



SOCIETY OF ACTUARIES

**Investment Symposium
March 2012**

**P1: Liquidity Measurement & Management –
Theory and Practice**

**Jim Eibel
Max Golts
Bruce Phelps**

**Moderator
Chris Foote**



Investment
SYMPOSIUM
Managing Global Investment Challenges

Liquidity Measurement & Management-Theory and Practice

Actuaries
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FHLB Membership & Liquidity Management

Presented by:

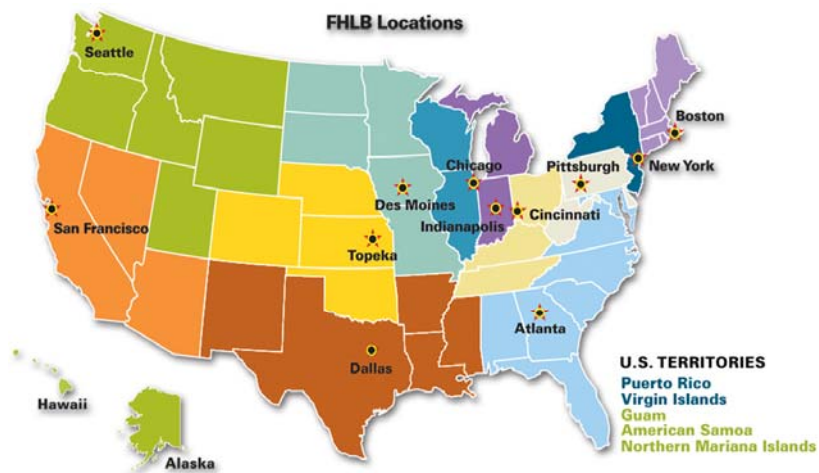
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About the Federal Home Loan Banks

- GSE created by FHLB Act of 1932 to provide liquidity to housing markets. Current mission includes community and economic development.
- 12 FHLBs are autonomous, member-owned financial services cooperatives
- Members/owners include banks, thrifts, credit unions, and insurance companies
- Individual banks linked by joint and several liability for repayment of System debt securities
- All consolidated obligations carry credit ratings from both Moody's (Aaa and P-1) and Standard & Poor's (AA+ and A-1+)

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FHLB Districts



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Insurers & the FHLBs' Mission

- Original signators of the Home Loan Bank Act
- Significant investors in
 - Residential mortgage assets
 - Section 42 LIHTC
- Direct lenders for community and economic development projects
- Charitable activities include support of affordable housing projects

Analysis of FHLB Membership

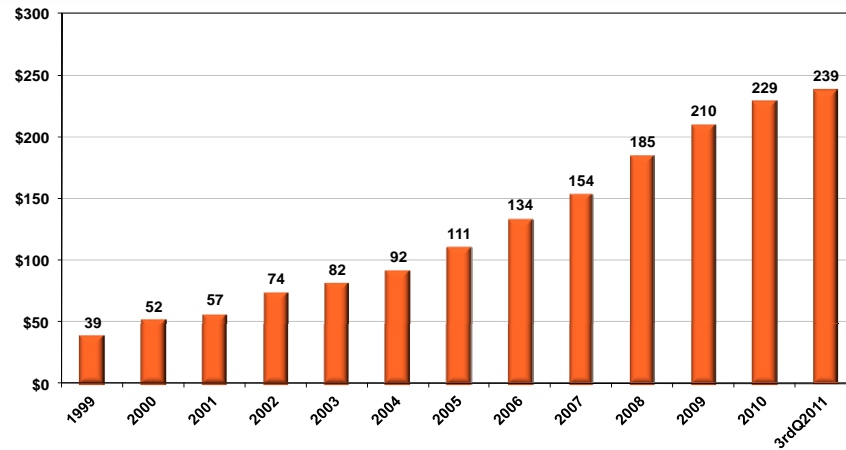
Costs

- Application process
- FHLBs vary in level of commitment to insurance sector
- Equity stake required
- Borrowings are collateralized

Benefits

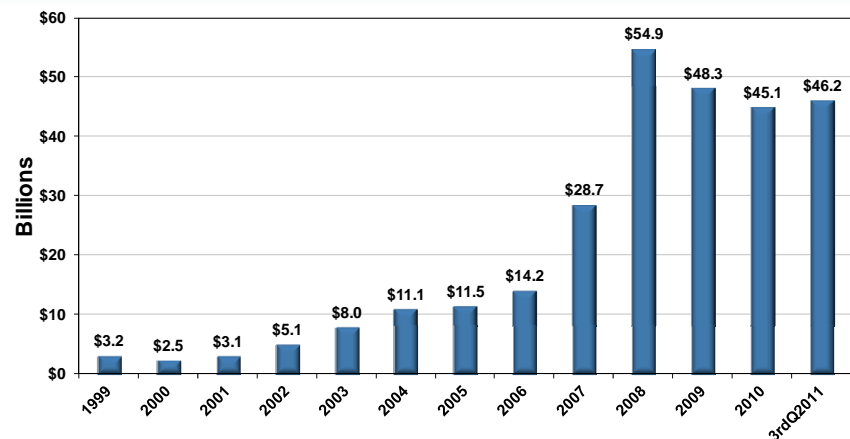
- Access to reliable low-cost funding
- Customized funding structures out to 30 years
- Access to long-term letters of credit

Insurance Company Membership



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FHLB System Insurance Advances

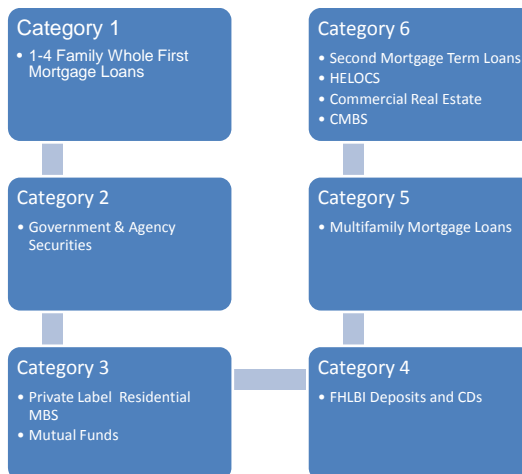


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Reliable Liquidity

- Access to global capital markets
- Cooperative structure
- Collateralized
- FHLBs maintain large cash positions for benefit of their membership

Eligible FHLBI Collateral



FHLB Borrowing Capacity

	FHLB Borrowing Capacity	*Average Borrowing Capacity by Institution
Life	\$811 billion	22.1%
Health	\$20 billion	16.0%
PC	\$231 billion	22.0%
Total Industry	\$1.06 Trillion	21.2%

*Based on 12/31/10 admitted assets and current FHLBI collateral haircuts.

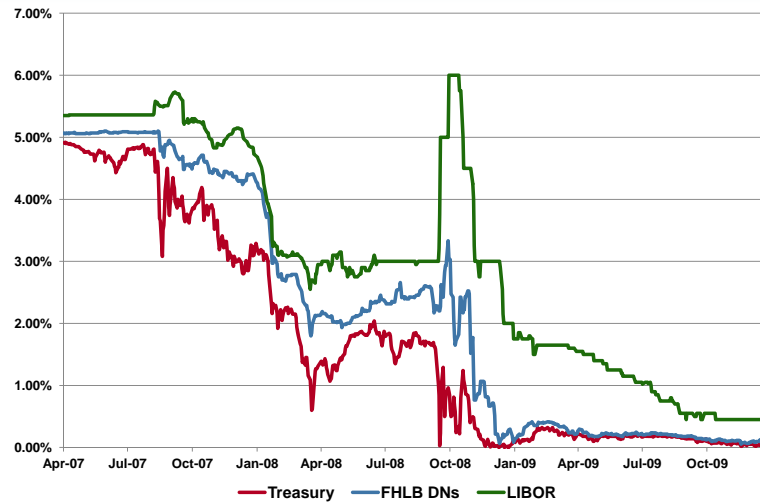
Stress Test Performance

“During the recent liquidity crisis, money market investors ran away from debt issued or sponsored by depository institutions...”

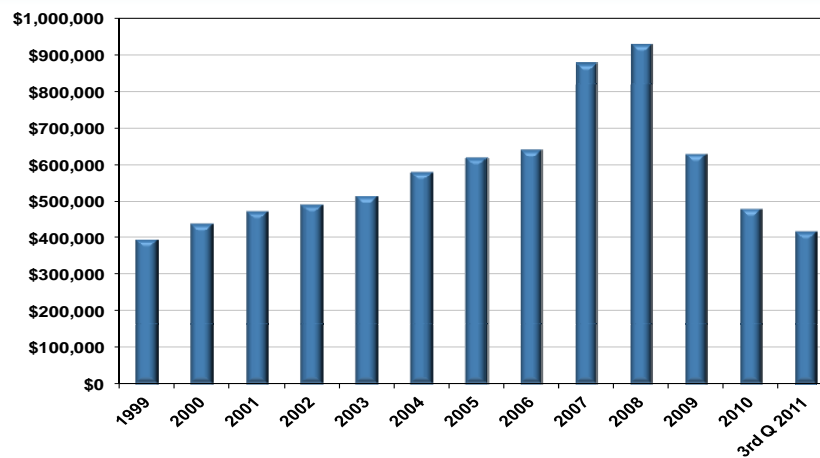
“By issuing implicitly guaranteed debt, the FHLB System was able to re-intermediate term funding to member depository institutions through advances.”

“The Federal Home Loan Bank System: The Lender of Next-to-Last Resort,” Federal Reserve Bank of New York Staff Report no. 357, November 2008, p. 3.

Three Month MM Rates



Total Advances



AM Best's Perspective

"FHLB programs provide financial flexibility for insurance company members and are an attractive source of capital due to the low rate offered for advances."

"A.M. Best's Perspective on Operating Leverage,"
Ratings Methodology, January 12, 2012.

FHLB Liquidity Strategies

#1 Back-up Liquidity

- Augment and/or replace existing facilities
- Liquefy relatively illiquid assets
- Fund unexpected liquidity needs without selling earning assets
 - Avoid fire sales
 - Manage capital gains and losses
- Incorporate into ERM and rating agency presentations

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#2 Adopt More Aggressive Posture

- Actively reduce cash and liquidity balances
- Invest proceeds in higher yielding, collateral-eligible assets
- Remain fully-invested and borrow, as needed, to fund shortfalls

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#3 Actively Use for Tactical Funding

- Take advantage of low rate environment to lock in term financing to fund working capital
- Opportunistic matched trades
- Utilize FHLB borrowings to assist in financing:
 - New facilities (CICA Program)
 - M&A
 - Etc.

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#4 Improve Spread Lending Liquidity

- Liquefy relatively illiquid earning assets
- Use FHLB funding agreements to
 - Execute tightly matched trades
 - Fill maturity gaps and reduce roll-over risk

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Questions?

Liquidity Options

SOA Investment Symposium

March 26, 2012

Max Golts
Quantitative Analyst



Summary

- Buying illiquid asset = writing an “option to trade”
 - What’s the structure of this option?
- Two relevant practical questions:
 - How to manage scheduled liquidity needs?
 - How to manage contingent liquidity needs?
- The (contingent) illiquidity risk can be mitigated with options
 - How expensive are these options?



Liquidity Discount

- Illiquid asset is bought at a discount to its “fundamental value”
 - Buying illiquid asset = writing an “option to trade”
 - The illiquidity discount = price of the “liquidity option”
- A few models pricing these liquidity options
 - In particular, Golts-Kritzman model (2010)
 - Applicable to a wide variety of assets/investments
 - Published in *The Journal of Derivatives*
<http://www.ijournals.com/doi/abs/10.3905/jod.2010.18.1.080>

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Holding Illiquid Portfolios

- A good source of alpha: buy illiquid at a discount
 - Problems: drawdown, meeting cash flow needs in a crisis
 - Scheduled cash flow: regular expenses, costs, fees, etc
 - Unscheduled cash flows: margin calls, redemptions, etc
- Standard solution: maintain sizable cash reserves
 - Lost opportunity
 - May burn through fixed cash reserves in a crisis
- Another solution: buy a portfolio of puts with expiries matching your cash flow horizon/schedule
 - In a severe crisis the puts will expire in the money, paying cash
 - The deeper the crisis, the more cash you get
 - No need to trade in very illiquid conditions

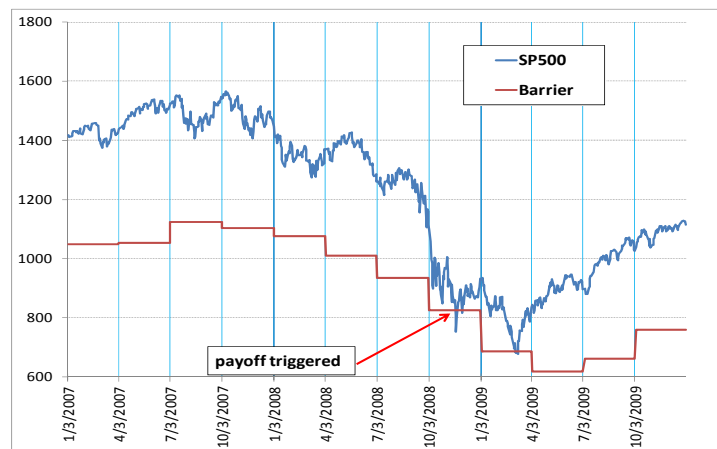
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Liquidity Options: Concepts

- Fundamentals are properties of the *asset/investment*
- Liquidity is specific to the *market player*
- Price depends on three things:
 - Volatility of an observable *reference process*: σ
 - Time to expiry: T
 - Length of the *liquidity interval*: τ
- The price of liquidity option increases
 - With increasing volatility
 - With increasing time to expiry
 - With decreasing length of the liquidity interval
- Structure
 - Bermudan or cliquet/ratchet

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Liquidity Options: 2007 to 2009 Chart



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Liquidity Options: Example

Parameters	Description	Value
tau	liquidity interval length	1-quarter
T	lock-up period (time to expiry)	3-years
B	downside barrier	74%

Date	VIX (%)	Liquidity Option Price
1/3/2007	12.04	0.0005%
1/3/2008	22.49	6.72%
1/2/2009	39.19	70.92%
1/4/2010	20.04	2.45%
1/3/2011	17.61	0.58%
1/3/2012	22.97	7.88%

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Liquidity Options Embedded in Bonds

- Buying a bond involves writing two options
 - Default option (Merton, 1974)
 - Liquidity option
- 3-year floating-rate bond, was sometimes treated as “cash”

Date	VIX (%)	Liquidity-Adjusted Bond Price
1/3/2007	12.04	99.999%
1/3/2008	22.49	93.285%
1/2/2009	39.19	29.084%

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Liquidity Options: Formulas

- Standard option pricing inputs: S , K , σ , τ , r
- Black-Sholes for European options

$$\text{Price} = e^{-r\tau} (KN(-d_2) - SN(-d_1))$$

- First-passage options: same inputs, barrier $B = e^{-r\tau}K$

$$\text{Price} = e^{-r\tau} (KN(-d_2) + SN(-d_1))$$

- Liquidity options are cliquets of the first-passage options, resetting at the start of every liquidity interval

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Liquidity Options: Greeks

- Vega and Gamma are always positive
- Vega tends to be high, a property shared with volatility instruments like variance swaps or VIX futures
- New Greek: Lambda, the sensitivity to the liquidity interval τ
 - Lambda is always negative
 - The price of the liquidity option decreases as the length of the liquidity interval increases

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Liquidity

- Concept I heard from Aaron Brown
 - The idea: crisis volatility spikes and liquidity gaps are related
 - How to bake them into one pie?
- In the context of liquidity options
 - Volatility of an observable *reference process*: σ
 - Time to expiry: T
 - Length of the *liquidity interval*: τ
- A liquidity candidate:

$$\sigma\sqrt{T/\tau}$$

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Conclusion

- A very liquid instrument may become illiquid in a crisis
- Liquidity and volatility are intricately related
- Liquidity risks can be mitigated with properly structured portfolios of options tailored to meet the cash flow needs

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Liquidity Measurement & Management – Theory and Practice

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Liquidity Cost Scores (LCS)™

**Incorporating Quantitative Bond-Level Liquidity Measures
in Portfolio Management**

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9 March 2012

Liquidity Cost Scores (LCS™) – Definition

We define a bond's liquidity as the cost of immediately transforming the bond to cash, and *vice versa*, for normal trade amount

Liquidity Cost Score (LCS)_{i,t}

= OASD_{i,t} x (bid spread_{i,t} – ask spread_{i,t}) if spread quoted

= (Offer Price_{i,t} – Bid Price_{i,t})/Bid Price_{i,t} if price quoted

A bond's Liquidity Cost Score (LCS) is the cost – as a percent of the bond's price – to execute a round-turn transaction

Example:

A bond with an OASD of 5 has a trader-quoted bid spread of 40bp and an ask spread of 25bp

Given the bid-ask spread of 15bp, the bond's LCS = 5 x .15 = 0.75%

In other words, an immediate round-turn would currently cost 75bp of the bond's price

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LCS is built on Trader Indicative Bid-Ask Spread Data

- Barclays (IG & HY) credit traders send out hundreds of messages each day, giving simultaneous bond-level bid-ask spread indications for normal institutional transaction amounts
- This information is collected by Barclays Capital Index Production for index price verification
 - We use parsing algorithms so that quotes are accurately matched to CUSIPs
 - CUSIPs are then matched to bond-level indicative and analytical information from the Barclays Capital Family of Indices
- We do not always believe trader quotes. Some are commitments to make a market, others are only indications and it may be difficult to execute at those quotes. We adjust these trader quotes wider

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For Non-trader Quotes Bonds We Use an LCS Model

- For the credit market we observe that
 - Liquidity varies by sector, subordination, size, age, risk characteristics, TRACE volume, etc.
 - How often a bond has been trader-quoted over recent months is important in determining its liquidity
 - Technical issues also affect liquidity. For example, seasoned bonds often become more liquid as they approach maturity → Interactive term between age and original maturity
- We use LCS values for trader-quoted bonds to estimate the LCS for a non-quoted bond based on its observed characteristics

Estimated LCS Non-Quoted Bond = f [...sector; age; OAS; amount outstanding; trading volume; benchmark status; ...]
- This attribute-based score is adjusted, based on how often the bond was quoted in recent months

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LCS Coverage

Index (100% coverage)	Inception Date	LCS (%) a/o Feb 29, 2012
USD Credit IG	Jan-07	1.166
USD Credit HY	Jan-07	1.772
USD Treasuries	Nov-09	0.029
USD TIPS	Jul-10	0.172
USD Fixed Rate Agency MBS	Mar-10	0.107
Pan-Euro Credit IG	May-10	0.883
Pan-Euro Credit HY	May-10	2.061
Pan-Euro FRN Credit	May-10	0.888
GBP Credit 100–200mm (Amt Outstanding)	Feb-11	2.065
Pan-Euro IG Local Currency Sovereigns (constituents of Pan-Euro Treasury Index)	Feb-11	0.305
Pan-Euro IG Local Currency Sovereign Linkers	Mar-11	0.864

In progress:

USD-Denominated EMG Bonds
EUR Covered Bonds

Source: Barclays Capital

Liquidity Cost Scores (LCS) Available via POINT® & TSP on BarCapLive

POINT 3.18.0.121

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US Credit

Return Universe Constraints

As of: 6/30/2011

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Partition	Base Currency	Access	Identifier	Description	Coupon	Maturity Date	OAS	Liquidity Cost Score	Liquidity Cost	Liquidity Cost	Liquidity Cost	Score (2)
000000	USD	Public	000000	TIME WARNER ENT	10.150	5/1/2012	54.7	0.91	0.000	0.000	0.000	0.715
000000	USD	Public	000000	AT&T WIRELESS SVCS...	8.125	5/1/2012	50.8	0.91	0.358	0.412	0.432	0.432
000000	USD	Public	000000	PLURBY OIL CORP	6.375	5/1/2012	102.2	0.92	0.951	1.037	0.944	0.944
000000	USD	Public	000000	ONCOR ELECTRIC DEL	6.375	5/1/2012	85.5	0.92	0.861	0.941	0.851	0.851
000000	USD	Public	000000	WALBPOOL CORP	8.000	5/1/2012	92.4	0.91	0.669	0.693	0.494	0.494
000000	USD	Public	000000	UNITED TECHNOLOGIES	6.100	5/1/2012	25.5	0.95	0.819	0.874	0.840	0.840
000000	USD	Public	000000	INCO LTD	7.750	5/15/2012	117.5	0.95	0.300	0.327	0.326	0.326
000000	USD	Public	000000	CHARTER ONE BANK FSB	6.375	5/15/2012	291.7	0.95	0.521	0.790	0.571	0.571
000000	USD	Public	000000	HOUSEHOLD FINANCE...	7.000	5/15/2012	56.2	0.95	0.249	0.323	0.541	0.541
000000	USD	Public	000000	GEORGE WATKINS...	4.750	5/15/2012	24.5	0.96	0.459	0.167	0.167	0.167
000000	USD	Public	000000	KREDET FLER WIEDER...	4.750	5/15/2012	23.0	0.96	0.296	0.302	0.298	0.298
000000	USD	Public	000000	BANK OF OKLAHOMA	5.750	5/15/2012	279.9	0.96	0.555	0.924	0.677	0.677
000000	USD	Public	000000	PERSCO INC	5.150	5/15/2012	25.5	0.96	0.407	0.781	0.475	0.475
000000	USD	Public	000000	GENWORTH GLOBAL F...	5.250	5/15/2012	96.8	0.96	0.379	0.580	0.885	0.885
000000	USD	Public	000000	FIRST BANK CORP	5.375	5/24/2012	60.9	0.98	0.462	0.769	0.733	0.733
000000	USD	Public	000000	KRAFT FOODS INC-GL	6.250	6/1/2012	55.2	0.97	0.498	0.530	0.322	0.322
000000	USD	Public	000000	PIES POWER-GLOBAL	6.950	6/1/2012	74.0	0.97	0.810	0.894	0.794	0.794
000000	USD	Public	000000	REYNOLDS AMERICAN...	7.250	6/1/2012	103.7	0.97	0.315	0.197	0.183	0.183
000000	USD	Public	000000	GOLDMAN SACHS CAP	5.750	6/1/2012	249.2	0.97	1.168	1.171	1.176	1.176

Aggregation

Coupon	Maturity Date	Price	Yield to Maturity	OAS	Liquidity Cost Score	Moody Rating	Market Value
5.405	6/1/2012	109.162912	3.512	134.3	6.43	A-2/A3	3,776,441,522

Index Dynamics

Reports

Attachments

Ready

Source: Barclays Capital

The LCS Extended Coverage Model for Non-Index USD Credit Bonds

- Provides LCS values for non-index credit bonds
- Uses the parameters estimated by the LCS Model every month, and applies them to client-supplied bond characteristics

CUSIP	Ticker	Market Price	OAS	Spread Duration	Industry Class 3	Capital Structure	HYIG Flag	Issue Size	Issue Date
656559BK	NTKS	107	538.544	0.465	CAPITAL_GOODS	2nd Lien	HY	753,333	12/17/2009
02378JAS	AMR	101.375	305.145	0.372	TRANSPORTATION	EETC	HY	391,909	1/30/2002
02378JAT	AMR	96.5	724.174	1.981	TRANSPORTATION	EETC	HY	297,430	5/24/2001
02378JBG	AMR	100.5625	448.224	0.23	TRANSPORTATION	EETC	IG	322,404	6/20/2002

BARCLAYS CAPITAL

QUANTITATIVE PORTFOLIO STRATEGY


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Liquidity Cost Scores (LCS) - Extended Coverage Model

CUSIP	LCS
000000	1.254
000000	5.020
000000	2.880
000000	0.230
000000	0.010
000000	2.914
000000	1.796
000000	0.467
000000	0.462
000000	0.462

Source: Barclays Capital

LCS Updates Are Posted in the LCS Report (Available *via* Barclays Capital Live)

																																																																																																																																																																																																																																																																																																																																																																					
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Contains up-to-date information on:

- Summary of LCS levels across markets
- New Developments, Asset class coverage
- Model enhancements
- Updated constituents and tracking performance for TCC replicating baskets
- LCS Applications
- Empirical studies using LCS

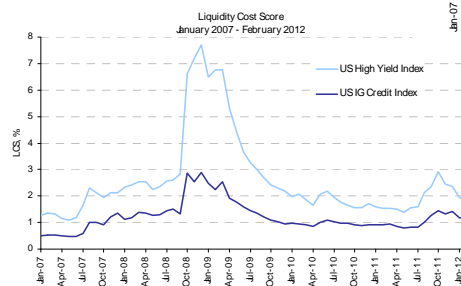
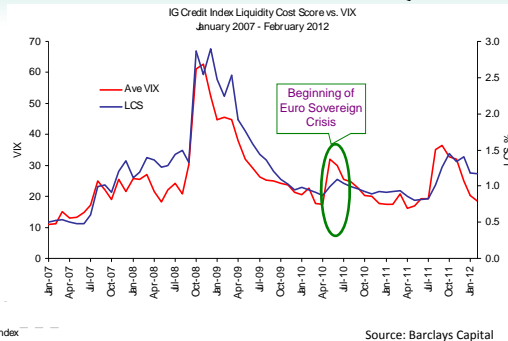
Source: Barclays Capital

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Current Liquidity Environment

Current LCS Levels Are Similar to 2007Q4

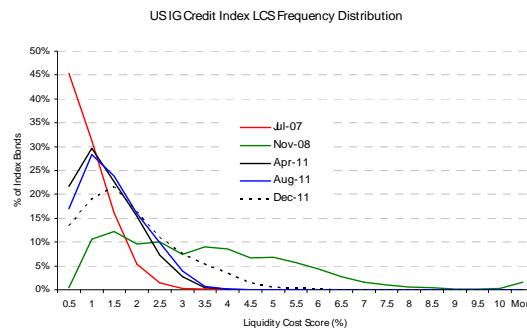
- LCS allows PMs to objectively measure and report the liquidity of their portfolio versus a benchmark and over time
- LCS is related to other indicators of market liquidity used by PMs intuitively (e.g., VIX)



While liquidity deteriorated in the last half of 2011, it was still much better than it was in Q4 2008 and Q1 2009.

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Cross-Sectional Distributions Say a Lot about the Liquidity Environment



- LCS displays cross-sectional variability and shows increased variability as the market became less liquid in late 2008
- The LCS distribution was becoming more concentrated before the turmoil in the 2nd Half of 2011

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LCS Uses: Credit OAS Decomposition

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Using LCS to Decompose Bond Spreads into Liquidity and Default Components

OAS of a bond = Risk premium + Expected default losses + Expected liquidity costs

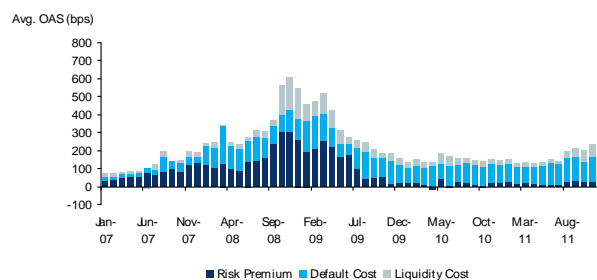
$$OAS_{it} = \alpha_t + \beta_t CDS_{it} + \gamma LCS_{it} + \eta_{it}$$

$\hat{\beta} * \overline{CDS} = \text{Default Cost}$;

$\hat{\gamma} * \overline{LCS} = \text{Liquidity Cost}$

$\hat{\alpha} = \text{Risk Premium}$

- Month-by-month cross-sectional regression of bond-level OAS on CDS and LCS
- Universe comprises trader-quoted USD IG 5-yr bonds, whose tickers are part of the CDX
- Over the last few months, the risk premium and the liquidity contribution to OAS has been low



Source: Barclays Capital

Value of Spread Decomposition

- Evaluating whether to invest in credit: Are spreads wide due to default risk or liquidity risk/high risk premia?
- Identifying relative value across individual credit bonds
- Regulators can monitor separately the liquidity and credit risk embedded in credit portfolios (capital adequacy)
- Constructing targeted hedges for specific drivers of OAS changes

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LCS Uses: LCS-Adjusted Tail Risk (VaR)

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Why Modify Traditional Tail-Risk Models?

- Investors ask how to measure their capital-at-risk, highlighting the high illiquidity during difficult market conditions
 - The mark-to-market portfolio value was especially difficult in the (cash) credit market during the crisis
 - Investors experienced large losses more frequently than suggested by tail-risk models
 - Since transactions costs are likely to spike during market downturns, incorporating such costs provides a more realistic picture of portfolio performance in tail events

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Incorporating LCS into a Tail-Risk Model

- As we saw, transaction costs are time-varying. Transaction costs increase substantially during stressed credit markets, *e.g.*, LCS for the Credit IG index was 2.598 in November 2008, and dropped to 0.803 in May 2011
- So the LCS of each bond needs to be calculated separately for every path in the VaR simulation
 - The Tail-Risk model generates sector-level and market-level OAS changes for each simulation path
 - We use the OAS change in each simulation path to determine the “liquidity regime” for that path
 - Bond-level LCS varies by regime, and the bond’s OAS in that simulation path
 - We model each bond’s “liquidation cost” for a simulation path by subtracting one-half of its LCS value (a %) from the bond’s modeled return for that path

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Results

Asset Class	Portfolio	Mar-11			Nov-08		
		99% VaR (in %)	99% LCS VaR (in %)	Difference	99% VaR (in %)	99% LCS VaR (in %)	Difference
Only Rates	100% Rates	-4.6	-4.7	0.0	-2.2	-2.4	0.1
Rates + Liquid Credit	60% Rates, 40% Liquid Credit	-2.8	-2.9	0.1	-3.5	-3.9	0.4
	40% Rates, 60% Liquid Credit	-4.3	-4.4	0.1	-4.7	-5.2	0.5
	0% Rates, 100% Liquid Credit	-4.3	-4.5	0.2	-7.2	-8.1	0.9
Rates + Risky Illiquid Credit	60% Rates, 40% Illiquid Risky Credit	-4.5	-4.6	0.1	-4.4	-5.2	0.8
	40% Rates, 60% Illiquid Risky Credit	-4.6	-4.8	0.2	-6.4	-7.7	1.3
	0% Rates, 100% Illiquid Risky Credit	-5.1	-5.4	0.4	-10.6	-12.7	2.0
Rates + Illiquid Low-OAS Credit	60% Rates, 40% Illiquid Low-OAS Credit				-3.5	-4.2	0.6
	40% Rates, 60% Illiquid Low-OAS Credit				-4.7	-5.6	0.9
	0% Rates, 100% Illiquid Low-OAS Credit				-7.2	-8.7	1.5

Source: Barclays Capital

- Transaction costs increase as portfolios have greater proportions of credit bonds, and even more when these bonds are illiquid. These costs are more prominent in Nov 2008, compared to Mar 2011
- Expected tail losses increase more in Nov 2008 relative to Mar 2011 with LCS VaR compared to traditional VaR
- The low-OAS illiquid portfolio has tail properties similar to the liquid portfolio according to the traditional VaR model, but larger tail losses according to LCS VaR
- During normal times, liquid credit portfolios help diversify the risk of tail events in interest rates, even after considering the transaction costs

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LCS Uses: Constructing Liquid Credit Cash Portfolios (TCX)

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Credit Replication with Liquid Bonds

- Clients often seek to obtain short-term credit beta exposure (e.g., replicate the Barclays Capital Credit Index)
 - Long or short; Funded or unfunded
- Clients have difficulty constructing basket of cash bonds to track index
 - How to construct a basket of cash bonds to track a desired credit beta?
 - How to identify the set of liquid bonds?
 - Synthetic replication of credit indices (e.g., swaps & CDX) can have high monthly tracking errors
- USD Credit TCX
 - Tracks excess returns of US Credit Index
 - Transparent, published construction rules
 - 50 Highly liquid (top 20% by LCS) bonds
 - Maximum ticker weight: 5%
 - Rebalanced monthly

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USD Credit TCX: Constituents (as of 12/31/11)

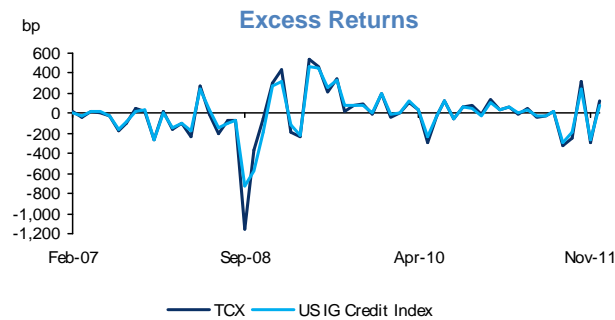
Identifier	Ticker	Description	Coupon	Mkt Date	MTY (%)	LCS	US Corp TBS	Identifier	Ticker	Description	Coupon	Mkt Date	MTY (%)	LCS	US Corp TBS
002624AT	ABT	ABBOTT LABORATORIES-GLOBAL	5.88	5/15/2016	2.04	0.39	1	017445GQ	AYS	MORGAN STANLEY DEAN WITTER GLO	6.63	4/1/2016	2.92	1.02	1
020674CE	AIG	AMERICAN INTL GROUP	4.88	9/15/2016	2.86	0.81	1	025432ET	BAISA	NEWS AMERICA INC	6.80	3/1/2019	1.59	0.87	6
031162B	AMGN	AMGEN INC	1.88	11/15/2014	1.34	0.33	1	04971MZZ	KYOCER	NEW YORK NY CITY TRANSITIONAL	5.77	8/1/2006	4.38	0.39	N/A
032318D	APC	ARADIGROUP HOLDING	7.00	3/15/2014	1.00	0.25	2	069308AL	PCD	PHILIPS CHINA ELECTRIC	3.50	9/1/2017	2.11	1.52	9
06739FZ	BADR	BARCLAYS BANK PLC	5.20	7/10/2014	5.00	0.24	1	713448BK	PEP	PEPSICO INC	3.75	3/1/2014	1.80	0.31	2
055451AH	BHP	BHP BILLITON FINANCE	6.50	4/1/2019	2.50	0.54	1	022522AD	ROSLIN	SHELL INTERNATIONAL FINANCE	6.38	12/15/2008	1.92	1.44	1
111124AB	BTTEL	BRITISH TELECOM PLC-GLOBAL	5.15	1/15/2013	0.86	0.73	5	010313FA	SO	ALABAMA POWER	5.80	11/15/2003	2.41	0.37	8
172292TT	C	OTICORP INC	4.50	1/14/2022	2.25	0.80	1	05717PAP	STLND	STATOIL	3.15	1/23/2022	0.82	0.74	N/A
130275BH	CHRON	CANADIAN NATIONAL RISK	4.40	3/15/2013	1.88	0.18	6	00200AAT	T	AT&T WIRELESS SVCS INC-GLOBAL	8.75	3/1/2001	2.24	1.60	6
260542D	DOW	DOW CHEMICAL	2.50	2/15/2016	0.50	0.39	1	00206RAI	T	AT&T CORP-GLOBAL	5.50	2/1/2008	0.76	0.87	2
260542CE	DOW	DOW CHEMICAL CO	5.25	11/15/2014	2.59	1.47	1	00206RAZ	T	AT&T INC-GLOBAL	3.88	8/15/2021	0.50	0.80	1
25459HAZ	DTV	DIRECTV HOLDINGS FINANCE	6.38	3/1/2011	1.55	1.34	1	01013EAV	TCT	TARGET CORP	3.88	7/15/2020	0.75	0.61	1
25459HAY	DTV	DIRECTV HOLDINGS FINANCE	3.50	3/1/2016	1.80	0.39	1	08723AVV	TWC	TRIBE WARNER CABLE INC	3.50	2/1/2015	1.80	0.44	4
28475PAG	EOG	EOG RESOURCES INC	4.10	2/1/2021	0.84	0.76	1	08731PAP	TWIN	TWIST WARNER INC	4.88	3/15/2020	1.47	1.02	2
29279VAV	EPD	ENTERPRISE PRODUCTS OPER	5.70	2/15/2012	3.91	1.41	2	00261VGB	UBS	UBS BANK OF SWITZERLAND	4.88	8/4/2020	0.50	0.71	1
186106CD	FE	CLEVELAND ELECTRIC LUM	5.05	12/15/2013	5.00	0.26	7	00344NAA	USE	USE CAPITAL XB	6.63	12/15/2009	1.95	2.01	4
36962QAZ	GE	GENERAL ELECTRIC CAPITAL-GLOBE	6.75	3/15/2012	1.08	1.41	1	01911TAL	VALDEE	VALE OVERSEAS LTD	4.63	9/15/2020	1.43	0.77	1
36962QAD	GE	GENERAL ELECTRIC CAPITAL	6.00	8/7/2019	2.40	0.77	1	025524BG	VIA	VIAISON INC	4.50	3/1/2021	1.53	0.73	1
377722AD	GSK	GLAXOSMITHKLINE CAPITAL INC	5.05	5/15/2018	1.31	0.41	1	02343VAY	VZ	VERIZON COMMUNICATIONS INC	3.00	4/1/2016	0.50	0.57	2
400566W	IBRD	INTERNATL BANK RECON DEV	5.25	7/15/2017	4.81	0.39	N/A	02570NBR	WFC	WACHOVIA CORP	5.50	5/1/2013	2.07	0.19	1
50079MA5	KFT	KRAFT FOODS INC-GLOBAL	6.50	8/1/2017	1.15	0.50	1	04106LAX	WNN	WASTE MANAGEMENT INC	2.60	8/1/2016	2.00	0.44	1
50079MAZ	KFT	KRAFT FOODS INC-GLOBAL	6.50	2/15/2010	2.30	1.38	1	02114CKK	WMT	WAL-MART STORES-GLOBAL	6.50	8/15/2007	2.11	1.14	1
494550E	KMP	KINDER MORGAN ENERGY PARTNERS	4.15	3/1/2022	2.30	1.03	1	06959HAD	WPF	WILLIAMS PARTNERS LP	7.25	2/1/2017	1.74	0.43	1
502413AY	LLL	L J COMMS CORP	5.25	10/15/2019	1.05	1.10	2	06959FAD	WPF	WILLIAMS PARTNERS LP	5.25	3/15/2020	2.21	0.94	1
59158BAU	MET	METLIFE INC	6.75	6/1/2016	4.33	0.80	2	094121CD	XRX	XEROX CORP	4.50	5/15/2001	0.95	0.77	1
											USD Credit TCX				
											0.749				
											1.409				
											4.2				

Source: Barclays Capital: Monthly LCS Report & Barclays Capital Live

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USD Credit TCX Performance: Tracking Credit Index Excess Returns

- From February 2007 through December 2011, the TCX had mean excess return tracking error of -4.0bp with tracking error volatility of 75bp
- Overweight to Lehman subordinated bonds caused underperformance of 444bp in Sept 2008



Source: Barclays Capital

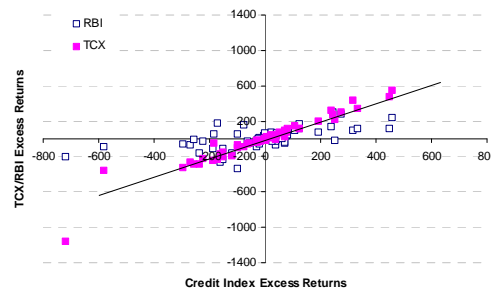
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USD TCX vs. IRS+CDX Performance

	Mean Monthly TE		Volatility (TEV)	
	TCX	IRS+CDX	TCX	IRS+CDX
Feb 07–Dec 08	(8.6)	71.7	111.6	188.0
Jan 09–Dec 11	(1.1)	(33.6)	38.3	123.6
Feb 07–Dec 11	(4.0)	7.5	75.0	159.1

- Overall, the TCX tracked the US Credit Index excess returns with less than half the volatility of an IRS+CDX ("RBI") basket
- IRS+CDX outperforms Credit Index when the latter does poorly, and *vice versa*. May be undesirable for clients looking to time credit exposure!

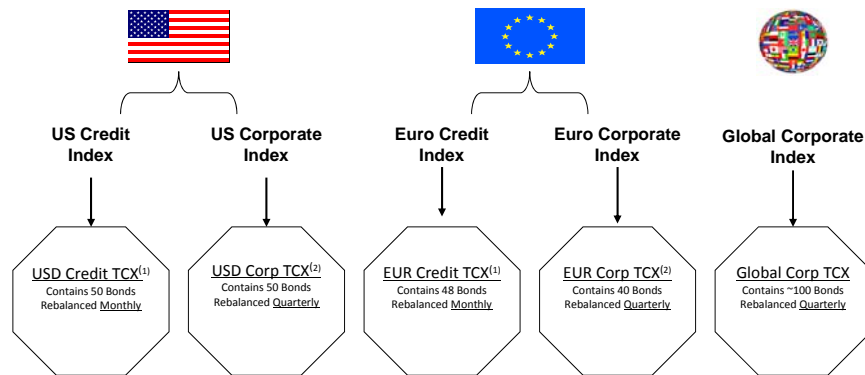
Comparing RBI, TCX vs. Credit Index Excess Returns: Feb 07-Dec 11



Source: Barclays Capital

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TCX Reference Guide



1. Constituents published in monthly LCS report (BCL keyword: QPSPubs) and as central portfolio on POINT
2. Returns published on the index website (BCL keyword: indexmap)
3. Under development

Source: Barclays Capital

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