BARCLAYS

Quantitative Portfolio Strategy

13 June 2018

Liquidity Dispersion in the USD IG and HY Corporate Market

- **We use the proprietary Barclays bond-level liquidity measure, Liquidity Cost Scores (LCS®), to examine the patterns and drivers of liquidity dispersion for USD corporate bonds.**
- **In previous research, we have observed, and frequently commented on, the fact that both the average level and dispersion of LCS vary over time, sometimes dramatically, as happened during the global financial crisis of 2008.**
- **In this study, we rely on a historical dataset of LCS for about 200,000 actively quoted investment-grade and high-yield corporate bonds to address the following questions:**
  - What are the key determinants of the level and dispersion in transaction costs (as represented by LCS)?
  - What is the relationship between transaction costs and credit spread, both over time and cross-sectionally?
  - How do LCS vary by duration for IG and HY bonds?
  - Do differences in spreads fully capture differences in liquidity? If so, do IG and HY bonds with similar spreads have similar liquidity costs?
  - Do LCS demonstrate the same relationship with credit ratings as with spreads?

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Barclays Liquidity Cost Scores (LCS®)

Over the past decade, we have dedicated significant effort to the development of uniform, bond-level measures of liquidity, for a wide range of global fixed income markets. In a recent publication,[1] we reviewed the methodology behind LCS and some related metrics, as well as their applications for bond portfolio management. In addition, that report described a number of empirical studies made possible by LCS. Some of those focused on the dependence of liquidity on various bond characteristics, eg, OAS, and revealed wide variability of liquidity both cross-sectionally and over time. This has been illustrated in various exhibits in our monthly and weekly periodic reports summarizing liquidity dynamics in different markets.[2]

LCS represents the cost of an institutional-sized round-trip trade in a particular security. The principal data input into the LCS calculation is two-way bid-ask quotes provided by Barclays traders. There are two ways such quotes can be issued: as yield spreads over a Treasury benchmark (typical for USD IG Credit) or directly as bid and ask prices (most USD High Yield and non-USD credit). Depending on the type of the quote, LCS is calculated in two distinct, but conceptually identical, ways:

LCS = (Bid spread – Ask spread) x OASD	if bond is spread-quoted
LCS = (Ask price – Bid price) / Bid price	if bond is price-quoted

Thus, LCS captures transaction costs in a consistent way (the trading cost as a fraction of the bond's price), regardless of how the bond is quoted. For a bond not quoted in a particular month, we estimate LCS using a statistical (matrix) model that relies on the bond's characteristics and is calibrated on the universe of quoted bonds. Different versions of this model have been designed for different asset classes, to reflect the structural features and trading patterns typical for each market. These models not only enable us to provide full coverage of broad market indices but also help estimate LCS for non-index bonds ("extended coverage" models). Our experience in building these models has helped us quantify some intuitive relationships between bond characteristics and liquidity. For example, better liquidity (lower LCS) tends to be associated with short duration, low spreads, recent issues, and large notional amounts.

The relationship between LCS and spreads, which is an important part of this study, plays out in two dimensions: cross-sectionally and over time. The matrix models described earlier are applied cross-sectionally at a given point in time: they show, for example, how much higher the LCS for a bond trading at a spread of 200bp would be than that for a similar bond trading at 100bp. In addition, if we look at how spreads and LCS vary over time, we find that LCS tend to be higher in months when spreads are higher.

In this study, we look at both dimensions. In addition to tracking the level of LCS over time, we also examine the dispersion of LCS across the market. We have found that during periods of wide spreads – especially during the global financial crisis – not only is the LCS level elevated, but LCS become very widely dispersed. In other words, during a systematic, market-wide worsening of liquidity, the differences in liquidity from one bond to another become accentuated.

In this study, we seek a better understanding of what drives the dispersion of liquidity. Why is there much greater variation in some periods than in others? To answer this question, we need to fully understand the dependence of LCS on relevant bond characteristics, in the cross-section and over time. We focus on the role played by the two bond characteristics particularly

[1] *Measuring Bond-Level Liquidity: Liquidity Cost Scores (LCS)*, Barclays Research, 24 July 2015.
[2] For a recent example, see *LCS® Report - May 2018*, Barclays Research, 06 June 2018.

relevant for credit securities, namely duration and spread. We also address two questions that arise naturally from the main line of investigation. First, if spread is found to be a key indicator of liquidity, should we expect IG and HY bonds trading at similar spreads to have similar LCS? Second, could we use credit rating instead of spread to estimate liquidity?

To address these questions, we carry out an extensive empirical analysis of a dataset comprising bond-level LCS accumulated since 2007. To ensure that the results are not influenced by the properties of the matrix models used to estimate LCS for non-quoted bonds, we use only trader-quoted bonds.

The Dataset

In this study, we use monthly LCS data for actively quoted USD corporate bonds, both investment-grade and high yield, from January 2007 to April 2018. We include only bonds with an option-adjusted spread duration of at least 1 year and apply some additional filters.

The total number of observations in the dataset is 193,485, of which 125,085 are investment-grade bonds and 68,400 high yield. The number of bonds in the sample has followed an increasing trend since the onset of our data gathering process in January 2007.

Two key determinants of transaction costs in the corporate bond market are duration and spread. We therefore partition the dataset along both dimensions. For duration, we have chosen a rather coarse partition: 1-4 years, 4-8 years, and above 8 years. For spread, we use a finer division, starting with ranges of 50bp and then increasing cell width gradually at higher spread levels.

The composition of the IG and HY universes is quite different, in terms of both duration and spread. As shown in Figure 1, IG bonds are fairly evenly distributed across short (1-4 years), intermediate (4-8 years) and long (8 years and up) duration ranges, but there are very few long-duration HY bonds. A profile of the distribution of spreads in our sample is given in Figure 2. Obviously, the ranges of spreads covered by the two groups are very different. The large majority of IG bonds have spreads of 300bp or less; HY bonds span a much wider range from about 150bp to over 1,500bp.

The distributions of spreads and LCS can change significantly from month to month; we will demonstrate this in the following sections.

FIGURE 1

Number of LCS Observations by Duration Range, January 2007 – April 2018

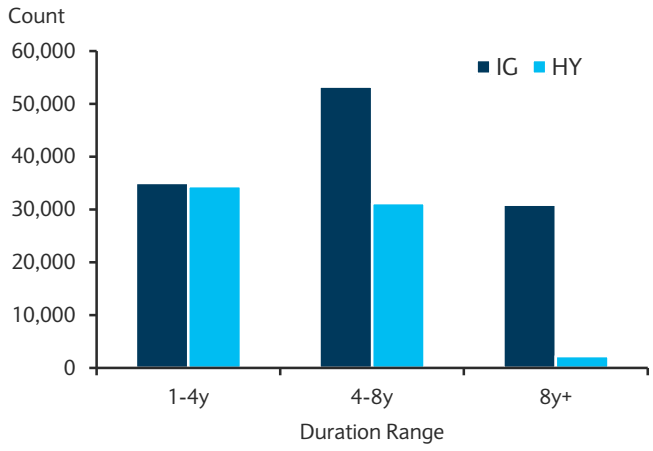
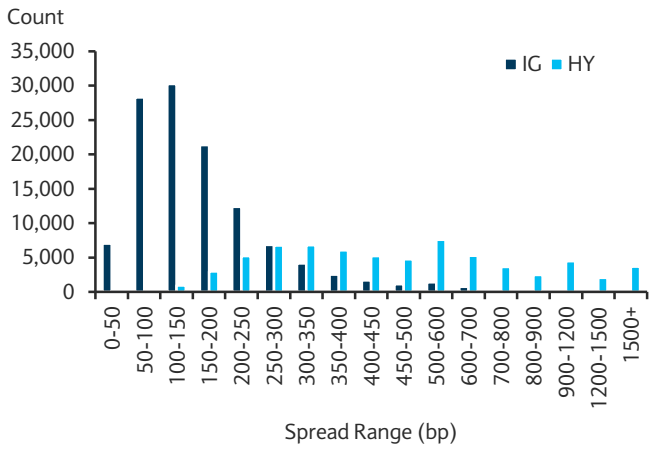


FIGURE 2

Number of LCS Observations by Spread Range, January 2007 – April 2018



Source for all figures in this report is Barclays Research.

Dependence of LCS on Duration

We now examine how LCS tends to vary with duration. We start by pooling the data from all months in the sample and then examine the distribution of LCS within each of the three broad duration cells defined in the previous section. Figures 3 and 4 show the effect of duration on the level and dispersion of liquidity, for IG and HY bonds, respectively.

For IG bonds, LCS increase almost linearly with duration. This is consistent with the fact that most quotes for IG bonds are spread quotes; if bid-ask spreads were identical for all bonds, then LCS would be precisely proportional to duration. For HY bonds, which are primarily quoted in price, LCS are more uniform, and if we translated the price differentials into spread differentials, they would tend to get higher – and more widely dispersed – at shorter durations. The range of LCS for the longest-duration IG bonds overlaps significantly with the range observed for HY bonds, in the vicinity of 1%. Besides the quoting convention, there is an additional, more fundamental, reason why the relationship between liquidity and duration of HY bonds is weak. As market participants know well, duration is a less important measure of risk in the HY market, where prices are more sensitive to expected default losses than they are to interest rates.

A brief note is in order about the way we present the dispersion statistics. In much of the financial literature, including our own research, the measures of choice are the mean, simple or market value-weighted, and the standard deviation. However, neither is very robust; both measures can be significantly distorted by a small number of outliers with extreme values. In a large universe of corporate bonds, there is always a small number of extremely illiquid bonds. Therefore, in this study, we have decided to use more robust statistical measures based on percentiles. We use the median LCS, rather than the average, as the key measure of the liquidity level for any group of bonds in a given period. Instead of the standard deviation, we use two percentile-based measures of dispersion. The interquartile range (IQR), ie, the difference between the 25th and 75th percentiles, represents the central range containing half of the observations. The interdecile range (IDR) is the difference between the 10th and 90th percentiles, emphasizing the width of the distribution (while excluding the extreme 10% at either end). These quantities are best represented by "box-and-whiskers" plots, and we use them throughout this report. The solid part of each bar represents the middle half of the distribution, from P25 to P75, so its height is equal to

FIGURE 3

Distribution of LCS by Duration Range, IG, January 2007-April 2018

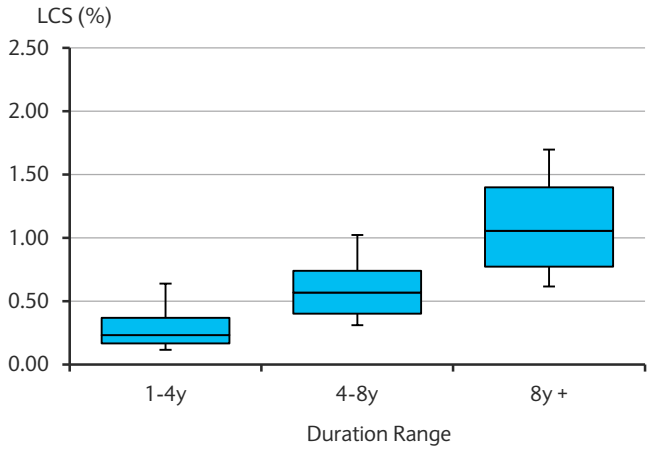
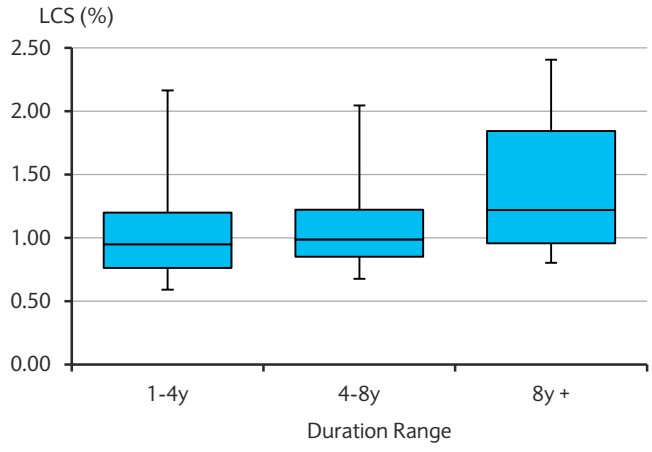


FIGURE 4

Distribution of LCS by Duration Range, HY, January 2007-April 2018



Note: The shaded areas indicate the range from the 25th to 75th percentile; the lines crossing the bars indicate the median LCS for each duration cell; the error bars indicate the 10th and 90th percentiles

the IQR. The crossing line of each bar shows the median of the distribution. The error bars extend upward to P90 and downward to P10, thus spanning the IDR. A clear advantage of this approach over the mean and standard deviation is that the asymmetry of the distribution becomes apparent as well. In the case of LCS, we see much more dispersion to the upside than the downside. We will use these measures to describe LCS dispersion.

To ensure that duration effects do not influence the results for HY bonds, we will restrict some parts of our analysis to the middle duration cell.

Dependence of LCS on Spread

We now look at the dependence of LCS on spread. As mentioned, to minimize the distortion from the duration effect, in this analysis we focus on the middle duration cell. LCS for bonds with durations of 4-8 years are pooled across all periods and partitioned by spread, for IG and HY respectively, in Figures 5 and 6.

We find a clear dependence of LCS on spread level in both IG and HY. There is also a tendency for the dispersion of LCS to increase at higher spread levels. (This is accentuated for the highest spreads found all the way to the right in Figure 6. We have to increase the width of the spread buckets gradually to keep them adequately populated, from 50bp at the lowest end to 100bp at the higher end and ultimately to 300bp for the very last bucket. A wider range of spreads naturally encompasses a wider range of LCS.)

These patterns may vary over time; spread buckets may be more densely populated in some months than in others. For example, Figures 7 and 8 show the distribution of LCS across spread ranges for December 2017, for IG and HY bonds, in two duration cells (only spread ranges with 20 or more bonds are shown). We find relatively little overlap in the spreads of IG and HY bonds. In the short duration cell, the only overlapping range is 100-150bp; in the medium duration cell, the two overlap also in only one range, 150-200bp. However, the patterns are quite different in the two cells. At short duration, LCS are consistently and significantly smaller for IG than HY. While both exhibit a dependence on spread, there is a clear disconnect between the two; even in the overlapping spread range, HY LCS tend to be double those of IG bonds. In the medium duration cell, the dependence on spread seems consistent, and there is a significant overlap of LCS values for IG and HY bonds with similar spreads.

FIGURE 5
Distribution of LCS by Spread Range, IG, Duration 4-8y, January 2007 – April 2018

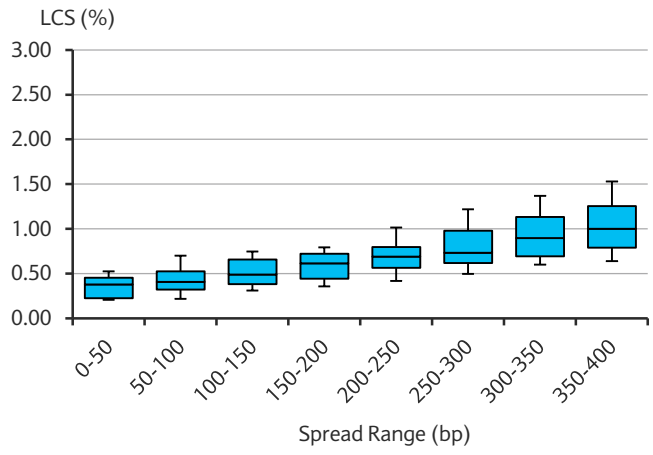


FIGURE 6
Distribution of LCS by Spread Range, HY, Duration 4-8y, January 2007 – April 2018

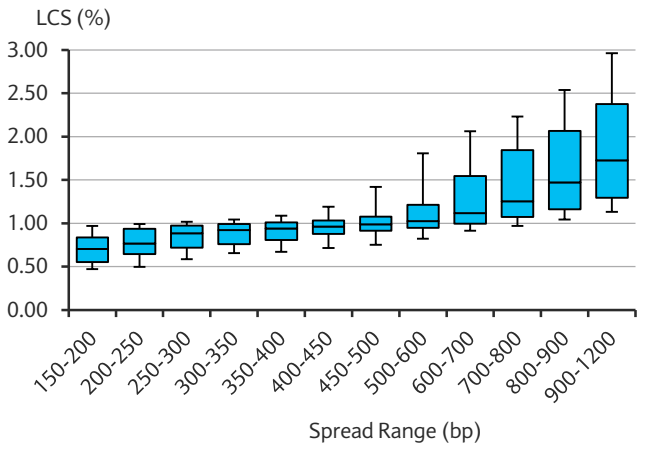


FIGURE 7
IG and HY, Short Duration Cell (1-4y), December 2017

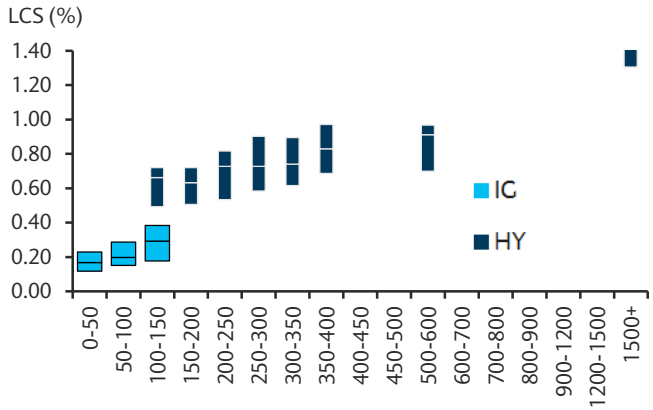
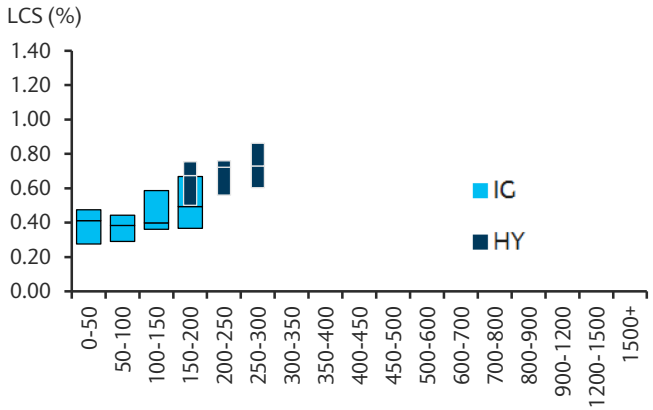


FIGURE 8
IG and HY, Medium Duration Cell (4-8y), December 2017



Examining the Dispersion of LCS

We now look at the extent to which the distribution of LCS varies over time. In particular, we compare the LCS distributions of IG and HY bonds in a recent month (April 2018) with the much wider ones experienced at the peak of the financial crisis, November 2008. As Figures 9 and 10 demonstrate, at the height of the crisis, LCS were not only unusually high but very widely dispersed as well.

Figure 9 shows the distribution of LCS as of the end of April 2018. LCS of most IG bonds are about 0.5%, and almost all of them are below 1%. LCS of HY bonds are more likely to be about 1% or somewhat higher.[3] Figure 10 depicts these distributions during the liquidity collapse of November 2008. The most common value of LCS for IG bonds was still about 1%, but for some IG bonds, they extended to 5% or even higher. For HY bonds, the distribution was even wider.

As we have seen earlier, there is a clear relationship between LCS and spreads. Might the increased dispersion in LCS be related to increased dispersion in spreads? Not only were LCS elevated and widely dispersed in late 2008; the same was true for spreads. Figures 11 and 12 show the distribution of OAS in these two months.

Instead of the histograms in Figures 9 through 12, we can employ box and whiskers plots to better illustrate the changes in these distributions. Figure 13 compares the LCS distributions for IG and HY at these two points in time, showing the median of each distribution as well as the ranges from the 25th to 75th percentile (IQR) and (using error bars) from the 10th to 90th percentile (IDR). These plots emphasize how much higher and wider the LCS distributions were in the crisis. Figure 14 does the same for the spread distributions. This figure makes it clear that the spread buckets in Figure 12 did not represent the full range of spreads for HY bonds in the crisis. Figure 12 shows that over half of the HY bonds fell into the highest spread bucket of 1500bp+, but does not reveal how much higher they went. Figure 14 shows that the 90th percentile of spreads was over 4000bp, meaning that 10% of the HY LCS were above that level!

[3] The scale of Figure 9 is not fine enough to give a detailed comparison of the distributions of LCS for IG and HY bonds as of April 2018; the scale was matched to Figure 10 to emphasize the contrast between the distributions in these very different market environments.

FIGURE 9
Distribution of LCS, IG and HY, April 2018

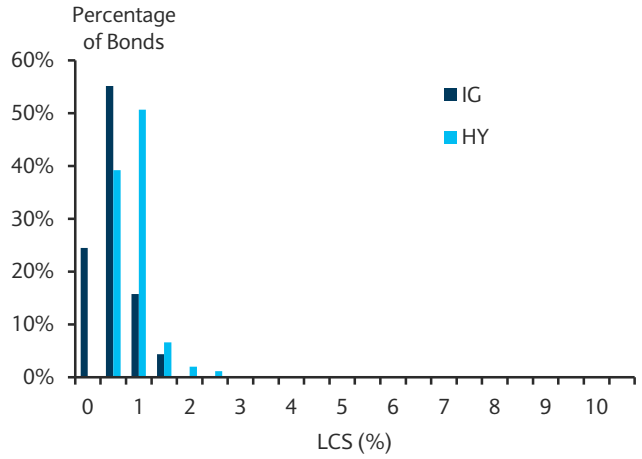


FIGURE 10
Distribution of LCS, IG and HY, November 2008

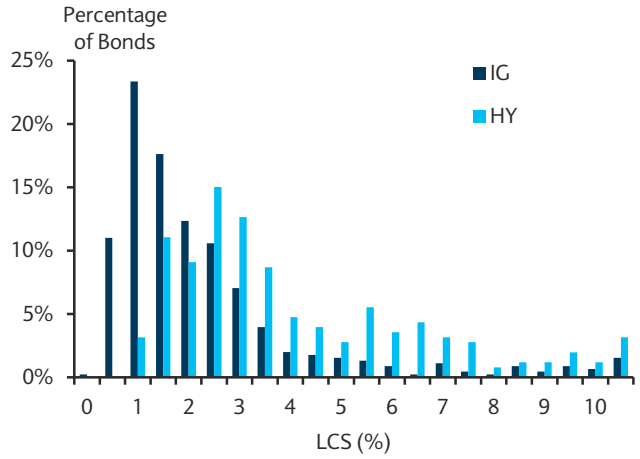


FIGURE 11
Distribution of OAS, IG and HY, April 2018

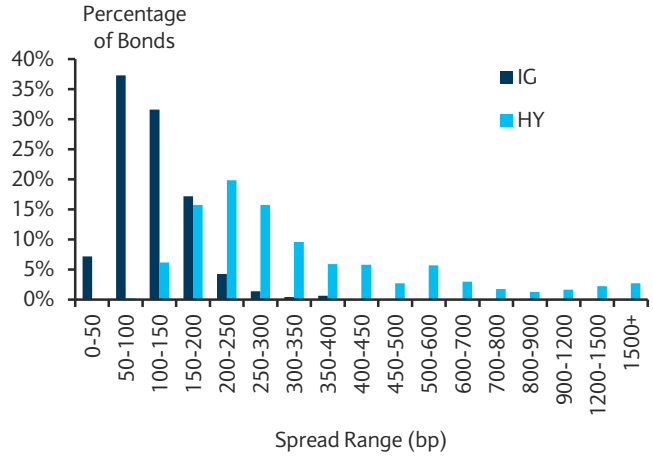


FIGURE 12
Distribution of OAS, IG and HY, November 2008

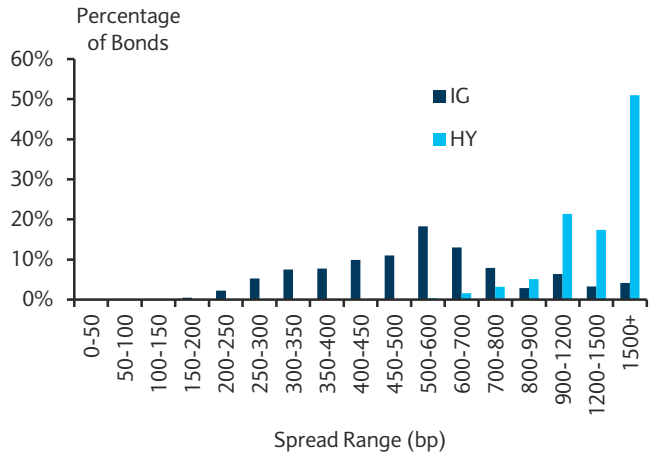


FIGURE 13
Distributions of LCS, IG and HY, April 2018 and November 2008

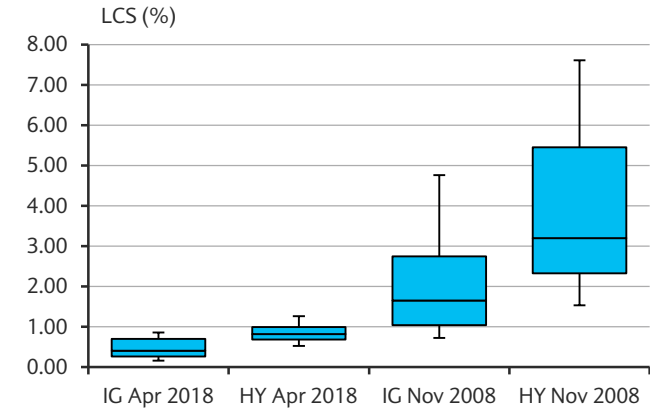
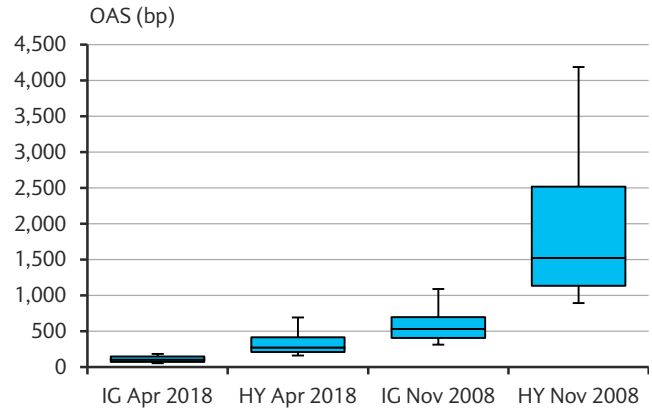


FIGURE 14
Distributions of OAS, IG and HY, April 2018 and November 2008



How much greater was the dispersion in the crisis? The scale of the plots in Figures 13 and 14 was expanded to accommodate the full range of values covered by HY bonds during the crisis; this makes it hard to see the details of the distributions for IG bonds in April 2018. However, if we take the ratios of the IDRs for LCS and spreads in these two months, we find that for IG

FIGURE 15
Time Variation of LCS and OAS: Median and Dispersion, IG, January 2007 – April 2018

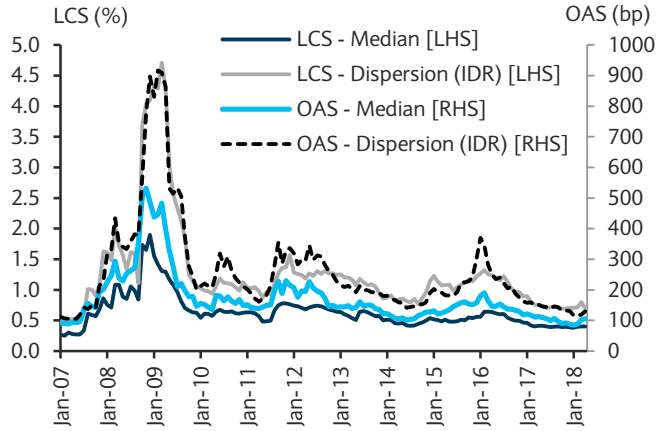
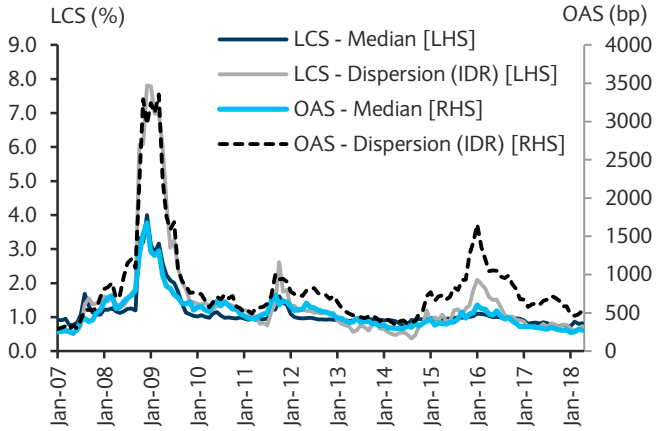


FIGURE 16
Time Variation of LCS and OAS: Median and Dispersion, HY, January 2007 – April 2018



bonds, the dispersion of LCS in November 2008 was 5.8 times that of April 2018, and the dispersion of OAS was 6.0 times larger – a remarkably similar ratio. For HY, the dispersion of OAS was 6.2 times larger in November 2008, while the LCS dispersion was 8.3 times larger.

Clearly, the liquidity crisis of 2008 was a unique event. We can look at the time series of LCS and spreads to see how their distributions have changed over the course of the study period. Figure 15 shows the time series of the median LCS, as well as its dispersion (measured by the IDR) for IG bonds, along with the same two measures for the spread distribution. All four measures spiked in the crisis and tend to move together over time; the correspondence between the median spread and median LCS is strong, and the correspondence between the spread dispersion and LCS dispersion is even stronger. A similar pattern is observed for HY bonds in Figure 16 (albeit at higher levels of both spread and LCS).

To confirm which relationship is the closest, we calculate correlations among the four quantities, shown in Figures 17 and 18. While all the correlations are very high, they are higher between the two dispersion measures (0.97 for IG, 0.95 for HY) than between the medians (0.96 and 0.91, respectively).

These numbers suggest a new, more nuanced understanding of liquidity dispersion. We have long known that the liquidity crisis was characterized by sharp increases in liquidity costs and dispersion. We now see that this is closely linked to the relationship between spreads and LCS: median spreads and spread dispersion increased in the crisis as well. Since high spreads are associated with high LCS, the wide dispersion of spreads is naturally accompanied by a wide dispersion in LCS. The distribution of LCS in a given spread range, however, can be fairly stable over time.

FIGURE 17
Time series correlations among medians and dispersions (P90-P10) of LCS and OAS, IG, January 2007 – April. 2018

	LCS (Med.)	OAS (Med.)	LCS Disp. (IDR)	OAS Disp. (IDR)
LCS (Med.)	1.00	0.91	0.97	0.90
OAS (Med.)	0.91	1.00	0.92	0.89
LCS Disp. (IDR)	0.97	0.92	1.00	0.95
OAS Disp. (IDR)	0.90	0.89	0.95	1.00

FIGURE 18
Time series correlations among medians and dispersions (P90-P10) of LCS and OAS, HY, January 2007 – April 2018

	LCS (Med.)	OAS (Med.)	LCS Disp. (IDR)	OAS Disp. (IDR)
LCS (Med.)	1.00	0.96	0.92	0.92
OAS (Med.)	0.96	1.00	0.93	0.94
LCS Disp. (IDR)	0.92	0.93	1.00	0.97
OAS Disp. (IDR)	0.92	0.94	0.97	1.00

To test this hypothesis, we can measure the median and the dispersion of LCS within each spread range and see how it changes over time (Figures 33 and 35). We see that the median and dispersion within each spread range are quite stable. For example, for medium-duration bonds with spreads of 200-250bp, neither the median LCS nor the LCS dispersion was substantially higher in 2008 than in subsequent years. The high-LCS portion of the bond universe corresponded to the high-spread portion.

Of course, this does not imply that high spreads are the cause of poor liquidity. In a liquidity crisis, it may well be the other way around: poor liquidity leads to high spreads.[4] Or, perhaps, both liquidity and spreads were reacting to increased uncertainty and pricing volatility. In any case, though, this analysis reinforces our confidence in using spreads to help estimate liquidity.

Crossover Bonds: How Different Is Liquidity for IG and HY Bonds with Similar Spreads?

We have now established that there is a clear relationship between spread and liquidity. We have also found a clear segmentation between the IG and HY markets. As we noted, HY bonds tend to be quoted on price, while the convention in IG markets is to quote bonds at a spread over Treasuries. This results in a much greater dependence of LCS on duration in IG than in HY.[5]

What does this imply for liquidity in the crossover range? In general, HY bonds trade at wider spreads than IG bonds. However, at any given point in time, there is some overlap in certain spread ranges, and the tightest HY bonds trade at spreads similar to those of the widest IG bonds. How should we expect the LCS levels for these two groups of bonds to compare?

The difficulty in studying this phenomenon is that it is a moving target. In each month, as corporate spreads widen and tighten, the crossover range may occur at different spread levels. We can explore this one month at a time, as we did in Figures 7 and 8, but then we are dealing with small populations of bonds, which makes it difficult to get accurate statistics. We can aggregate over time, but then different cells would contain observations from very different market environments. In Figures 19 through 24, we choose an intermediate level of aggregation, at the level of a single calendar year. We present results for the short and intermediate duration cells using all observations from 2016 (Figures 19 and 20), all of 2017 (Figures 21 and 22) and those from January through April 2018 (Figures 23 and 24).

[4] In fact, we have used LCS in a spread decomposition analysis that measures how much of a bond's spread is due to an illiquidity premium. For details, see *Decomposing Bond-Level Credit OAS into Default and Liquidity Components*, 8 July 2010.

[5] In a similar vein, we have explored the segmentation between these two markets in our earlier research on empirical duration (*Empirical Duration of Corporate Bonds and Credit Market Segmentation*, 25 January 2010). There, the difference in behavior was also closely linked to the different trading conventions in the two markets, with HY bonds trading on price and IG bonds trading at a spread to Treasuries. We have also seen this segmentation play a key role in the selling pressure experienced by Fallen Angel bonds (see *Fallen Angels: Characteristics, Performance and Implications for Investors*, 14 December 2010).

FIGURE 19

Interquartile Ranges of LCS by Spread Range (bp), IG and HY, Short Duration (1-4y), 2016

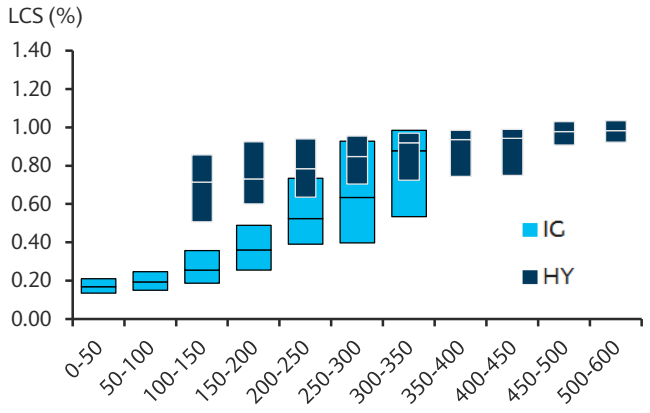


FIGURE 20

Interquartile Ranges of LCS by Spread Range (bp), IG and HY, Medium Duration (4-8y), 2016

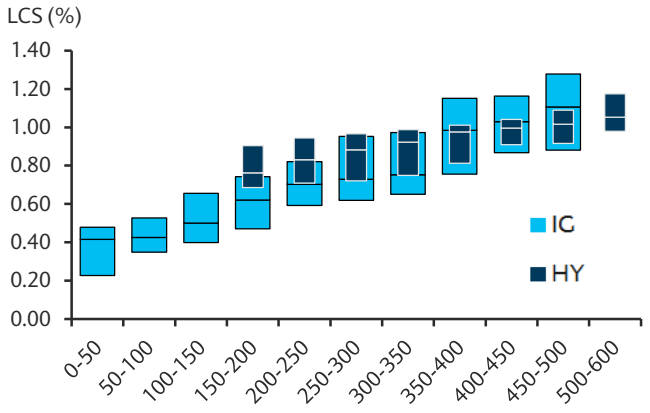


FIGURE 21

Interquartile Ranges of LCS by Spread Range (bp), IG and HY, Short Duration (1-4y), 2017

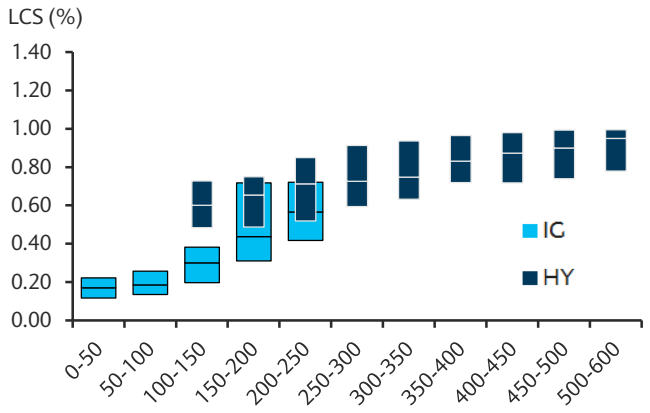


FIGURE 22

Interquartile Ranges of LCS by Spread Range (bp), IG and HY, Medium Duration (4-8y), 2017

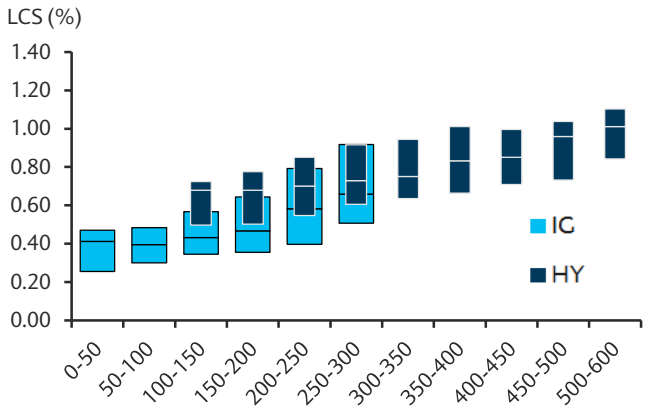


FIGURE 23

Interquartile Ranges of LCS by Spread Range (bp), IG and HY, Short Duration (1-4y), January-April 2018

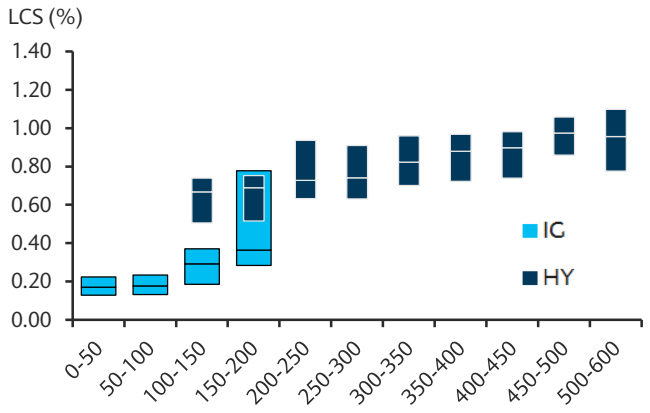
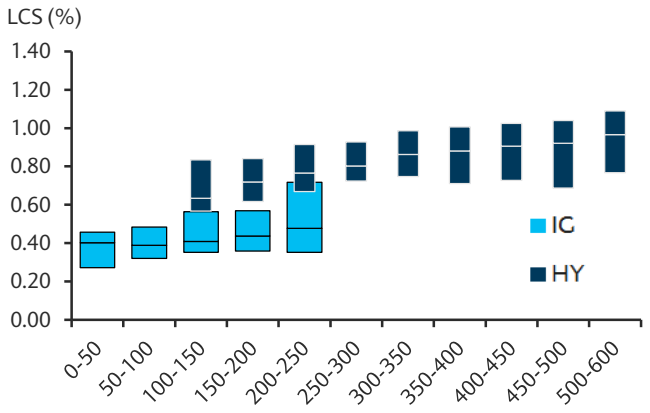


FIGURE 24

Interquartile Ranges of LCS by Spread Range (bp), IG and HY, Medium Duration (4-8y), January-April 2018



Note: Only spread cells with 50 or more observations are shown in Figures 19-22; and only 20 or more observations are shown in Figures 23 and 24

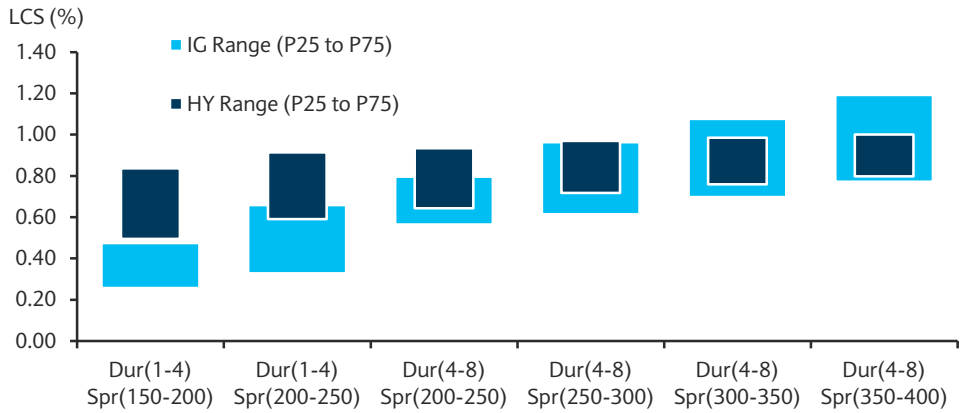
We find that at shorter durations (all the figures on the left-hand side), the tightest groups of HY bonds trade at significantly higher LCS levels than IG bonds with similar spreads. In the intermediate duration cell, however, this is not necessarily the case. There is significant overlap between the LCS of IG and HY bonds at similar spread levels, particularly at higher spreads. This is especially apparent for 2016, as shown in Figure 20, and less so for the more current market data in Figure 24. This is perhaps determined by how many distressed bonds still retain an investment-grade rating. These bonds often trade like HY even before their ratings are officially changed by the rating agencies.

The improvement in credit conditions in the IG market from 2016 to 2018 can be seen clearly in the progression from Figure 20 to Figure 24. The set of spread cells for which we have sufficient population of IG bonds extends to 500bp in 2016, 300bp in 2017, and 250bp for the first part of 2018. Similarly, the lowest spread cell for which we have a sufficient number of HY observations steps down in 2017 from 150-200bp to 100-150bp. As we move to lower spread cells, we see less overlap between the LCS distributions of IG and HY bonds.

There are a few cells sufficiently well populated over time in both the IG and HY markets for us to summarize the range of LCS over the full period. The interquartile ranges for these cells are shown in Figure 25. The two leftmost observations are for short durations; here, we find that for the same spread levels, LCS are typically lower for IG than HY. For the four rightmost observations, for different spread ranges within the intermediate duration range, we find a significant overlap between the LCS of IG and HY bonds with similar spreads.

FIGURE 25

Interquartile Range of LCS, IG and HY, the most populated spread/duration cells, January 2007-December 2017



Perhaps we can summarize the crossover behaviour of LCS as follows. Liquidity for HY bonds is intrinsically limited; HY LCS never go below a certain level. For IG bonds, liquidity can get substantially better when risk is low, and we can see this in two dimensions. For short-duration bonds, there can be especially big gaps in LCS levels between IG and HY bonds, especially as spreads get tight. Shortening duration will naturally pull down LCS for IG bonds, but not for HY. In longer duration cells, a similar effect can be seen for spreads. In wide spread cells, the LCS for IG and HY bonds largely overlap, but as we move to tighter spread buckets, LCS decrease by more for IG bonds than for HY, and the difference between the two becomes more prominent. One might say that while the widest-spread IG bonds may trade like HY, the tightest-spread HY bonds do not necessarily trade like IG.

Dependence of LCS on Credit Rating

We have chosen spread as the key variable on which to partition corporate bonds into categories with different liquidity characteristics. Could we have chosen to partition by credit rating instead, with similar results? If so, this might be a more desirable approach, since categories based on ratings are more stable and do not require a pricing source.

To answer this, we now partition our dataset by credit rating and examine the distributions of LCS within each rating. To minimize the effect of duration, we once again focus on the intermediate duration cell of 4-8 years. The results for IG bonds, pooled across the entire period of our study, are shown in Figure 26. We find that credit rating does not do a very good job of separating bonds with distinct liquidity characteristics. The median LCS starts increasing gradually only after the credit rating gets below A1, but the ranges of LCS of each rating tier are largely overlapping. In fact, LCS between 0.50% and 0.60% could be found in the central range of the distribution (IQR) for *any* IG rating. For comparison, Figure 27 (a reprint of Figure 5) shows the corresponding plot with the spread partitions. Here we see a much clearer differentiation among different liquidity tiers. For example, there is no overlap between the IQR for the 100-150bp range and those of any spread cell above 300bp. The two corresponding partitions of the HY bond market are shown in Figures 28 and 29 (a reprint of Figure 6). There is a marked increase in both median LCS and LCS dispersion as we move to the riskiest bonds at the rightmost part of each plot. However, in the less-risky range, while spread levels do distinguish among different levels of liquidity, rating tiers do not, as the distributions of LCS are nearly identical from BA1 through B1.

We also examine to what extent measuring liquidity in different cells at a given point in time can be applied to different spread environments. Figure 30 shows the IQR of LCS for each credit rating tier for two particular points in time: February 2016 and February 2018. Although just two years apart, the spread environment in these two months was very different; the median OAS within this set of bonds was 193bp in February 2016, vs. only 95bp in February 2018. The range of LCS within each rating tier is significantly lower in the lower-spread environment of 2018. Figure 31 shows the same set of bonds partitioned by spread range. Here, the primary effect of the lower-spread environment is that a different set of cells contains the majority of observations. However, within each cell, the typical ranges of LCS in the two periods are largely overlapping. For example, while a bond with a spread of 100-150bp was at the low end of the IG spectrum in February 2016 but at the high end in February 2018, in both cases an LCS of about 0.50% was typical.

FIGURE 26

Distribution of LCS by Credit Rating, IG, Duration 4-8y, January 2007-April 2018

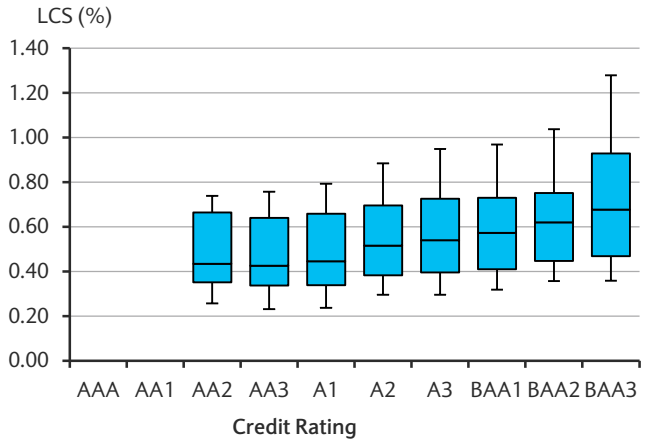


FIGURE 27

Distribution of LCS by Spread Range, IG, Duration 4-8y, January 2007-April 2018

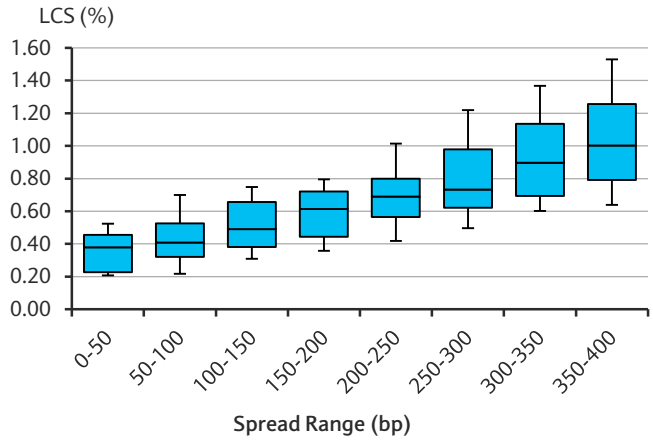


FIGURE 28

Distribution of LCS by Credit Rating, HY, Duration 4-8y, January 2007-April 2018

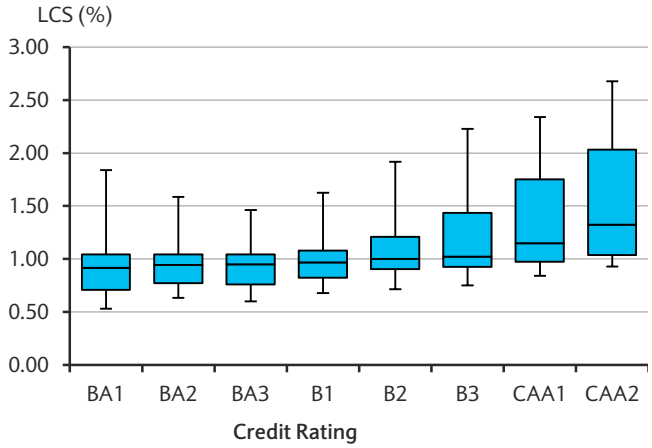


FIGURE 29

Distribution of LCS by Spread Range, HY, Duration 4-8y, January 2007-April 2018

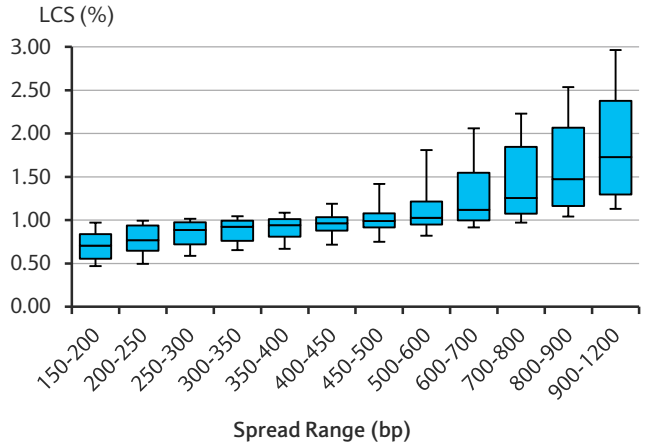


FIGURE 30

Interquartile Range of LCS by Credit Rating, IG, Duration 4-8y, February 2016 vs. February 2018

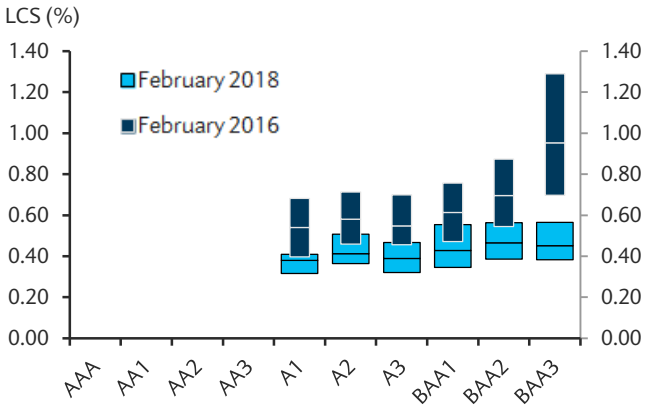
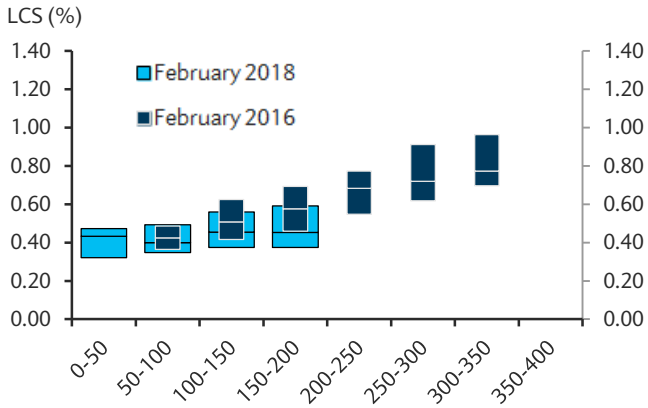


FIGURE 31

Interquartile Range of LCS by Spread Range, IG, Duration 4-8y, February 2016 vs. February 2018



This becomes even more obvious in Figures 32-35. We pool all observations of IG bonds of the intermediate (4-8y) duration cell by calendar year and then partition each year by spread range and by credit rating. We then plot the annual time series of the median LCS and the dispersion of LCS within each cell (again using the IQR). Rather than plot all of the cells shown in Figures 26-31, we choose a sequence of three different cells from each partition, to provide some spacing between them. Figure 32 shows that when we partition by credit rating, the median LCS in each rating tier varies over time far more than it does across ratings. Not only did LCS spike for all rating tiers during the financial crisis, but as shown in Figure 34, the dispersion of LCS within each tier spiked as well. By contrast, Figures 33 and 35 show that the median LCS and the LCS dispersion within each spread range remained relatively stable over time.

FIGURE 32

Median LCS for Selected Credit Ratings, IG, Duration 4-8y, Annual Pools, 2007-18

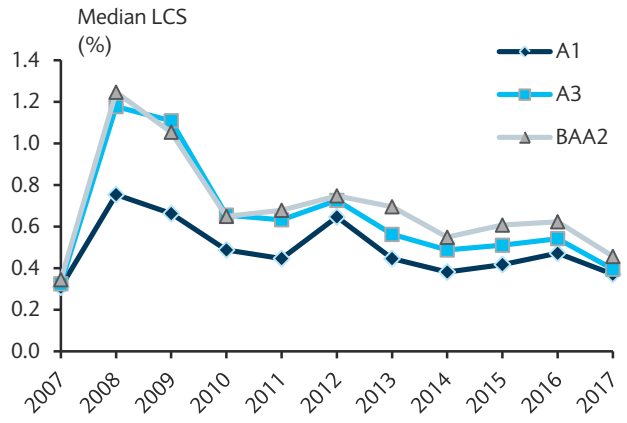


FIGURE 33

Median LCS for Selected Spread Ranges, IG, Duration 4-8y, Annual Pools, 2007-18

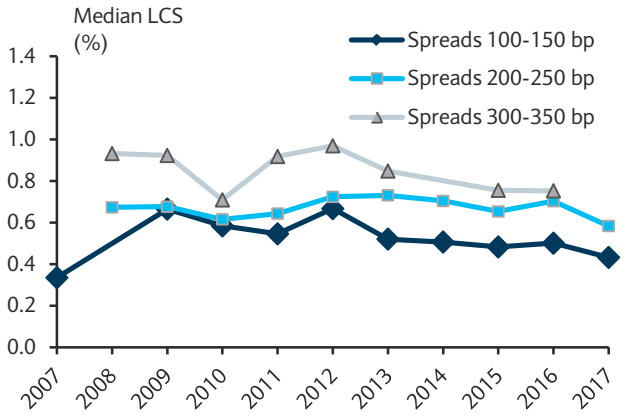


FIGURE 34

LCS Dispersion (IQR) for Selected Credit Ratings, IG, Duration 4-8y, Annual Pools, 2007-18

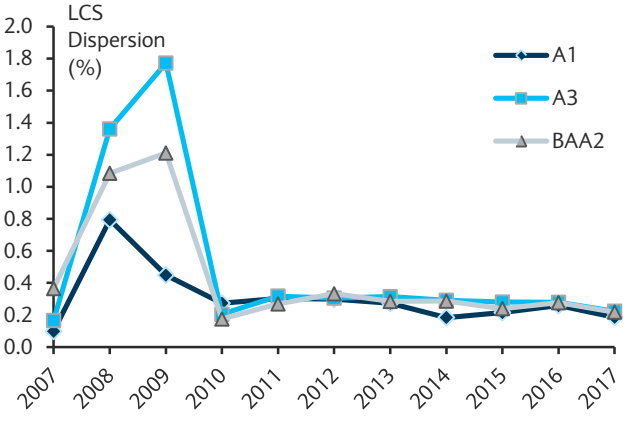
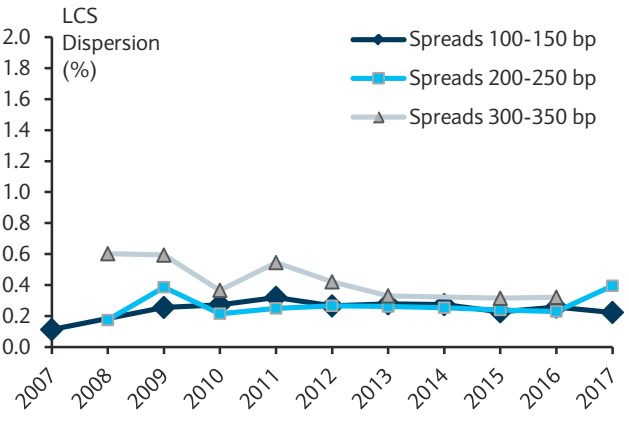


FIGURE 35

LCS Dispersion (IQR) for Selected Spread Ranges, IG, Duration 4-8y, Annual Pools, 2007-18



Conclusion

Our study has demonstrated a strong linkage between spread and liquidity. Bonds that trade at higher spreads at any particular time tend to have higher LCS, and in periods when spreads widen, LCS usually increase as well. LCS dispersion is also highly correlated with spread dispersion. This relationship does not imply causality; as in the proverbial chicken-and-egg problem, one can argue that each effect causes the other. Wider spreads indicate greater risk, and traders tend to demand larger safety cushions – bid and ask spreads – to protect themselves from the increased price volatility. Alternatively, one could argue that the illiquidity premium in itself is a component of spread. This was certainly true during the financial crisis of 2008, when the spreads of cash bonds widened much more than CDS spreads. There is a reason why the crisis is often referred to as "the liquidity crunch of 2008." We believe that both claims are true, and one does not negate the other. The Illiquidity premium can push spreads wider. In turn, wider spreads and higher volatility can widen bid-ask spreads.

Our examination of the distribution of liquidity costs in IG and HY bond markets reveals some commonality and some fundamental differences. At longer durations and higher spreads, IG and HY bonds with similar spreads tend to have LCS of similar magnitudes. However, as we move to less risky tiers of the market – shorter durations and (to some extent) tighter spreads – LCS come down faster for IG bonds. As a result, IG bonds in those tiers have significantly lower LCS than HY bonds with similar characteristics.

We have also confirmed that credit ratings are not good predictors of liquidity. This is not particularly surprising. Market participants know that spreads react to changes in bonds' risk instantaneously, while credit rating agencies tend to act with a considerable delay. This became particularly apparent during the crisis, when spreads of relatively high-rated issuers shot up deep into high yield territory; the LCS spikes in Figures 32 and 34 show this as well. Compared with credit ratings, spreads have a much stronger and more stable linkage to liquidity.

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