

Presentation to Atlanta Actuarial Club

Liquidity Risk Premium

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Some Observations

- Liquidity is like water: “rising water lifts all boats”
 - Recent Fed Quantitative Easing has caused broad increase in commodity prices
- Hot money flows can create damages
- Flooding of money supply can cause high inflation
- Like friction, a bit of illiquidity is useful. Just imagine driving on the icy Atlanta roads back in early 2011.

Different Levels of Liquidity Risk

- 1) Systemic Risks: Liquidity associated with a financial system (e.g. 2008 financial crisis)
 - 2) A firm's own funding liquidity (LTCM)
 - 3) Liquidity risk premium associated with individual assets and liabilities (subprime mortgage securities; insurance contracts)
- These three levels may intersect with each other

Channels for Money Flow

Where Did Stimulus Money Go?

Liquidity for Actively Traded Assets

- Bid-Ask Spread (simultaneous)

$$\frac{Ask - Bid}{0.5(Ask + Bid)}$$

- High-Low Spread (during a time interval), account for trading volume (thin, normal, heavy) and its impacts on price change

$$\frac{High - Low}{0.5(High + Low)} \cdot \frac{1}{\sqrt{Volume}}$$

Bid-Ask Spread Increases for out-of money Options

Volkswagen Story: Background

- Volkswagen was underperformer in mid-2000
- Market is Generally Short on VW Stock, Hedge funds in particular
- In 2005, Porsche buys 20% of VW matched by Lower Saxony in order to prevent foreign takeover
- In 2007, Porsche ups ownership to 30% but denies any interest in taking over VW
- In 2008, Porsche buys over 42% of cash-settled stock options on VW shares...no disclosure

Volkswagen Story: High drama

- October 24, 2008 – VW share price is 200 Euros, over 12% of VW stock is sold short
- October 28, 2008 – Porsche announces it controls 74.1% of VW shares. Lower Saxony holds 20%. 5.9% of shares are available on the market
- Infinite Short Squeeze – situation where the short market struggles to cover their positions in an unavailable market(illiquid)
- October 28, 2008 – VW share price is 1000 Euros
- Hedge Fund Short Sellers lose approximately 10-12 billion Euros

Illiquidity Risk Premium

- Non-Actively Traded Contracts such as property-casualty insurance contracts
 - Q-P Spread
 - P-measure: Physical probability measure
 - Q-measure: Risk-adjusted (or price implied) probability measure

Fixed transaction costs

- Information Search Costs
 - Opaqueness
- Transaction costs that reflect cost of doing business
 - Taxation
 - Regulation
 - Infrastructure

Liquidity & Uncertainty

- Liquidity risk premium can be viewed as compensation for information search cost
- There is uncertainty around assessment of probabilities associated with potential outcomes
- Low frequency events are subject to higher uncertainty, thus command higher relative illiquidity premium

P-measure vs. Q-measure

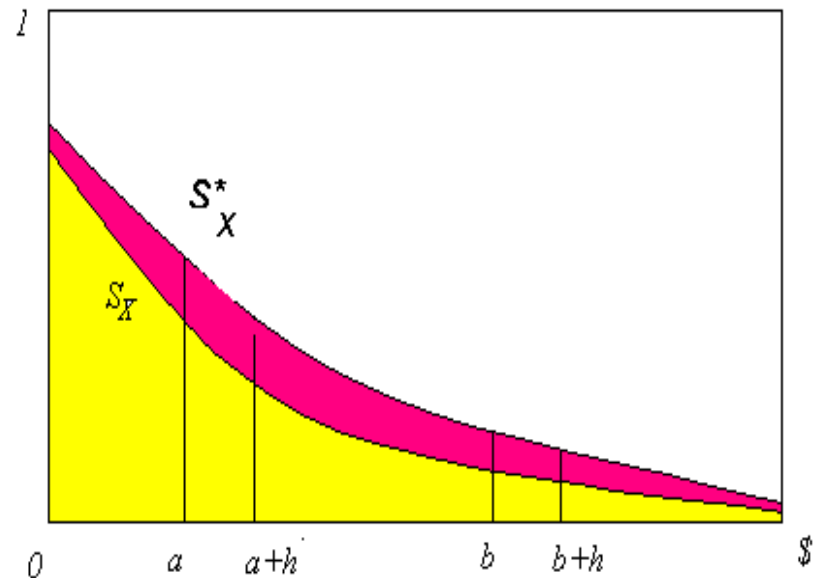
Mapping between

1. Loss Curve

- *physical measure*
- $S(x) = 1 - F(x)$

2. Pricing Curve

- *risk-neutral measure*
- $S^*(x) = 1 - F^*(x)$



Wang Transform

- Map loss curve to a price curve:

$$F^*(x) = \Phi[\Phi^{-1}(F(x)) - \lambda] \quad \text{or}$$

$$F^*(x) = \text{normsdist}(\text{normsinv}(F(x)) - \lambda)$$

$$\text{e.g. } 0.97 = \Phi[\Phi^{-1}(0.99) - 0.45]$$

- If F_X is normal(μ, σ), F_X^* is normal($\mu + \lambda\sigma, \sigma$):
 - $E^*[X] = E[X] + \lambda \sigma[X]$
- If F_X is lognormal(μ, σ), F_X^* is lognormal($\mu + \lambda\sigma, \sigma$)
- λ extends Sharpe ratio to skewed distributions

2-factor Wang Transform

- With adjustment for parameter uncertainty:

$$F^*(y) = t_k \left(\Phi^{-1}(F(y)) - \lambda \right)$$

where

- Φ is standard normal CDF, and
- t_k is Student-t CDF with k degrees-of-freedom

1999 Cat-bond transactions

(Data Source: Lane Financial LLC)

Cat bond Transaction	Probability of First \$ Loss	Probability of Last \$ Loss	Expected Loss given default	Model Yield Spread	Empirical Yields Spread
Mosaic 2A	0.0115	0.0012	0.3652	3.88%	4.06%
Mosaic 2B	0.0525	0.0115	0.541	10.15%	8.36%
Halyard Re	0.0084	0.0045	0.75	4.82%	4.56%
Domestic Re	0.0058	0.0044	0.8621	4.36%	3.74%
Concentric Re	0.0062	0.0022	0.677	4.01%	3.14%
Juno Re	0.006	0.0033	0.75	4.15%	4.26%
Residential Re	0.0076	0.0026	0.5789	4.08%	3.71%

Pre & Post Katrina Risk Premiums

	2-factor Wang transform	Pre-Katrina	Post-Katrina
Euro Wind	lambda	0.21	0.33
	def	5	5
Jpn Qk	lambda	0.30	0.29
	def	5	6
US Qk	lambda	0.37	0.57
	def	5	5
US Wind	lambda	0.42	0.70
	def	5	5

- US Wind risk premium increased drastically
- Followed by US Earthquake
- In contrast, Japan Earthquake risk premium declined after Katrina (diversifying risk?)

Actuarial Valuation Example

- You are asked to put Saudi Arabia Oil Reserves on its balance-sheet on 12/31/2010.
 - Oil Reserve = 230 billion barrel
 - Oil Production = 3.5 billion barrel
- How much asset value will you put on the balance-sheet?
- What are the potential impacts on the earning for Saudi Arabia due to oil price fluctuation?