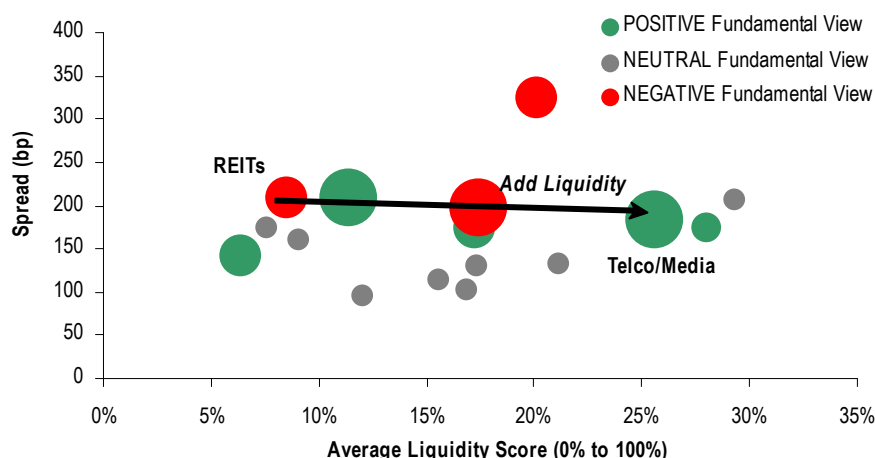


Liquidity Scores by Issue

Quantifying the hard to quantify

- **Overview:** It seems that every investor is very mindful of liquidity conditions in the current environment, but it is nonetheless quite difficult to get a sense of exactly how liquid any particular CUSIP actually is. In an effort to better incorporate liquidity into the investment decision-making process we compiled liquidity scores for approximately 6000 high-grade and high-yield issues.
- **Scoring Liquidity:** The liquidity factors that are used in our model are: (1) the number of block trades in the recent past, (2) the extent that trading activity is clustered, (3) the "quality" of block trades, (4) the diversity of trading activity, (5) and issuer spread volatility.
- **Scoring the GE 5.625s of '18:** To highlight our approach we score the GE 5.625s of '18, and find that this bond ranks fairly well despite the fact that it was issued back in '08 and carries a dollar price of about \$119! Don't take liquidity for a given or make undue assumptions, in our view.
- **Sector Relative Value:** For investors with a bias toward owning more liquid bonds, in the high-grade space we favor a rotation from REITs into telcos. From a fundamental perspective we believe that the telecom sector has a more favorable outlook relative to consensus expectations. In addition, the rotation increases liquidity dramatically without much spread give-up.

Figure 1. In the high-grade market we favor rotating from REITs into telcos to enhance fundamental prospects (vs. consensus) and liquidity at little spread giveup



Source: Citi Research, TRACE
Note: As of August 29, 2012

See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

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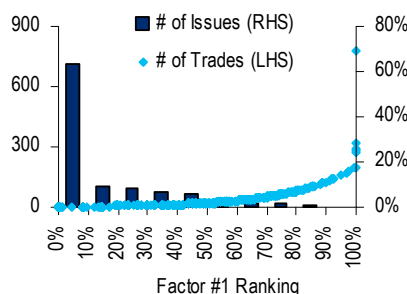
Liquidity Score by Issue

It seems that every investor is very mindful of liquidity conditions in the current environment, but it is nonetheless quite difficult to get a sense of exactly how liquid any particular CUSIP actually is, much less how it should be priced. Factors such as the number of TRACE trades, deal size, time since issuance, etc. are all helpful, but in our experience a bit lacking.

In an effort to better incorporate liquidity into the investment decision-making process we compiled liquidity scores for approximately 6000 high-grade and high-yield issues based on a five-factor model. We summarize model details in this article, and encourage readers with interest to contact us directly to discuss further.

The liquidity factors used in our model are: (1) the number of block trades in the recent past, (2) the extent that trading activity is clustered, (3) the “quality” of block trades, (4) the diversity of trading activity, (5) and issuer spread volatility. Throughout this article we use the GE 5.625s of '18 to illustrate our approach to scoring liquidity.

Figure 2. In our liquidity model with regard to Factor #1, few CUSIPs rank high while most rank below 20% (i.e., are illiquid)



Source: Citi Research, TRACE
Note: As of August 29, 2012; August IG constituents; block size of \$5mm+; top 5 issues excluded from scaling

- FACTOR #1 — absolute number of trades:** As a starting point, we begin by counting the number of block trades for each CUSIP over the past 60 trading days; note that we use 60 days because liquidity can be transient over time rather than static. A block trade is defined as \$5 mm+ in the high-grade space and \$1 mm+ in high-yield.

We scale trading activity for each CUSIP relative to others in the two markets. Using a logarithmic ranking, CUSIPs with the least trading activity are assigned a 0%, and those with the most activity are ranked 100%. As Figure 2 shows, the bulk of the TRACE eligible issues scored 20% or less.

The GE 5.625s of '18 traded 42 times in size over the past 60 trading days. This is a relatively high number in comparison to other IG index constituents (about 7 on average), and as such this issue receives a score of 66% in terms of the absolute number of trades.

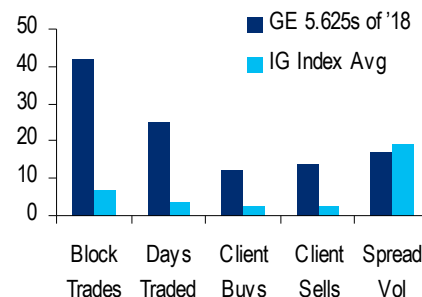
- FACTOR #2 — clustering of trades:** Any given bond has the potential to log a high number of trades on any given day — an earnings warning, an LBO announcement, speculation of a lawsuit, etc. could all prompt a flurry of activity. That said, we would argue that a flurry of activity on one day does not necessarily translate into liquidity on an “average” day.

Figure 3. By many liquidity metrics the GE 5.625s of '18 rank favorably

	GE 5.625s of '18	IG Index Average
No. of Block Trades	42	7
Days Traded	25	4
Client Buys	12	3
Client Sells	14	3
1Y Spread Vol	17 bp	19 bp

Source: Citi Research;
Note: From Jun 6 to Aug 29, 2012; trade size of \$5 mm+; spread vol as of Aug 29, 2012

Figure 4. By many liquidity metrics the GE 5.625s of '18 rank favorably



Source: Citi Research;
Note: From Jun 6 to Aug 29, 2012; trade size of \$5 mm+; spread vol as of Aug 29, 2012

To capture the consistency of trading activity we simply count the number of times in which at least one block trade took place over the past 60 trading days. The GE 5.625s of '18 traded in block size in 25 of the past 60 days, relative to 4 for the typical issue in the high-grade market. This translates into a score of 82% for Factor #2 (again, we rank the days traded using a logarithmic function).

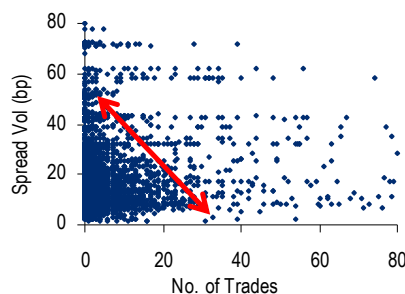
- **FACTOR #3 — quality of trading activity:** While the number of trades is important, in our view it is not an end-all measure of liquidity. That is, if the Street is simply punting an issue back and forth but there is no client activity involved, can the bond really be considered liquid? We would argue that client involvement should be taken into account, with more client activity consistent with a higher quality of trading activity.

To capture the quality of trading we calculate the ratio of trades that are attributable to end client buys and sells versus all trading activity, and then adjust it by Factor #1 (66%). We find that the GE '18s score a 41% in this regard $[(\text{client sells (14)} + \text{client buys (12)}) / \text{total number of trades (42)}] = 62\%$; $62\% * 66\% = 41\%$.

- **FACTOR #4 — diversity of trades:** In addition to trade quality we also believe that the diversity of trading activity is a meaningful consideration. The logic is that even if there is significant trading activity, if everyone is on the same side can one really expect to be able to move a bond without dramatically impacting valuations? A close balance between end investor buying and selling interest can be a sign of a more liquid bond, in our view.

In our model we consider the difference between client buys and sells as a percent of the total client activity (and we subtract this ratio from 1) and again use Factor #1 as an adjustment factor. With regard to our GE example, we find that the 5.625s of '18s exhibit diverse trading activity $[(\text{client sells (14)} - \text{client buys (12)}) / (\text{client sells (14)} + \text{client buys (12)})] = 8\%$; $1 - 8\% = 92\%$; $92\% * 66\% = 61\%$.

Figure 5. Spread volatility vs. number of block trades – less volatile issues tend to trade more



Source: Citi Research, TRACE
Note: As of August 29, 2012; August IG constituents; block size of \$5mm+; IG constituents only

- **FACTOR #5 — volatility:** Assuming that Factors 1 through 4 are equivalent, we also believe that in general less volatile issues tend to be a bit more liquid than more volatile ones (Figure 5). The obvious exception to this rule is when a rise in volatility increases the investor universe for a particular issuer, drawing from the distressed universe, equity accounts, etc. But away from this exception and all else equal we believe that risk-transfer ability is likely to increase if an issue is stable.

To capture this component we use our Quantitative Strategy team's volatility model, which essentially isolates the amount of each issuer's spread that can be attributed to mark-to-market risk ([Market-Implied Default Probabilities: Update](#) dated September 9, 2011). We rank each issue based on a scale of 0% to 100%, with 0% being the most volatile and 100% being the least volatile. Since the GE 5.625s of '18 have spread volatility of only 17 bp the issue receives a score of 88% for this metric.

Compiling the results

While we will not pore through model details such as factor weightings (again, we encourage those with interest to call directly), the five factors highlighted above translate into a fairly high liquidity score of 67% for the 5.625s of '18. In fact, the bond really doesn't "score" poorly in any of our liquidity categories, which is a bit surprising given that it was issued back in '08 and carries a dollar price of about \$119!

Even more interesting, in our view, is how sharply the scores can vary for the same issuer in the same maturity bucket (Figure 6). Again, the 5.625s of '18 log a score of 67%, while the 5.4s of '17 receive a liquidity score of only 30%. Do not take liquidity for a given!

Figure 6. How does the liquidity score of GE 5.625s of '18 compare to other issues of similar maturity?

	Liquidity Score	No. of Trades	Clustering	Quality	Diversity	Spread Vol
GE 2.3s of '17	80%	85%	91%	50%	66%	88%
GE 5.625s of '18	67%	66%	82%	41%	61%	88%
GE 2.9s of '17	56%	54%	64%	36%	47%	88%
GE 6.08s of '19	54%	53%	64%	39%	31%	88%
GE 5.25s of '17	48%	43%	50%	38%	40%	88%
GE 5.625s of '17	34%	30%	41%	23%	10%	88%
GE 5.4s of '17	30%	19%	41%	16%	20%	88%

Source: Citi Research, TRACE

Note: As of August 29, 2012; block trades of \$5mm+

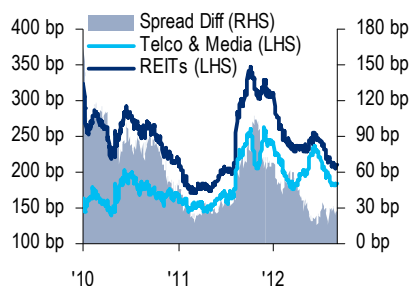
Using the data

In terms of putting our liquidity scores to use in the investment decision-making process consider relative value at the sector level. This process normally takes into account views on sector fundamentals and valuations, among others, but we are now able to incorporate liquidity into the equation. Below we highlight two sector rotation recommendations in the high-grade space, and we then outline a recommendation for high-yield investors.

REIT → Telecom, Banks → Insurance

In Figure 8 (next page) we present three sector considerations — valuations (y-axis), liquidity (x-axis), and our fundamental outlook (color and size of each dot). A green dot reflects a positive fundamental outlook for the sector relative to consensus expectations, red a negative view, and the larger the dot the more conviction we have on our outlook. We use a +2 to -2 scoring system, with a +2 representing a very favorable fundamental view and -2 the opposite.

Figure 7. Spread difference between REITs and telecoms is near multi-year lows



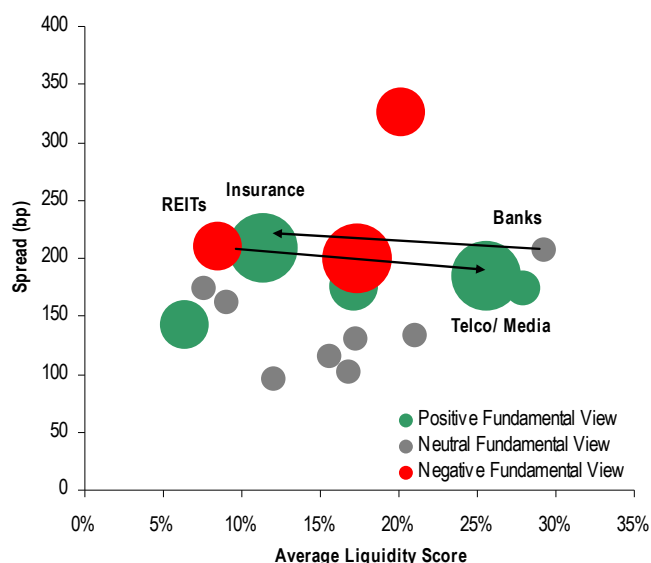
Source: Citi Research Note: As of August 31, 2012

- **Add liquidity:** Many investors have a bias toward owning more liquid bonds, and for such an investor one rotation that jumps out is a shift from REITs into Telcos (we acknowledge the completely different business models of the two sectors). First, from a fundamental perspective we strongly believe that telecom has a more favorable outlook relative to consensus expectations than the REITs sector (+2 for telecom vs. -1 fundamental score for REITs).

In addition, this rotation would increase liquidity by 18 percentage points (score of 26% for Telcos vs. 8% for REITs) and while there is a nominal spread give up of 27 bp (184 bp vs. 211 bp), the spread difference is at multi-year tight (Figure 7).

- **Sell liquidity:** In the current low-yield environment other investors are looking for opportunities to sell liquidity in an effort to boost yield and meet investment bogeys. For such an investor, consider a rotation from banks into insurance sector. Insurance is not a terribly liquid sector (10% vs. 28% for banks), but we like it better from a fundamental perspective and it is a lower-beta sector. And importantly, one gets paid for giving up liquidity in this space. On average insurance trades at a similar spread as the typical bank (209 bp vs. 207 bp), and the spread difference between the two sectors is at the one-year tight.

Figure 8. For investors looking to ADD liquidity move from REITs into telecoms; for those looking to SELL move from banks into insurance



Source: Citi Research, TRACE
Note: As of August 29, 2012

Figure 9. Key stats for more and less liquid sectors in the high-grade market

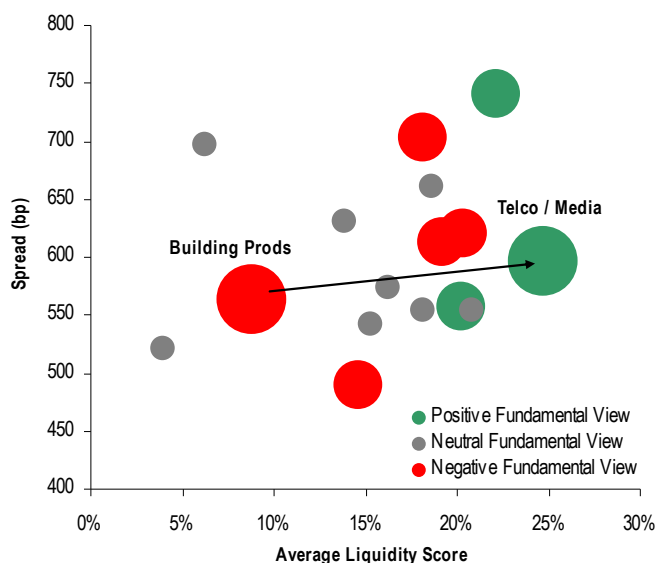
Sector	Liquidity Score	Price (\$)	Spread (bp)	Analyst View (-2 to 2)
Five More Liquid Sectors				
Banks	29%	109.1	207	0
Autos	28%	110.3	175	+0.5
Telco & Media	26%	117.7	184	+2
Technology	21%	112.4	134	0
Financial Svc	20%	108.6	327	-1
Five Less Liquid Sectors				
Insurance	11%	115.1	209	+2
Consumer Svc	9%	118.4	162	0
REITs	8%	111.5	211	-1
Transportation	8%	117.8	175	0
Utilities	6%	119.8	143	+1

Source: Citi Research, TRACE
Note: As of August 29, 2012

Out of HY builders, into HY telecoms

In high-yield market we believe that a rotation from the builders to the telecom space appears attractive from various vantage points (Figure 10). Again, we believe that telcos have a strong fundamental outlook versus consensus expectations, particularly so when compared to the builders (+2 vs. -2). The rotation would enable a modest uptick in spread (564 bp for builders vs. 598 bp for telcos), and the liquidity enhancement would be dramatic (9% vs. 25%).

Figure 10: Move from the building sector into telcos to enhance fundamentals (vs. consensus), boost spread and liquidity in high-yield



Source: Citi Research, TRACE
Note: As of August 29, 2012

Figure 11. Key stats for more and less liquid sectors in high-yield

Sector	Liquidity Score	Price (\$)	Spread (bp)	Analyst View (-2 to 2)
Five More Liquid Sectors				
Telco & Media	25%	103.4	598	+2
Technology	22%	101.9	741	+1
Autos	21%	104.9	554	0
Basic Materials	20%	102.0	621	-1
Financial Services	20%	96.8	558	+1
Five Less Liquid Sectors				
Manufacturing	15%	106.4	490	-1
Consumer Service	14%	102.6	632	0
Builders/Bldg Prod	9%	105.4	564	-2
Transportation	6%	101.3	698	0
REITs	4%	102.6	521	0

Source: Citi Research, TRACE
Note: As of August 29, 2012

Please note that this liquidity model is a work in progress and we will continue to refine/improve. We welcome any feedback on our methodology.

Appendix A-1

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