdings	17	E
Nalco Company	16	RC	Springleaf Finance Corporation	17	EC_c
Qwest Capital Funding, Inc.	16	RC	Sunoco, Inc.	17	EC_r
Temple-Inland Inc.	16	RC	Texas Competitive Electric Holdings Company LLC	17	EC_c
UNIVISION COMMUNICATIONS INC.	16	RC	Vulcan Materials Company	17	EC_r
DYNEGY HOLDINGS, LLC	17	Default	DELUXE CORPORATION	18	EC_r
Eastman Kodak Company	17	Default	Kinder Morgan, Inc.	18	EC_c
El Paso Corporation	17	CA	Liberty Interactive LLC	18	EC_c
Kinder Morgan Kansas, Inc.	17	CA	Norbord Inc.	18	E
Liberty Media LLC	17	CA	PHH Corporation	18	EC_r
Starwood Hotels & Resorts Worldwide, Inc.	17	RC	Pactiv Corporation	18	E
Textron Financial Corporation	17	RC	Sealed Air Corporation	18	E
The PMI Group, Inc.	17	Default	UNITED STATES STEEL CORPORATION	18	E
Ford Motor Company	18	RC	CCO Holdings, LLC	19	E
Liz Claiborne, Inc.	18	CA	CIT Group Inc.	19	E
Pactiv Corporation	18	CA	Calpine Corporation	19	E
Pioneer Natural Resources Company	18	CA	Fifth & Pacific Companies, Inc.	19	EC_c
Residential Capital, LLC	18	Default	Pactiv LLC	19	EC_c
CMS Energy Corporation	19	RC	CenturyLink, Inc.	20	EC_r
GenOn Energy, Inc.	19	CA	J. C. Penney Company, Inc.	20	E
Realogy Corporation	19	CA	PulteGroup, Inc.	20	E
Sanmina-SCI Corporation	19	CA	Realogy Group LLC	20	EC_c
Sunoco, Inc.	19	RC	Sanmina Corporation	20	EC_c
United Rentals (North America), Inc.	19	CA	UNITED RENTALS (NORTH AMERICA), INC.	20	EC_c
BOMBARDIER INC.	20	CA	BOMBARDIER INC.	21	EC_c
Bausch & Lomb Incorporated	20	CA	D.R. Horton, Inc.	21	EC_c
Belo Corp.	20	CA	Dell Inc.	21	EC_r
INTELSAT S.A.	20	RC	H. J. HEINZ COMPANY	21	EC_r
Limited Brands, Inc.	20	CA	L Brands, Inc.	21	EC_c
Saks Incorporated	20	CA	New Albertson's, Inc.	21	E
TRW Automotive Inc.	20	RC	THE RYLAND GROUP, INC.	21	EC_c
Weyerhaeuser Company	20	RC	The Jones Group Inc.	21	EC_c

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Exclusion			Inclusion		
Issuers	**Ser.**	**Res.**	**Issuers**	**Ser.**	**Res.**
Fifth & Pacific Companies, Inc.	21	CA	BEAZER HOMES USA, INC.	22	E
Health Management Associates, Inc.	21	CA	General Motors Company	22	EC_r
Host Hotels & Resorts, L.P.	21	RC	Kate Spade & Company	22	EC_c
SPRINT NEXTEL CORPORATION	21	CA	Sprint Communications, Inc.	22	EC_c
The Neiman Marcus Group, Inc.	21	CA	The Neiman Marcus Group LLC	22	EC_c
ARAMARK Corporation	22	CA	Aramark Services, Inc.	23	EC_c
Clear Channel Communications, Inc.	22	CA	Constellation Brands, Inc.	23	E
Kate Spade & Company	22	RC	Navient, LLC	23	EC_c
Texas Competitive Electric Holdings Company LLC	22	RC	Nine West Holdings, Inc.	23	EC_c
The Jones Group Inc.	22	CA	iHeartCommunications, Inc.	23	EC_c
Caesars Entertainment Operating Company, Inc.	23	Default	Avon Products, Inc.	24	EC_r
Dillard's, Inc.	23	RC	Genworth Holdings, Inc.	24	EC_r
FOREST OIL CORPORATION	23	CA	Navient Corporation	24	EC_c
Kinder Morgan, Inc.	23	CA	PPL Energy Supply, LLC	24	E
Navient, LLC	23	CA	Peabody Energy Corporation	24	E
RadioShack Corporation	23	Default	Sabine Oil & Gas Corporation	24	EC_c
Seagate Technology HDD Holdings	23	RC	Safeway Inc.	24	EC_r
BRUNSWICK CORPORATION	24	RC	CALIFORNIA RESOURCES CORPORATION	25	E
Constellation Brands, Inc.	24	CA	Communications Sales & Leasing, Inc.	25	E
Cooper Tire & Rubber Company	24	RC	DaVita HealthCare Partners Inc.	25	E
Dean Foods Company	24	CA	Dynegy Inc.	25	EC_r
GANNETT CO., INC.	24	CA	HD SUPPLY, INC.	25	EC_r
General Motors Company	24	RC	Iron Mountain Incorporated	25	EC_c
H. J. HEINZ COMPANY	24	RC	MarkWest Energy Partners, L.P.	25	E
Iron Mountain Incorporated	24	CA	SABINE PASS LIQUEFACTION, LLC	25	E
Levi Strauss & Co.	24	CA	T-Mobile USA, Inc.	25	EC_r
Norbord Inc.	24	CA	TEGNA Inc.	25	EC_c
PPL Energy Supply, LLC	24	CA	Talen Energy Supply, LLC	25	EC_c
Sabine Oil & Gas Corporation	24	Default	VALEANT PHARMACEUTICALS INTERNATIONAL, INC.	25	EC_r
Smithfield Foods, Inc.	24	CA	Whiting Petroleum Corporation	25	E
Windstream Corporation	24	CA	Windstream Services, LLC	25	EC_c
iStar Financial Inc.	24	CA	iStar Inc.	25	EC_c
197			197		