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# Liquidity: Barclays Bond-Level Liquidity Measure – LCS®

**Quantitative Portfolio Strategy**
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Liquidity is one of the most important, and widely used, characteristics of any market. Yet it means different things for different people and in different contexts. What's more, popular definitions of liquidity usually are difficult to quantify rigorously. Metrics that do exist are often market aggregates, eg, dealer inventories, total trading volume, the number of bonds traded, etc. However, a truly useful liquidity measure must be security-level. It can still be aggregated to market level, with an added advantage of flexibility in defining the "market". More importantly, it makes it possible to measure precisely, and manage, the liquidity of any particular bond portfolio or benchmark. It also makes it easy to factor in liquidity into a multitude of investment decisions: selecting a bond universe for portfolio rebalancing, monitoring desk inventories, testing feasibility of alpha strategies, quantifying liquidity risk, etc.

In 2009, Barclays created a bond-level liquidity measure, Liquidity Cost Score (LCS), that defines liquidity as cost of trading. More specifically, LCS measures the cost of an immediate, institutional-size, round-trip transaction and is expressed as a percent of the bond's price.

At the time of this writing, Barclays computes LCS for more than 20,000 fixed-income securities, with the total outstanding of $45trn, covering a broad range of asset classes. Figure 1 shows the current LCS coverage universe.

FIGURE 1
**LCS Market Coverage, as of October 2017**

| Index | Inception Date |
|---|---|
| USD Credit IG | Jan-07 |
| USD Credit HY | Jan-07 |
| USD IG Credit 144A (no reg rights) | Jan-07 |
| USD Treasuries | Nov-09 |
| USD TIPS | Jul-10 |
| USD Fixed Rate Agency MBS | Mar-10 |
| USD Emerging Markets | Feb-12 |
| | |
| Pan Euro Credit IG | May-10 |
| Pan Euro Credit HY | May-10 |
| Pan Euro Credit FRN | May-10 |
| GBP Corporate £100–200mn | May-10 |
| Pan Euro Agencies | May-10 |
| Pan Euro Local Authorities | May-10 |
| Pan Euro Treasuries | Feb-11 |
| Pan Euro Inflation Linked | Mar-11 |
| Global Covered Bonds | Sep-12 |
| Asia Pacific Treasury | Sep-13 |

Source: Barclays Research

Unlike exchange-traded equities, actual bond transaction data are not widely available. Besides, relatively few bonds trade on a daily basis. However, many more bonds are *quoted* on a daily basis. Accordingly, LCS relies on simultaneous two-way quotes issued by Barclays' traders to other market participants. This data set is quite extensive, as each day, traders post thousands of simultaneous, bond-level quotes for normal institutional transaction amounts. Any particular bank's bid-ask spread is unlikely always or even often to be the "effective" market, ie, the highest bid and lowest offer across all broker/dealers. As a result, LCS may overstate best-execution transaction costs, so should be treated as a conservative measure. However, given Barclays' material presence in fixed-income markets, most of the time, its bid-ask quotes are not too far from market levels.

Bonds are quoted on either spread or price; therefore, LCS can be expressed in one of the two, conceptually identical, ways:

$$LCS = (Bid\ spread - Ask\ spread) \times \mathrm{OASD}$$

$$LCS = \frac{Ask\ price - Bid\ price}{Bid\ price}$$

Trader quotes, collected on a daily basis, form the principal input into the proprietary LCS methodology. The modelling component of this methodology (tailored to different asset classes) deals primarily with two issues. The reliability of trader quotes may be uneven across bonds. Very actively traded issues are likely to be quoted at executable levels and uniformly among broker/dealers. Sometimes, however, these are bid-ask indications, not necessarily executable. The LCS methodology applies a number of criteria to distinguish between the two. The model widens quotes deemed indicative to ensure they are not too narrow compared with the "true" market. However, it never tightens them, in the spirit of keeping LCS a conservative measure.

The second, more challenging, problem is dealing with bonds that have no two-way trader quotes in a particular month. Even though such bonds are a minority in most markets, their bid-ask spreads must be estimated to ensure the full coverage of popular bond indices. The LCS methodology (again, adapted to different asset classes) relies on regression-based econometric models to establish a relationship between directly computed, "observed", LCS of quoted bonds and their various attributes, eg, issue size, sector, and trading volume, among others. It is reasonable to assume the same relationship holds for bonds not quoted in this month. Hence, the established relationship (regression coefficients) is used to estimate LCS of non-quoted bonds. As always, there are many nuances. The models apply a widening mechanism to reflect the non-quoted status of a bond, take into account whether a bond was quoted in previous months, etc.

Most attributes used in the LCS models are quite intuitive. For example, recent and large issues are usually cheaper to trade than seasoned and small ones, so bond age and issue size must be important. Still, however intuitive an attribute seems to be, we always seek empirical confirmation. The next few figures illustrate this. For example, Figure 2 segments the universe of trader-quoted credit bonds by age and issue size while controlling for maturity (hence, four tables). Two clear gradients emerge: LCS increases for older bonds and decreases for smaller issues, so there was a clear case for including these two attributes in the model.

FIGURE 2

**Average LCS by Issue Size and Age, USD IG Credit, October 2017**

| | Maturity: 1-5 (40.3% MV) | | | | Maturity: 5-10 (29.2% MV) | | | |
|---|---|---|---|---|---|---|---|---|
| | Age, yr | | | | Age, yr | | | |
| Size, $mn | <1 | 1-5 | 5-7.5 | 7.5+ | <1 | 1-5 | 5-7.5 | 7.5+ |
| <500 | 0.46 | 0.46 | 0.56 | 0.46 | 0.67 | 0.74 | 0.68 | 0.98 |
| 500-750 | 0.31 | 0.35 | 0.49 | 0.33 | 0.54 | 0.64 | 0.57 | 0.89 |
| 750-1,500 | 0.22 | 0.26 | 0.39 | 0.32 | 0.39 | 0.52 | 0.48 | 0.74 |
| 1,500-2,000 | 0.19 | 0.19 | 0.34 | 0.20 | 0.34 | 0.44 | | |
| 2,000-3,000 | 0.17 | 0.17 | 0.25 | 0.20 | 0.30 | 0.37 | | |
| >3,000 | 0.16 | 0.17 | 0.20 | | 0.28 | 0.30 | | |

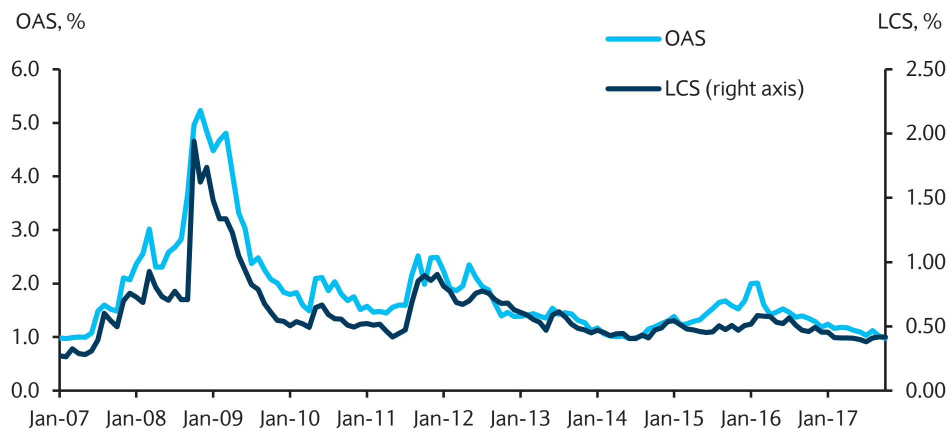
| | Maturity: 10+ (30.5% MV) | | | | Maturity: All | | | |
|---|---|---|---|---|---|---|---|---|
| | Age, yr | | | | Age, yr | | | |
| Size, $mn | <1 | 1-5 | 5-7.5 | 7.5+ | <1 | 1-5 | 5-7.5 | 7.5+ |
| <500 | 1.06 | 1.45 | 1.47 | 1.49 | 0.74 | 0.88 | 0.90 | 1.19 |
| 500-750 | 0.85 | 1.27 | 1.41 | 1.42 | 0.52 | 0.73 | 0.79 | 1.00 |
| 750-1,500 | 0.69 | 1.06 | 1.20 | 1.23 | 0.37 | 0.51 | 0.65 | 0.90 |
| 1,500-2,000 | 0.61 | 0.80 | 1.09 | 0.96 | 0.32 | 0.40 | 0.53 | 0.67 |
| 2,000-3,000 | 0.58 | 0.73 | 0.93 | 0.94 | 0.34 | 0.39 | 0.42 | 0.68 |
| >3,000 | 0.63 | 0.70 | | | 0.28 | 0.31 | 0.27 | 0.46 |

Buckets with fewer than 10 bonds are not shown. Source: Barclays Research

Another "common-sense" candidate for inclusion is spread. Indeed, Figure 3 demonstrates the stability and strength of this relationship.

FIGURE 3

**LCS vs. OAS, Trader-Quoted USD IG Corporates, January 2007-October 2017**

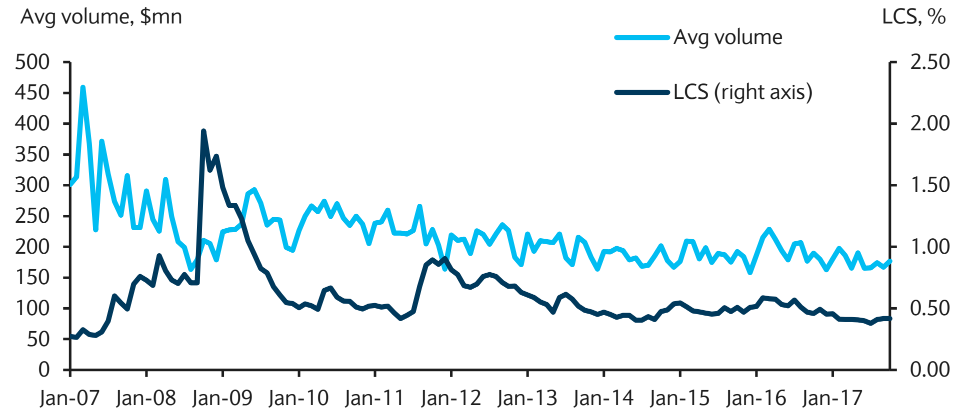



Source: Barclays Research

Not all seemingly intuitive attributes are necessarily highly correlated with liquidity. One example is trading volume, which is a popular indicator of market liquidity, often used in academic studies, as well by many practitioners. Yet when liquidity is defined as cost of trading, one should be careful. We found no discernible relationship (Figure 4) between the two – most of the time. In fact, even though one would assume volume and LCS to be negatively correlated, they occasionally move in concert. Only during the credit crisis of 2008-09 did LCS and trading volume exhibit a clear negative relationship.

FIGURE 4

**LCS vs. Trading Volume, Trader-Quoted USD IG Corporates, January 2007-October 2017**




Source: Barclays Research

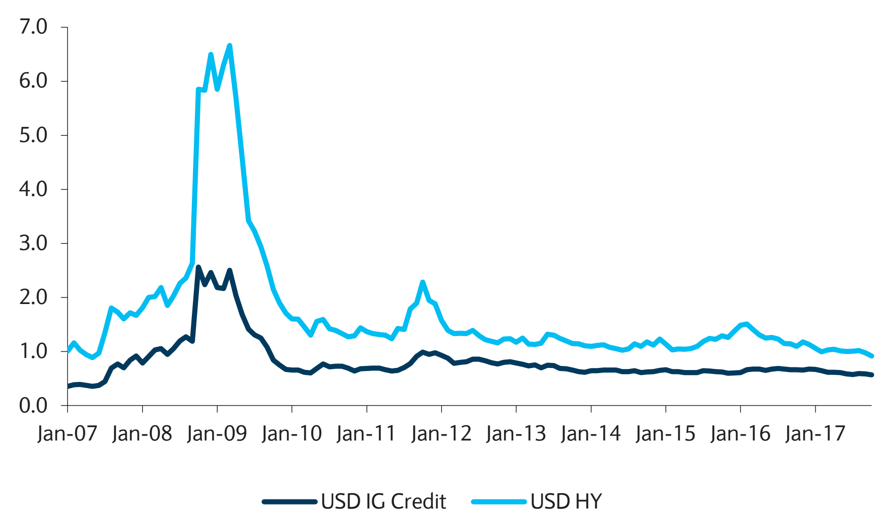
## Applications of LCS

LCS is now used by a number of money managers, plan sponsors, and regulators, for a variety of purposes. Next, we provide several examples pertaining specifically to bond portfolio management.

As mentioned before, a bond-level measure can be used for monitoring and analyzing market liquidity, while allowing full flexibility in defining the universe of interest, from large markets such as USD credit to very narrowly defined market segments suited for some particular inquiry. Investors often compare today's liquidity environment to various periods in the past. Aggregated to market level, LCS makes such comparisons rigorous, replacing qualitative opinions, often unsupported by evidence, with hard numbers. This is one of the reasons we have seen interest in LCS from regulators and central banks. Figure 5 shows historical LCS for USD IG and HY Credit.

FIGURE 5

**Time Series of USD IG and HY Credit LCS, %, January 2007-October 2017**




Source: Barclays Research

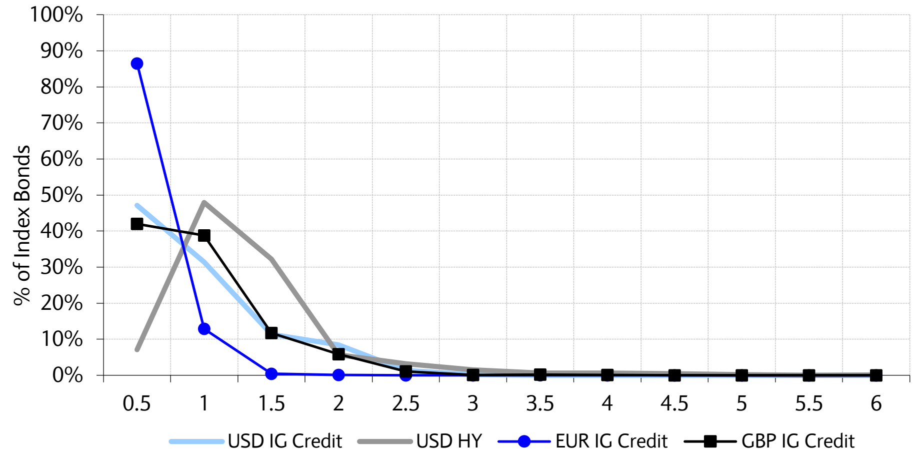
Contemporaneous, cross-sectional market analysis can be as illuminating as historical patterns. An intra-market distribution of LCS contains valuable information about market conditions, beyond simple statistics such as a market-value-weighted average or median.

Side-by-side distributions for different markets highlight differences between their liquidity conditions. Figure 6 shows October 2017 cross-sectional distributions of LCS for four major credit markets, USD IG and HY, EUR IG, and GBP IG. EUR IG credit, for example, is not only the most liquid "on average" but is heavily concentrated, with 99% of bonds with an LCS below 1.0. On the other hand, USD HY is not only the least liquid market in terms of LCS levels, but has the fattest tail as well.

Cross-sectional distributions for the same market at different points in time can be equally instructive. Figure 7, for example, shows cross-sectional distributions for two very different market environments: the pre-crisis month of July 2007, widely considered a time of very good market liquidity, and the turbulent November 2008. Today's liquidity conditions lie between the two extremes.

FIGURE 6

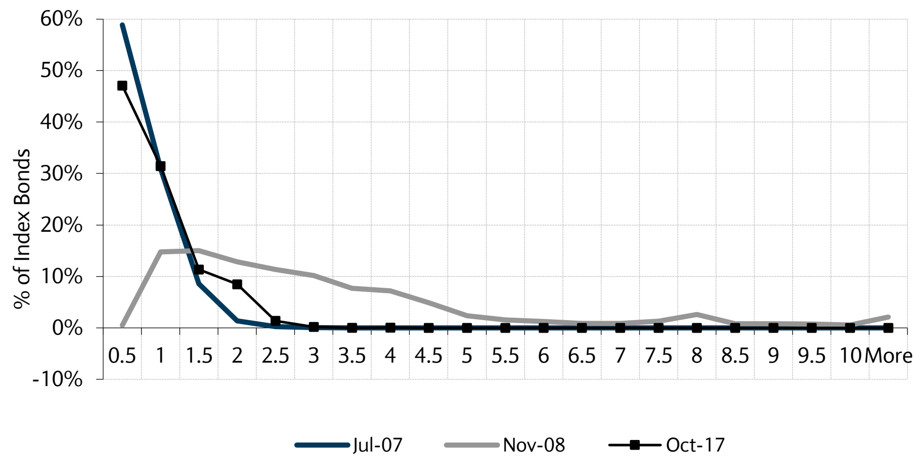
**Cross-Sectional LCS Frequency Distribution, October 2017**




Source: Barclays Research

FIGURE 7

**Historical Comparisons of Cross-Sectional LCS Frequency Distribution for USD IG Credit**




Source: Barclays Research

A bond-level liquidity measure lends itself naturally to portfolio structuring and benchmark replication. One of the challenges of managing a portfolio with a limited number of bonds against a broad market index is narrowing down the investable universe. The portfolio manager cannot evaluate thousands of bonds and must impose some selection constraints. Obviously, liquidity is always among them. Without a bond-level measure, one has to use multiple, indirect proxies for liquidity. Having one number for every bond in the index streamlines this process and makes it more robust. Once a liquid investable universe is in place, the manager can proceed to construct or rebalance a replicating portfolio without worrying about the feasibility of its implementation.

A good example is Barclays TCX baskets, liquid portfolios of relatively few bonds, structured to track their respective index. At the moment, six such baskets are produced on a monthly basis, summarized in Figure 8.

FIGURE 8

**Tradable Cash Credit Baskets (TCX) Scorecard; TE and TEV in bp, LCS in %**

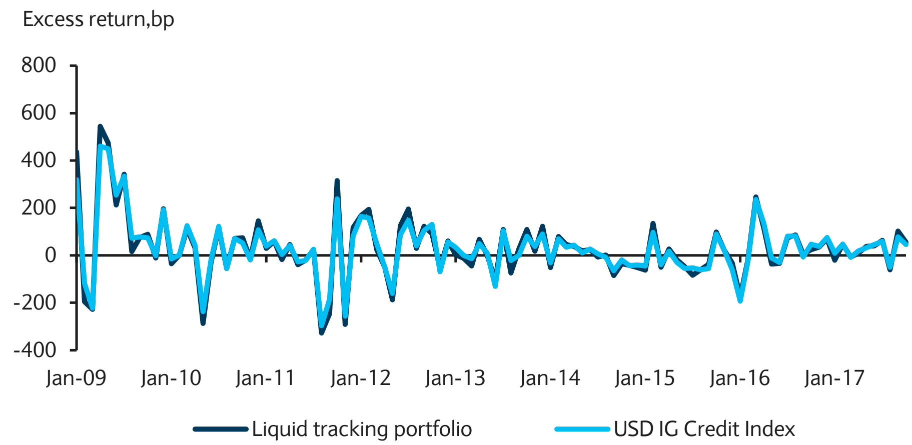
| | USD Credit | USD Long Credit | USD Corporate | EUR Credit | EUR Corporate | USD EM Corp |
|---|---|---|---|---|---|---|
| Inception | Feb-07 | Feb-07 | Feb-07 | Jun-10 | Aug-10 | Feb-12 |
| # of bonds | 50 | 36 | 50 | 48 | 40 | 28 |
| Rebalancing | Monthly | Monthly | Quarterly | Monthly | Quarterly | Monthly |
| | | October 2017 | | | October 2017 | |
| LCS | 0.334 | 0.657 | 0.359 | 0.193 | 0.214 | 0.390 |
| Index LCS | 0.566 | 1.047 | 0.603 | 0.302 | 0.332 | 0.527 |
| | | Since January 2009 | | | Since inception | |
| Avg. monthly TE | -0.4 | 2.9 | -1.1 | 0.9 | -1.4 | -11.2 |
| TEV | 27.4 | 39.3 | 34.5 | 12.6 | 25.7 | 48.4 |
| Index ExcRet Vol | 119.4 | 217.2 | 133.8 | 77.3 | 87.9 | 146.7 |

Source: Barclays Research

These replicating portfolios have tracked their benchmarks quite well while being consistently more liquid. Figure 9 shows the historical performance of the USD IG Credit TCX (vs. USD Credit Index). Since January 2009, it has tracked the index with an average monthly tracking error of just -0.4bp and a monthly tracking error volatility of less than a quarter of the index's excess return volatility (27bp/mo vs. 119bp/mo). In October 2017, the market value-weighted average LCS of the TCX basket was 0.334 vs. 0.566 of the index.

FIGURE 9

**USD Credit TCX and Credit Index Excess Returns, January 2009 – October 2017**




Source: Barclays Research

Some other applications of LCS, not covered in this introductory piece, include analyzing liquidity risk; the liquidity adjustment of VaR models; decomposing a bond's spread into risk premium, default, and liquidity components; and intra-market relative measures of liquidity.

LCS adds to bond investors' toolbox an objective and quantitative way to measure individual bonds' liquidity. A few LCS applications described here illustrate how fixed-income portfolio managers use this measure. LCS also provides valuable current and historical data for academics and policy makers studying and monitoring liquidity in bond markets.

**Selected Publications** (see p.10 in *LCS Report* for the complete list)


*Edelstein, A., S. Dastidar, and B. Phelps, April 2010,* Tradable Credit Portfolio (TCX) to Track the USD IG Credit Index, *Barclays Cross Asset Research*

*Dastidar, S., and B. Phelps, July 2010,* Decomposing Bond-Level Credit OAS into Default and Liquidity Components, *Barclays Cross Asset Research*

A Case Study: Constructing and Testing an Alpha Strategy Using LCS, *June 2011, LCS Report, Barclays Cross Asset Research*

*LCS Application: LCS-Adjusted Tail Risk, August 2011, LCS Report, Barclays Cross Asset Research*

*A Case Study: Dependence of Liquidity on Bond Age, April 2012, LCS Report, Barclays Cross Asset Research*

*Konstantinovsky, V., and B. Phelps, May 2012,* Implications of Constrained Broker/Dealer Inventories for Corporate Market Liquidity, *Barclays Cross Asset Research*

A Case Study: The Relationship between LCS Level and LCS Volatility, *June 2013, LCS Report, Barclays Cross Asset Research*

*Konstantinovsky, V., and B. Phelps, September 2014*, Corporate Liquidity across Markets, *Barclays Cross Asset Research*

*Konstantinovsky, V., and B. Phelps, March 2015,* Liquidity and Market Efficiency: Cash Corporates, ETFs, and CDX, *Barclays Cross Asset Research*

*Konstantinovsky, V., K. Y. Ng, and B. Phelps, July 2015,* Measuring Bond-Level Liquidity: Liquidity Cost Scores (LCS), *Barclays Cross Asset Research*

*Konstantinovsky, V., and B. Phelps, October 2015*, A Note on Daily LCS and the Recent Market Volatility, *Barclays Cross Asset Research*

*Konstantinovsky, V., and B. Phelps, October 2016,* Liquidity Dynamics of Newly Issued Bonds, *Barclays Cross Asset Research*

*LCS Report - September 2017*

*Weekly LCS Monitor, October 23 - 27*

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