Quantitative Credit Tools
Quantitative Credit Strategy

William Porter, Managing director
+44 20 7888 1207, william.porter@credit-suisse.com

Chiraag Somaia, Associate
+44 20 7888 2776, chiraag.somaia@credit-suisse.com

Jessica Orts, Analyst
+44 20 7888 4188, jessica.orts@credit-suisse.com

Christian Schwarz, Vice President
+44 20 7888 3161, christian.schwarz.2@credit-suisse.com

Joachim Edery, Analyst
+44 20 7888 7382, joachim.edery@credit-suisse.com

ANALYST CERTIFICATIONS AND IMPORTANT DISCLOSURES ARE IN THE DISCLOSURE APPENDIX. FOR OTHER IMPORTANT DISCLOSURES, PLEASE REFER TO https://firesearchdisclosure.credit-suisse.com.
# Table of contents

1. Summary
2. CUSP® 2007
3. PortfolioRisk+
4. APS Basis
Executive Summary

- Credit Suisse’s Quantitative Credit Strategy group provides clients with
  - Access to Credit Suisse’s quantitative credit tools
  - Advice on how to leverage the tools to identify and evaluate value-adding transactions

<table>
<thead>
<tr>
<th>Tool</th>
<th>Delivery</th>
<th>Description/Objective</th>
<th>Types of Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSP®</td>
<td>LOCuS</td>
<td>▪ Forward-looking spread distribution based on equity/credit data</td>
<td>▪ Asset managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Directional credit trades and steepeners</td>
<td>▪ Hedge funds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Relative value between equity and credit</td>
<td>▪ CDO managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ LBO studies: change in capital structure</td>
<td>▪ Loan portfolio groups/ insurance groups</td>
</tr>
<tr>
<td>PortfolioRisk+</td>
<td>Excel</td>
<td>▪ Advanced risk/return aggregation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Attribution of risk/return to issuers, sectors, maturities, etc</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Hedging trade suggestions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Identification of impact of trades, structured credit, etc</td>
<td></td>
</tr>
<tr>
<td>APS</td>
<td>LOCuS</td>
<td>▪ A way to trade CDS against cash bonds or identify relative value between them</td>
<td>▪ Asset managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Hedge funds</td>
</tr>
</tbody>
</table>

Source: Credit Suisse Quantitative Credit Strategy
### Summary: Single-Name Tools

- Credit Tools of use for many different applications...

<table>
<thead>
<tr>
<th>Trade Type</th>
<th>CUSP 2007</th>
<th>APS</th>
<th>PR+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Directional</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curve</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Structure Arbitrage</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit / Equity Option</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior / Sub / Hybrid</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LBO</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index trades</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Counterparty Risk</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Portfolio Optimisation / Hedging</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
CUSP Overview

- CUSP = Credit Underlying Securities Pricing
- Modern Implementation of Merton’s Contingent Claims Analysis

Objectives
- Measures credit risk at the firm level and across the CDS curve
- Extracts forward-looking information from market prices and option volatilities
- Highlights relative value across CDS and between asset classes
- Focuses on spread risk, rather than default risk

Delivery
- Much of the functionality is delivered over LOCuS
Merton’s Model of the Firm

– A corporation has two classes of claims: debt (zero-coupon) and equity.
– The firm promises to pay face amount of the debt at specific date, say ten years from now.
– At maturity, if the value of the firm is above the debt, the firm pays off the debt, and equity holders own the remainder of the firm; if the value of the firm is below the face amount of the debt, then equity holders call bankruptcy and receive nothing, and bond holders get the leftover value of the firm – the recovery value.

– **Equity holders** long a call option on the underlying asset
– **Bond holders** long a riskless bond and short a put option on the underlying asset

Source: Credit Suisse Quantitative Credit Strategy
CUSP 2007 – New Model Configuration

CUSP 2007 improves on earlier versions of CUSP in a number of ways:

- The process used to describe firm value is a generalised jump-diffusion process (a geometric Lévy process), so large, rapid moves in spread are possible.
- The default mechanism is the passage of firm value below a fuzzy barrier, the level of which depends on debt face value.
- Basic model calibration is now to the CDS curve rather than to a debt spread.
- Debt pays coupons and is perpetual, so there is no finite “life” of the firm.
- Equity becomes a perpetual defaultable call on firm assets. At each point in time, equity holders can choose to make coupon payments to debt holders or to dissolve the firm.
- Debt maturity is taken into account – spreads depend on maturity.
- Different subordinations of debt can be dealt with.

CUSP 2007 is a CDS-based barrier model and consistently models the whole capital structure, across maturities.
CUSP 2007 calibrates the whole CDS curve for a universe of 800 issuers:

- It allows us to identify relative value across the curve and between names.
- Model for default is jump-diffusion hitting a “fuzzy” barrier (red zone, below).
- A whole spectrum of jumps is employed, rather than just a jump to default.

Source: Credit Suisse Quantitative Credit Strategy
The Equity-Credit Relationship in Theory ...

- Many of the ideas in CUSP are based on this picture, a “hockey-stick” curve:
... and in Practice: Xerox and Radian “Hockey Sticks”

- Real data points shown (Xerox LHS, Radian RHS): reasonably consistent link
  - In the Xerox example, spread means long-dated cash bond spread; for Radian, it is CDS 5Y.

Source: Credit Suisse Quantitative Credit Strategy
CUSP parameters

CUSP 2007 is essentially the earlier version of CUSP with an extra parameter: the skew

- There are three parameters: debt/assets, vol ($\sigma$) and skew ($\kappa$).
- The next three slides show how these parameters affect the CDS curve.
- The summary is below.

<table>
<thead>
<tr>
<th></th>
<th>Firm value</th>
<th>Equity px</th>
<th>Debt PV</th>
<th>CDS Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher firm value</td>
<td>Up</td>
<td>Up</td>
<td>Up</td>
<td>Tightens</td>
</tr>
<tr>
<td>Lower firm value</td>
<td>Down</td>
<td>Down</td>
<td>Down</td>
<td>Rises &amp; inverts</td>
</tr>
<tr>
<td>Higher vol</td>
<td>Same</td>
<td>Up</td>
<td>Down</td>
<td>Rises</td>
</tr>
<tr>
<td>Higher skew</td>
<td>Same</td>
<td>-</td>
<td>-</td>
<td>Flattens</td>
</tr>
</tbody>
</table>

Source: Credit Suisse Quantitative Credit Strategy
CUSP and the CDS Curve: Firm Value (Leverage)

Base Case ($\sigma=40\%$, $\kappa=0.6$, $D:A=30\%$)

Debt:Assets = 50%

Debt:Assets = 150%

Debt:Assets = 80%

Source: Credit Suisse Quantitative Credit Strategy
CUSP and the CDS Curve: Volatility

Base Case ($\sigma=40\%, \kappa=0.6$, Debt:Assets=30%)

Lower Vol ($\sigma=35\%$)

Higher Vol ($\sigma=50\%$)

Source: Credit Suisse Quantitative Credit Strategy
CUSP and the CDS curve: skew

Base Case ($\sigma=40\%$, $\kappa=0.6$, Debt:Assets=30\%)

Zero Skew ($\kappa=0$)

Higher Skew ($\kappa=0.9$)

Source: Credit Suisse Quantitative Credit Strategy
CUSP: Fitting Some Real Credits (Q4 2008)

Pinnacle West (PNW US)
Low spread

Xerox (XRX US)
Wider IG

Ford Credit (F US)
Distressed

Tenet Healthcare (THC US)
High Yield

Source: Credit Suisse Quantitative Credit Strategy
CUSP Measures I: SWR and IRD

- Two measures of risk are derived from basic calibration:
  - Spread Widening Risk (SWR)
  - Implied Roll-Down (IRD)

- In brief: interpretation for bondholders
  - SWR is a measure of spread risk, in bp.
  - IRD is the average (expected) spread change, annualised and quoted in bp.
  - Bad signals are SWR ↑ and IRD<0 (or falling).

- Idea
  - Bring in the equity vol (not used in the spread-based calibration).
  - Equity vol tells us the spread distribution, assuming equity-spread relationship persists.
  - Assume lognormal equity vol – not right, but these are just measures!
IRD (Implied Roll-Down)

- When you sell CDS, you usually hope to make the “roll-down”.
  - Curve might not stay put though – and the more uncertainty, the worse it is for you (on average).
  - IRD is defined as the expected spread reduction (annualised)
    - using the equity option vol,
    - assuming credit-equity relationship holds, and
    - taking into account the reduction in maturity (so curve gradient matters).
  - Zero equity vol $\implies$ IRD is just the roll-down as seen from the CDS curve today.
  - Lower equity price / higher equity vol will reduce the IRD.
  - Negative IRD means spread widening and so is bad.

Source: Credit Suisse Quantitative Credit Strategy
SWR (Spread Widening Risk)

- SWR is the amount that the CDS spread widens when the equity price drops by one standard deviation at the horizon in question (typically three months)
  - It is based on the distribution of equity implied from the equity option vol.
  - It assumes that the credit-equity relationship holds.
  - CDS spread and its volatility are maturity-dependent, so SWR is different at different points on the curve.
  - Rising SWR means that the credit is riskier and thus probably less desirable.
  - The typical sell signal for a credit is SWR rising and a sudden drop in IRD.
Why Equity Signals Are Useful

- **Case Study: Qwest versus Radian, 03-Aug-07**
  - Both had widened; spreads were about equal – so what next?

  - Enter CUSP: SWRs are Qwest=228bp, Radian=380bp, because equity vol much higher (58%/150%).
  - So CUSP thinks that Radian has significantly higher spread vol.
  - Two weeks later, CDS are Qwest=341bp, Radian=950bp.

- **Conclusion: Equity vol gives important information in quantifying spread risk.**
CUSP Signals: Radian, 2007

- Radian gave similar negative signals in Mar-07 and then again at end of Jul-07 (equity vol went to >150%).
- Signal is IRD < -10bp and zscore < -2.5.

Source: Credit Suisse Quantitative Credit Strategy

A: 08 Jan 08: 1st signal to go short
IRD = -17.3, CDS = 165 bp;
CDS goes to 465 bp on Mar 13

B: 10 Jun 08: 2nd signal to go short
IRD = -35.6, CDS = 390 bp;
CDS goes to 480 bp on July 8

C: 29 Sep 08: Signal to get out
IRD = -219.1, CDS = 425 bp;
CDS widened to 1685 on Nov 25

- Sharp declines in IRD, like those seen for DSG International and Radian, have tended to be very strong sell signals. If acted on quickly, there can be enough warning to avoid the worst losses.
CUSP Signals: Metro AG, 2008

- IRD started dropping significantly below zero for Metro at the end of September 2008; contrast with the previous period of spread-widening in March, when IRD barely moved.

Since the drop in IRD wasn’t extreme and spreads widened simultaneously, rather than suggesting an outright short position, it made more sense to use the signals to recommend a relative value trade by comparison with other retailers.

Source: Credit Suisse Quantitative Credit Strategy
CUSP Signals: Metro AG versus Tate & Lyle, 2008

Based on level and trend of CUSP signals, long Tate & Lyle versus short Metro AG made sense:

<table>
<thead>
<tr>
<th>Value COB 17/10/2008</th>
<th>CDS</th>
<th>SWR</th>
<th>SWR Z-score</th>
<th>IRD</th>
<th>IRD Z-score</th>
<th>CDS/SWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro AG</td>
<td>155</td>
<td>98.48</td>
<td>3.91</td>
<td>-49.75</td>
<td>-3.36</td>
<td>1.6</td>
</tr>
<tr>
<td>Tate &amp; Lyle PLC</td>
<td>235</td>
<td>73.97</td>
<td>2.83</td>
<td>-15.02</td>
<td>-2.93</td>
<td>3.2</td>
</tr>
</tbody>
</table>

P&L on a trade notional EUR 10 million by EUR 10 million was as follows:

Source: Credit Suisse Quantitative Credit Strategy
CUSP Signals: Default of DANA, 2005-6

- Sell signal on 12-Apr-05 before spreads widened.
- Intermediate buy signal for two to three months indicated get-back-in opportunity.
- Clear get-out signal on 13-Sep-05 before blow-up and subsequent default.

Source: Credit Suisse Quantitative Credit Strategy
CUSP and Cap Arb (I)

- “Cap-Arb” trade is a directional play on the implied asset vol.
- Example: Sainsbury
  - With SBRY, the asset vol was lower than that of Tesco at the indicated point (seems wrong).
  - Implied trade: Buy equity and buy CDS, or buy CDS on SBRY and sell CDS on TSCO.
  - Long-vol trade (buy equity, buy CDS) also works well in LBO scenario (which happened, see over)

![Graph showing asset vol comparison between SBRY and TSCO]

Source: Credit Suisse

(1) The Sainsbury example was originally published in CUSP 2007: Overview of our new Structural Model, 28 February 2007
CUSP and Cap Arb (II)

- Example: Sainsbury (conclusion)
  - After LBO, spread widened and equity increased.
  - Implied asset vol went to 50%, anticipating change in capital structure.
CUSP Results: ITX.IG9, 2008

- In March 2008, we ranked the issuers of ITX.IG9 by IRD:
  - Sell (=buy prot): HBOS, UBS, DSGILN, BACR, VLOF, TITIM (very financials oriented).
  - Buy (=sell prot): EOANGR, MUNRE, BATSLN, VIVFP, ELES, HANRUE.
  - The shorts generally widened more than the index; the longs generally widened less – with the differentiation during the last three months.
In March 2008, we ranked the issuers of CDX.IG10 by IRD:

- Sell (=buy prot): CIT, WM, RDN, SFI, MBI, XL, S, COF, TOL, NYT, M.
- Buy (=sell prot): OMC, DGX, FO, HPQ, RTN.
- The shorts generally widened more than the index; the longs widened less. Again, the underperformance of the shorts was in the most recent three months.

Source: Credit Suisse Quantitative Credit Strategy
CUSP and Financials

- “Financials don’t model well using structural models” – WRONG
  - Just need the right model

- Typical structure shown on the right
  - High leverage
  - Ignore deposits (too unlikely for that hard a hit)

- To get right shape of CDS curve, need jumps
  - Otherwise, senior tiers don’t get hit

- Exactly what is the default mechanism?
  - See next slide

Source: Credit Suisse Quantitative Credit Strategy
CUSP and Financials

- Note that one model fits (or tries to fit) everything:
  - One set of vol parameters, one default threshold
  - But different “attachment points” (as in CDO)
  - So different seniorities have different average recovery rates – senior is much higher, of course

Source: Credit Suisse Quantitative Credit Strategy
CUSP and Financials

- Example: RBS

![Graph showing CDS (bp) vs maturity for different types of debt: Sub-market, Sub-model, Senior-market, Senior-model]

Source: Credit Suisse Quantitative Credit Strategy
## LOCuS Site: Breakdown Report

### CUSP Breakdown Analysis

#### Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Count</th>
<th>SY SWR</th>
<th>SY SWR Z-score</th>
<th>SY IRD</th>
<th>SY IRD Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>500</td>
<td>1.82</td>
<td>0.46</td>
<td>-26.91</td>
<td>-0.21</td>
</tr>
<tr>
<td>Europe</td>
<td>192</td>
<td>2.65</td>
<td>0.34</td>
<td>-2.99</td>
<td>-0.61</td>
</tr>
</tbody>
</table>

#### Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Count</th>
<th>SY SWR</th>
<th>SY SWR Z-score</th>
<th>SY IRD</th>
<th>SY IRD Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Industries</td>
<td>37</td>
<td>27.25</td>
<td>0.02</td>
<td>-3.84</td>
<td>0.22</td>
</tr>
<tr>
<td>Consumer Products</td>
<td>93</td>
<td>20.81</td>
<td>0.27</td>
<td>-2.14</td>
<td>-0.42</td>
</tr>
<tr>
<td>Electric Utilities</td>
<td>42</td>
<td>26.56</td>
<td>0.42</td>
<td>1.08</td>
<td>-0.34</td>
</tr>
<tr>
<td>Energy</td>
<td>44</td>
<td>33.84</td>
<td>0.12</td>
<td>-1.69</td>
<td>0.01</td>
</tr>
<tr>
<td>Finance</td>
<td>21</td>
<td>16.22</td>
<td>0.35</td>
<td>-6.36</td>
<td>-0.35</td>
</tr>
<tr>
<td>Banking and Lending</td>
<td>14</td>
<td>30.06</td>
<td>0.13</td>
<td>-5.55</td>
<td>-1.60</td>
</tr>
<tr>
<td>Gas Pipelines</td>
<td>14</td>
<td>41.06</td>
<td>0.12</td>
<td>-4.15</td>
<td>-0.18</td>
</tr>
</tbody>
</table>

### Largest SWR Increase Issuers

<table>
<thead>
<tr>
<th>Issuers</th>
<th>SY SWR</th>
<th>SY SWR Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Technology Corp</td>
<td>27.43</td>
<td>0.36</td>
</tr>
<tr>
<td>Overture Shipping Group Inc</td>
<td>22.00</td>
<td>-0.26</td>
</tr>
<tr>
<td>ConocoPhillips Inc</td>
<td>8.45</td>
<td>-2.95</td>
</tr>
<tr>
<td>Halliburton Co</td>
<td>10.35</td>
<td>1.90</td>
</tr>
<tr>
<td>Atwood Inc.</td>
<td>10.05</td>
<td>-1.92</td>
</tr>
</tbody>
</table>

### Largest SWR Decrease Issuers

<table>
<thead>
<tr>
<th>Issuers</th>
<th>SY SWR</th>
<th>SY SWR Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schlumberger DHC Corp</td>
<td>760.12</td>
<td>8.86</td>
</tr>
<tr>
<td>Merck &amp; Co</td>
<td>6.06</td>
<td>3.67</td>
</tr>
<tr>
<td>Vale SA</td>
<td>1.82</td>
<td>3.30</td>
</tr>
<tr>
<td>Petro-Canada</td>
<td>35.57</td>
<td>3.24</td>
</tr>
<tr>
<td>Advanced Micro Devices Inc</td>
<td>725.32</td>
<td>3.03</td>
</tr>
</tbody>
</table>

### Largest IRD Increase Issuers

<table>
<thead>
<tr>
<th>Issuers</th>
<th>SY IRD</th>
<th>SY IRD Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerson Electric Co</td>
<td>2.24</td>
<td>2.83</td>
</tr>
<tr>
<td>Six Flags Inc.</td>
<td>-1.64</td>
<td>2.95</td>
</tr>
<tr>
<td>Petro Canada</td>
<td>0.27</td>
<td>1.90</td>
</tr>
<tr>
<td>Enisis Communications Corp.</td>
<td>-2.30</td>
<td>1.83</td>
</tr>
<tr>
<td>WrightCorp</td>
<td>15.92</td>
<td>4.43</td>
</tr>
</tbody>
</table>

### Largest IRD Decrease Issuers

<table>
<thead>
<tr>
<th>Issuers</th>
<th>SY IRD</th>
<th>SY IRD Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schlumberger DHC Corp</td>
<td>-814.82</td>
<td>-6.89</td>
</tr>
<tr>
<td>United Parcel Service Inc.</td>
<td>0.89</td>
<td>-2.66</td>
</tr>
<tr>
<td>Petro Canada</td>
<td>-0.91</td>
<td>-3.10</td>
</tr>
<tr>
<td>Enisis Communications Corp.</td>
<td>-412.17</td>
<td>-3.11</td>
</tr>
<tr>
<td>WrightCorp</td>
<td>2.81</td>
<td>3.43</td>
</tr>
</tbody>
</table>
LOCuS Site: Risk Report

![Risk Report](image)

<table>
<thead>
<tr>
<th>Region</th>
<th>Rating</th>
<th>Sector</th>
<th>CUSP</th>
<th>SY</th>
<th>SY</th>
<th>SY</th>
<th>SY</th>
<th>SY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL REGIONS</td>
<td>ALL RATINGS</td>
<td>ALL SECTORS</td>
<td>Telecom Italia S.p.A</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>North America</td>
<td>AAA</td>
<td>Tech</td>
<td>AT&amp;T Inc</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Latin America</td>
<td>AAA</td>
<td>Tech</td>
<td>Telefonica S.A</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Asia</td>
<td>AAA</td>
<td>Tech</td>
<td>SoftBank Corporation</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Europe</td>
<td>AAA</td>
<td>Tech</td>
<td>Deutsche Telekom AG</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Japan</td>
<td>AAA</td>
<td>Tech</td>
<td>NTT DoCoMo, Inc.</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

*Note: CUSP Risk Report as of [Date].*
CUSP and Sovereigns

- We believe that the CDS spread on sovereigns can be decomposed into several components, of which mark-to-market risk is a major one.
- Do to lack of “visibility” (E.g. market data) MTM risk is hard to assess
- One of CUSP’s capabilities is to estimate MTM risk for corporates
- ➔ Extend CUSP to sovereigns
- Some approximations need to be made with regards model inputs:
  - Leverage of the sovereign: Measured as public debt as % of GDP
  - Implied equity volatility: Implied equity volatility of the main equity index of the respective country
    - For equity indices with no implied volatility data we use the historical volatility as a proxy
- Model outputs (E.g. SWR and IRD) have similar interpretation as for corporates adjusted for input approximations
CUSP and Sovereigns: Examples Feb 2010

Portuguese Republic

United Kingdom

Republic of Ireland

Kingdom of Spain

Source: Credit Suisse Quantitative Credit Strategy
CUSP Signals: Portugal 2009 / 2010

A: 14 May 09: light short signal
   IRD = -2.4, CDS = 65 bp;
   CDS goes to 81 bp on May 29

B: 4 Nov 09: light short signal
   IRD = -0.7, CDS = 59 bp;
   CDS goes to 92 bp on Dec 21

Source: Credit Suisse Quantitative Credit Strategy
CUSP Signals: Greece 2009 / 2010

A: 1 Dec 09: signal to go short
IRD = -15.3, CDS = 172 bp;
CDS goes consecutively to
- 230 bp on 9 Dec 2009
- 290 bp on 21 Dec 2009 and
- 346 bp on 20 Jan 2010

- As for corporates, sharp declines in IRD, like those seen for Portugal and Greece, have tended to be very strong sell signals. If acted on quickly, there can be enough warning to avoid the worst losses.
The previous slides suggest to go short credit when:
- The IRD is negative and/or its Z-score measure is negative.

For long credit signals we look at a Sharpe ratio type measure and its Z-score:
- Sharpe Ratio := (CDS +IRD)/SWR, i.e. (5y CDS spread + implied roll down) divided by the spread widening risk
- Longs are triggered when this measure is significantly increasing (i.e. its Z-score positive)

Three different strategies have been back-tested
- “Conservative”: High thresholds for IRD or Sharpe Ratio must be exceeded for a trade to be triggered. Short trades are closed if the IRD Z-score increases (but is still negative) and long trades are closed if the Sharpe Ratio Z-score decreases (but is still positive)
- “Less conservative”: Same high thresholds for trade entry but exit signals are only triggered if IRD or Sharpe Ratio Z-scores revert to zero.
- “Aggressive”: Lower trade entry thresholds and same trade exit signals as in “less conservative”.
- Additionally, trades are closed in all three strategies if the P/L exceeds a certain level (+10bp, -10bp) or if a trade is open for more than 60 business days
CUSB Signals: Back-testing (II)

- Aggregated over all 15 members of the iTraxx SovX Series 2, all three trading strategies have a positive P/L for the period 22 Jan 2009 – 22 Dec 2010.
- As expected, the more aggressive a strategy is, the higher its expected P/L but also the higher its volatility!

<table>
<thead>
<tr>
<th>Country/Strategy</th>
<th>conserv.</th>
<th>less cons.</th>
<th>aggressive</th>
<th>conserv.</th>
<th>less cons.</th>
<th>aggressive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>France</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Greece</td>
<td>9</td>
<td>9</td>
<td>23</td>
<td>25</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Italy</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>13</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Belgium</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Denmark</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Norway</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Spain</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Sweden</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>Netherlands</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Portugal</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>20</td>
<td>20</td>
<td>33</td>
</tr>
<tr>
<td>Austria</td>
<td>-</td>
<td>-</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>35</td>
</tr>
<tr>
<td>Finland</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>5</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Ireland</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>23</td>
<td>32</td>
<td>70</td>
</tr>
<tr>
<td>UK</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>14</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>47</td>
<td>47</td>
<td>117</td>
<td>79</td>
<td>100</td>
<td>147</td>
</tr>
</tbody>
</table>

Source: Credit Suisse Quantitative Credit Strategy
Back-testing: Conservative Strategy

- 8 different sovereigns traded
- 5 made a profit, greatest: Greece (+25bp)
- 2 made a small loss, worst: Spain (-4bp)

Source: Credit Suisse Quantitative Credit Strategy

Sovereigns that haven’t traded in the back-testing have been excluded for presentation purposes
Back-testing: Aggressive Strategy

- 13 different sovereigns traded
- 7 made a profit of more than 2bp, greatest: Ireland (70bp)
- 3 made a loss of more than 2 bp, worst: Sweden (-25bp)

Source: Credit Suisse Quantitative Credit Strategy
Sovereigns that haven’t traded or whose absolute P/L is insignificant (<2bp) have been excluded for presentation purposes
PortfolioRisk+
What Is PortfolioRisk+?

- Cutting-edge mark-to-market credit risk management tool
- Developed for and used on our trading desks – now available to clients
  - CUSP spread distributions + factor correlation framework ➔ portfolio spread distribution
  - Analytic engine (Saddle Point method) ➔ no Monte Carlo simulations
    - Fast (5000 positions in 30 minutes)
    - Accurate
    - Reproducible
  - Provides issuer- and asset-level risk attribution
  - Microsoft Excel-based interface. Locally installed software allows for speed, convenience and confidentiality
  - Daily update of model inputs
  - Supports CDS, bonds, structured credit, etc.
MTM PortfolioRisk+ Process Overview

Source: Credit Suisse Quantitative Credit Strategy
Why PortfolioRisk+?

- Many market participants suffered large write-downs due to credit losses.
- We believe that the probabilities of certain developments have been underestimated:
  - jumps in credit spreads
  - higher volatility
  - curve inversion
  - breakdown of relationships that were considered stable
- Credit Suisse has developed PortfolioRisk+ to include these and uses it
  - daily on several trading desks (US, Europe, Asia and Switzerland)
  - as a credit portfolio risk management tool
  - to look at mark-to-market risk
Mark-to-Market Risk Management

- MTM means risk from any variation in value or spread.
  - MTM risk includes default and rating migration risk.

- How might we go about quantifying MTM risk?
  - DV01 (CS01) = change in PV consequent on 1bp parallel shift
    - Does not distinguish volatile from less volatile credits, does not take curve risk into account.
  - IDR = Instantaneous Default Risk
    - No differentiation between high- and low-quality credits. Only makes assertion about loss in default, not about probability of default.

- Need to be able to capture all MTM risk, without reliance on historical data or ratings, and allocate it to the issuer/position level. Specifically:
  - Spread volatility, including big moves (default is special case)
  - Curve risk – i.e., handle different maturities correctly
  - Correlation between spreads
Idea Behind CUSP/PR+ Approach

- Being a structural model, many of these effects are captured:
  - Spread risk
    - Volatility of the firm value causes spreads to be volatile.
  
  - Jump/default risk
    - Jumps in the firm value are necessary to fit the CDS curve.
  
  - Use of market instruments
    - Spread vol is inferred from equity volatility; jump risk from current CDS curve.
  
  - Curve risk
    - The structural model does not predict that curves should move parallel.
    - Convexity of the instruments is captured ➔ different parts of the curve move differently.
Merging the Equity Vol and CDS Viewpoints

- ATM equity vol gives information about moderate spread movements.
  - Credit-equity relationship is employed.
  - However, there is little depth in the out-of-money puts.
  - Hence, there is little useful information about very large spread moves (or default).

- CDS gives information about very large spread movements.
  - However, we can’t infer anything about spread vol from just looking at today’s CDS curve.

- Therefore, we need to combine the two so that both views are accommodated.
  - CUSP/PR+ use a proprietary algorithm for doing this.
Although equities sometimes decouple from credit, equity vol has generally been a pretty good indicator of spread and spread vol.

- When equity vol is higher, spreads need to be higher to compensate for the extra risk.
- When equity vol is higher, spreads tend to be more volatile.

Source: Credit Suisse Quantitative Credit Strategy
CUSP Captures Jump Risk as well as Spread Vol

- By calibrating to CDS term structure, we naturally pick up short-term jump risk.
  - Example below: PV of short CDS contract, 5Y spread 145bp, flat CDS curve, at 3M horizon:
    - Prob of losing (in MTM) >32% of notional, i.e., >700bp widening, is ~0.01
    - Prob of losing (in MTM) >74% of notional, i.e., >1700bp widening, is ~0.001

- Conclusion: CDS curve prices in jump risk; we just need a good enough model to extract the info.

Source: Credit Suisse Quantitative Credit Strategy
Current Market View versus Historical Data

Rely as much as possible on current prices, particularly option prices.

- This means NOT using historical data but instead using a model and calibrating it to current market instruments.

- For example, for spread volatility, use equity vol and equity/spread relationship.  
  - Then you get the opinion of the equity derivatives market.

- This also means calibrating to current CDS spread rather than using ratings.
  - For example, both Fiat (ca. 1375bp) and Peugeot (ca. 525bp) were rated Baa3/BBB- on 16-Mar-09.

- PR+ uses a structural model and works off current CDS spread and equity vol.
Curve Risk

- CUSP naturally incorporates curve risk as a result of spread moves:
  - In structural models, CDS are options on firm value.
  - Different maturities therefore have different convexity and cannot cancel.
  - A curve trade may be delta-neutral in the firm value but not gamma-neutral.

- Case Study: CFC steepener trade, Jul-07.
  - Trade: Sell $4.25M 2Y prot, buy $1.9M 5Y prot (DV01 neutral but convexity negative and IDR negative)
    - DV01 methodology: Zero risk.
    - PR+ methodology: 3M 99% VaR = ca. $250K.
    - One month later, loss of ca. $250K when name “blew up” and the curve inverted

- Conclusion: DV01 is not risk.
Curve Risk Cont’d

- Several popular trades are exposed to curve risk.
- A curve position is never risk free:
  - Steepener (DV01 neutral): bullish trade, most likely positive carry ➔ higher risk
  - Flattener (DV01 neutral): bearish trade, most likely negative carry ➔ lower risk
  - Butterfly (DV01 neutral, neutral to rotation of the curve as a whole): two kinds possible
    1. Steepener in the short end, flattener in the long end
    2. Flattener in the short end, steepener in the long end
      The shorter the maturity, the more volatile the spreads ➔ 1st trade has higher risk than the 2nd
- PR+ captures the risk of a curve trade.
Curve Risk Example (I)

Positioning and CDS Curve

Positioning: Steepener

Curve Shapes

Worst case: wider and inverted curve

- Positioning: Steepener
- Worst-case scenario: wider and flatter curve
- Best-case scenario: tighter and steeper curve
- Recommended trade: buy short-dated protection or sell the curve – e.g., 1s5s

Source: Credit Suisse Quantitative Credit Strategy
Curve Risk Example (II)

- Positioning: short-maturity flattener
- Worst-case scenario: tighter and steeper curve
- Best-case scenario: wider and flatter curve
- Recommended trade: buy the curve – e.g., 2s5s

Source: Credit Suisse Quantitative Credit Strategy
Optimising the Portfolio

Without having to perform a full-scale optimisation, one can determine which assets to switch:

- Switch out of assets with high risk versus return (spread) contribution.
- Switch into assets with low risk versus return (spread) contribution.

Source: Credit Suisse Quantitative Credit Strategy
PR+ Index Trading Signals

Source: Credit Suisse Quantitative Credit Strategy

iTraxx is a trademark of International Index Company Limited
Comparison of CDS indices based on risk/spread ratio:

- Use PR+ to calculate the risk – e.g., VaR at 95% confidence and 3m horizon
- VaR doesn’t track CDS spread entirely. Why?
- PR+ takes into account not only the spread of each constituent but also
  1. The equity price and volatility
  2. The curve shape
  3. The correlations between issuers
- PR+ outputs can therefore be used to compare different CDS indices and to generate trading signals.
  - use PR+ to compute the risk (VaR)
  - calculate the spread over VaR
  - retrieve trading signals from the differential of the spread/VaR measure
Counterparty Risk Analysis

- PR+ allows assessment of the risk of a loss due to a counterparty default:
  - If a counterparty defaults, all the CDS protection one has bought from it becomes void.
  - To re-establish your original position (e.g., DV01 neutral), you need to buy protection from a different counterparty.
  - By the time the default has happened, the market will most likely have gapped wider already.
  - You have to buy the new CDS protection at a wider spread – i.e. at greater cost.
  - You can use PR+ to assess this gap risk and to find the specific issuers and sectors to which you are most exposed in terms of gap risk.
  - PR+ therefore suggests trade ideas to lower your gap risk.
PR+ Index Swaption Analysis

- Index swaption market is priced predominantly off realized volatility and technicals.
- No tools exist that provide a forward-looking view of spread volatility based on the equity volatility and credit quality of the underlying index names.
  - PortfolioRisk+ is the answer to this, in our view. It is a forward-looking solution based on fundamentals that takes into account the full non-gaussian nature of credit spreads.
  - PR+ produces a spread distribution for an index based on a bottom-up analysis of constituents.
  - Payer and receiver swaptions can be priced directly off this distribution.
  - This premium can be converted into a Black-equivalent lognormal volatility.

Source: Credit Suisse Quantitative Credit Strategy
APS Basis
Traditional Approaches: Need for New Thinking

- The traditional approach to basis trades is Z-spread versus CDS spread.
  - Traditional spread measures were invented in the days when there was no CDS curve.
  - Bond spreads and CDS spreads are not the same beast.
  - We cannot uniquely go from bond price to spread.
    - We need to make assumptions about curve shape, par/non-par, etc.
  - This approach does not always identify differences in real value; negative carry does not necessarily mean good RV.

- New idea: Use whole CDS curve to price cash flows of bond
  - The deviation from market price is then a potential trade opportunity.
  - The model tells us how to hedge too.
  - Going from a set of spreads to a price is possible.
  - CDS is a cleaner way of extracting credit risk info.
Method

- **Valuation of risky cash flows**
  - \( PV = (\text{Cash flow}) \times (\text{Probability of receiving it}) \times (\text{Risk-free Discount Factor}) \)

- **Calculate probabilities from CDS curve by bootstrapping**
  - Assume recovery rate, \( R \)
  - Swap market gives risk-free discount factors
  - Get 0-1Y, 1Y-2Y ... implied default (or survival) probabilities

- **Reprice the bond**
  - As above, using the precise cash flows (careful over dates etc) of the bond
  - Discrepancy in price is called Arbitrage Price Difference (APD)
  - Conversion to asset swap spread gives Arbitrage Pricing Spread (APS)
APS and APD

Arbitrage price difference, \( \text{APD} = P_{B/CDS} - P_{MKT} \)

Arbitrage pricing spread, \( \text{APS} = s_{B/CDS} - s_{MKT} \)

\[ \text{APD} > 0, \text{APS} < 0 \]

Source: Credit Suisse Quantitative Credit Strategy
Locking in the Profit

- Numerous hedge ratios are applied in practice.
  - Delta hedged: account for difference in DV01 of bond and CDS
  - Cash hedged: adjust for premium/discount bond trades at
  - Notional flat (simple) hedge: buy CDS in amount of bond nominal

- Each has advantages and disadvantages.
  - Consequently, hedging such trades is not an exact science.

- Default risk versus spread risk
  - Spread risk is a result of curve movement – curve can deform in many ways.
  - Natural hedge for spread risk is to hedge parallel bump in CDS curve.

\[
\Delta = \frac{d(PV \text{ of Bond})}{d(PV \text{ of CDS})} = \frac{d(PV \text{ of Bond})}{d(CDS\text{spread})} / \frac{d(PV \text{ of CDS})}{d(CDS\text{spread})}
\]
APS Example 1: ICI 2007s

- Traditional view
  - Simple basis <0 ⇒ buy bond, buy CDS
  - August 2004: Simple basis of +3 bp not attractive
  - Had been –25 bp in Feb 2004: missed the boat

- APS view
  - Bond trading 33 bp cheap in August 2004
  - Buy bond, Buy CDS
  - Spreads converged rapidly: profit in seven weeks

Source: Credit Suisse Quantitative Credit Strategy
APS Example 2: GM 2013s

- APS identified rich bond on 07-Jan-05
  - APS = +75bp
  - Sell € GMCO 7.25% 13's (250 bp ASW spread)
  - Sell 10Y CDS (314 bps)
  - On DV01 flat basis

Source: Credit Suisse Quantitative Credit Strategy
APS Example 2: GM 2013s Cont’d

- APS collapsed on 20-Jan-05
  - APS = +38bp
  - CDS outperformed cash by 34 bp
    - CDS has widened 111 bps, while cash bond has widened 145 bps (taking bid/offer & into account)
  - All-in profit would have been $230K on $10M size in two weeks
Delivery

- Delivered over LOCuS
  - >1000 bonds, >500 issuers currently tracked daily (more bonds to be priced in future)
  - Bond spreads, CDS spreads, APD and APS all plotted over time
  - Z-scores, etc computed
#### Screen for negative basis trades

**Choose universe, sector and maturity**

**Sorted by APS**

---

**APS**

**Report Data: 13-Jan-10**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Duration (year)</th>
<th>ASW</th>
<th>Z</th>
<th>3Y</th>
<th>5Y</th>
<th>7Y</th>
<th>10Y</th>
<th>Implied</th>
<th>APD</th>
<th>APD</th>
<th>APS</th>
<th>APS</th>
</tr>
</thead>
<tbody>
<tr>
<td>COFF 4.875 04/10/2014</td>
<td>3.67</td>
<td>55.10</td>
<td>93.75</td>
<td>59.4</td>
<td>90.2</td>
<td>102.0</td>
<td>119.4</td>
<td>106.59</td>
<td>106.29</td>
<td>0.71</td>
<td>-8.76</td>
<td>-17.09</td>
</tr>
<tr>
<td>COFF 5.500 01/30/2015</td>
<td>4.27</td>
<td>105.12</td>
<td>101.82</td>
<td>53.4</td>
<td>90.2</td>
<td>102.0</td>
<td>119.4</td>
<td>106.17</td>
<td>106.57</td>
<td>0.39</td>
<td>-9.47</td>
<td>-8.77</td>
</tr>
<tr>
<td>METNL 5.750 07/14/2014</td>
<td>3.86</td>
<td>57.77</td>
<td>93.22</td>
<td>53.8</td>
<td>100.0</td>
<td>112.7</td>
<td>120.2</td>
<td>100.34</td>
<td>100.28</td>
<td>-0.06</td>
<td>0.07</td>
<td>1.79</td>
</tr>
<tr>
<td>CAPP 5.375 06/12/2015</td>
<td>4.57</td>
<td>58.55</td>
<td>56.13</td>
<td>38.6</td>
<td>54.6</td>
<td>52.8</td>
<td>76.5</td>
<td>110.06</td>
<td>109.98</td>
<td>-0.11</td>
<td>-0.15</td>
<td>2.59</td>
</tr>
<tr>
<td>CINF 5.125 10/01/2014</td>
<td>4.16</td>
<td>51.97</td>
<td>49.65</td>
<td>38.6</td>
<td>54.6</td>
<td>52.8</td>
<td>76.5</td>
<td>108.94</td>
<td>108.64</td>
<td>-0.21</td>
<td>-0.65</td>
<td>4.61</td>
</tr>
<tr>
<td>AUCHAN 5.125 07/18/2014</td>
<td>3.94</td>
<td>43.52</td>
<td>41.79</td>
<td>35.6</td>
<td>51.7</td>
<td>56.9</td>
<td>73.5</td>
<td>108.08</td>
<td>108.72</td>
<td>-0.33</td>
<td>-0.35</td>
<td>7.79</td>
</tr>
<tr>
<td>PRP 6-R25 04/03/2014</td>
<td>3.43</td>
<td>113.08</td>
<td>102.06</td>
<td>85.2</td>
<td>118.6</td>
<td>137.3</td>
<td>147.9</td>
<td>119.94</td>
<td>119.74</td>
<td>-0.38</td>
<td>0.04</td>
<td>9.81</td>
</tr>
<tr>
<td>CAPP 4.375 11/02/2014</td>
<td>5.80</td>
<td>38.85</td>
<td>36.83</td>
<td>38.6</td>
<td>54.6</td>
<td>62.8</td>
<td>76.5</td>
<td>105.73</td>
<td>104.18</td>
<td>-1.55</td>
<td>-0.25</td>
<td>25.10</td>
</tr>
<tr>
<td>TSCOLN 5.675 08/12/2015</td>
<td>5.47</td>
<td>60.94</td>
<td>57.53</td>
<td>51.5</td>
<td>71.4</td>
<td>81.3</td>
<td>98.1</td>
<td>113.45</td>
<td>111.87</td>
<td>-1.62</td>
<td>0.38</td>
<td>26.95</td>
</tr>
</tbody>
</table>
Identify negative basis trades

Market and model prices converged

So did market and model ASW spreads

Curve steepened and z-spread tightened
Generate relative value ideas

Compare bond of interest with other bonds of the same issuer and its CDS curve

Compare bond of interest with other bonds in the same sector

Compare bond of interest with other bonds in the same Rating Class
Find issuer and issue details

All historic measures at one glance  

Plus all issuer details

**History Chart**

- **ASW-Spd**
- **HISTORIC DATA**
  - Price Bid: 110.00  
  - Price Ask: 110.58  
  - Price Chg: 0.02  
  - Bank Spd Bid: 76.91  
  - Bank Spd Ask: 67.41  
  - Accrued Interest: 4.09  
  - Duration: 4.57  
  - DV01: 0.051025

**Bond Lookup**

- **By Identifier**  
  - Company: Carrefour SA
- **By Company**  
  - Siblings: Carrefour SA
- **By Instrument**  
  - Chooser: Bond
  - CARP 5.325% 06/12/2015

**STATIC DATA**

- Issuer: Carrefour SA
- Type: MTN
- Subtype: EURODOLDS
- Industry: UNKNOWN
- Class: EUROBOND
- Source: DB

**SECURITY INFO**

- **Maturity Date**: 06/12/2015
- **Issue Date**: 06/03/2008
- **Series**: MNTN
- **ISIN**: K30329928812
- **CUSIP**: F19220145
- **SEDOL**: 5391204
- **BBG ID**: BH390583 Corp

**REDEMPTION INFO**

- **ISIN**: DE0001392993
- **BBG ID**: BB002129029
- **DEKB ID**: BB002129029
- **Maturity Date**: 06/12/2015
- **ISIN**: DE0001392993
- **BBG ID**: BB002129029
- **DEKB ID**: BB002129029

**BENCHMARK INFO**

- **ISIN**: DE0001392993
- **BBG ID**: BB002129029
- **DEKB ID**: BB002129029

**ISIN**

- **ISIN**: DE0001392993
- **BBG ID**: BB002129029
- **DEKB ID**: BB002129029

**RATINGS**

- S & P: A

**IDENTIFIERS**

- ACT/ACT: 06/03/2008
- CSFBID: 25391204
- ISIN: K30329928812
- CUSIP: F19220145
- SEDOL: 5391204
- BBG ID: BH390583 Corp
- DEKB ID: BB002129029

**Credit Suisse**
Find issuer and issue details (II)

Access Bloomberg bond description & yield and spread analysis by clicking here

Plus for all other names in that sector
Further Developments

- **Callables**
  - In addition to standard “Z-spread to first call date”, we can do “APS to first call date”.
  - More substantially, we can use spread/IR volatility to value optionalties in callable bonds.
  - This is run internally rather than delivered over LOCuS.
Disclosure Appendix

Analyst Certification

Helen Heworth and Christian Schwarz each certify, with respect to the companies or securities that he or she analyses, that (1) the views expressed in this report accurately reflect his or her personal views about all of the subject companies and securities and (2) no part of his or her compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

CUSP® Certification and Definition

With respect to the analysis in this report based on the CUSP® methodology, Credit Suisse certifies that (1) the views expressed in this report accurately reflect the CUSP® methodology and (2) no part of the firm’s compensation was, is, or will be directly related to the specific views disclosed in this report.

CUSP® is an analytical model that relates an issuer’s capital structure, stock price, and equity option-implied volatility to its credit risk. CUSP® can be used for systematic monitoring of credit risk. Details on the CUSP® methodology can be found in the Corporates, Reference, Education tab of LOCuS (http://locus.fi.csfb.com/) or by contacting the Credit Suisse Quantitative Credit Strategy Group.

Important Disclosures

Credit Suisse's policy is to publish investment research that is impartial, independent, clear, fair and not misleading. For more detail, please refer to Credit Suisse’s Policies for Managing Conflicts of Interest in connection with Investment Research: http://www.csfb.com/research-and-analytics/disclaimer/managing_conflicts_disclaimer.html

Credit Suisse's policy is to publish research reports as it deems appropriate, based on developments with the subject issuer, the sector or the market that may have a material impact on the research views or opinions stated herein.

The analyst(s) involved in the preparation of this research report received compensation that is based upon various factors, including Credit Suisse’s total revenues, a portion of which are generated by Credit Suisse’s Investment Banking and Fixed Income Divisions.
Disclosure Appendix cont’d

Corporate Bond Risk Category Definitions

In addition to the recommendation, each issue may have a risk category indicating that it is an appropriate holding for an “average” high yield investor, designated as Market, or that it has a higher or lower risk profile, designated as Speculative and Conservative, respectively.

Credit Suisse Credit Rating Definitions

Credit Suisse may assign rating opinions to investment-grade and crossover issuers. Ratings are based on our assessment of a company’s creditworthiness and are not recommendations to buy or sell a security. The ratings scale (AAA, AA, A, BBB, BB, B) is dependent on our assessment of an issuer’s ability to meet its financial commitments in a timely manner. Within each category, creditworthiness is further detailed with a scale of High, Mid, or Low – with High being the strongest sub-category rating: High AAA, Mid AAA, Low AAA – obligor’s capacity to meet its financial commitments is extremely strong;

High AA, Mid AA, Low AA – obligor’s capacity to meet its financial commitments is very strong;

High A, Mid A, Low A – obligor’s capacity to meet its financial commitments is strong;

High BBB, Mid BBB, Low BBB – obligor’s capacity to meet its financial commitments is adequate, but adverse economic/operating/financial circumstances are more likely to lead to a weakened capacity to meet its obligations;

High BB, Mid BB, Low BB – obligations have speculative characteristics and are subject to substantial credit risk;

High B, Mid B, Low B – obligor’s capacity to meet financial commitments is very weak and highly vulnerable to adverse economic, operating, and financial circumstances;

High CCC, Mid CCC, Low CCC – obligor’s capacity to meet its financial commitments is extremely weak and is dependent on favorable economic, operating, and financial circumstances. Credit Suisse’s rating opinions do not necessarily correlate with those of the rating agencies.

Credit Suisse’s Distribution of Global Credit Research Recommendations* (and Banking Clients)

<table>
<thead>
<tr>
<th>Global Recommendation Distribution**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy</td>
</tr>
<tr>
<td>2%</td>
</tr>
<tr>
<td>(of which 50% are banking clients)</td>
</tr>
<tr>
<td>Outperform</td>
</tr>
<tr>
<td>20%</td>
</tr>
<tr>
<td>(of which 87% are banking clients)</td>
</tr>
</tbody>
</table>
Disclosure Appendix cont’d

References in this report to Credit Suisse include all of the subsidiaries and affiliates of Credit Suisse operating under its investment banking division. For more information on our structure, please use the following link: http://www.credit-suisse.com/en/contact/we-answerg this report is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or which would subject Credit Suisse or its affiliates (“CS”) to any registration or licensing requirement within such jurisdiction. All material presented in this report, unless specifically indicated otherwise, is under copyright to CS. None of the material, nor its content, nor any copy of it, may be altered in any way, transmitted to, copied or distributed to any other party, without the prior express written permission of CS. All trademarks, service marks and logos used in this report are trademarks or service marks or registered trademarks or service marks of CS or its affiliates.

The information, tools and material presented in this report are provided to you for information purposes only and are not to be used or considered as an offer or the solicitation of an offer to sell or to buy or subscribe for securities or other financial instruments. CS may not have taken any steps to ensure that the securities referred to in this report are suitable for any particular investor. CS will not treat recipients of this report as its customers by virtue of their receiving this report. The investments and services contained or referred to in this report may not be suitable for you and it is recommended that you consult an independent investment advisor if you are in doubt about such investments or investment services. Nothing in this report constitutes investment, legal, accounting or tax advice, or a representation that any investment or strategy is suitable or appropriate to your individual circumstances, or otherwise constitutes a personal recommendation to you. CS does not advise on the tax consequences of investments and you are advised to contact an independent tax adviser. Please note in particular that the bases and levels of taxation may change.

Information and opinions presented in this report have been obtained or derived from sources believed to be reliable, but CS makes no representation as to their accuracy or completeness. CS accepts no liability for loss arising from the use of the material presented in this report, except that this exclusion of liability does not apply to the extent that such liability arises under specific statutes or regulations applicable to CS. This report is not to be relied upon in substitution for the exercise of independent judgment. CS may have issued, and may in the future issue, other reports that are inconsistent with, and reach different conclusions from, the information presented in this report. Those reports reflect the different assumptions, views and analytical methods of the analysts who prepared them and CS is under no obligation to ensure that such other reports are brought to the attention of any recipient of this report. CS may, to the extent permitted by law, participate or invest in financing transactions with the issuer(s) of the securities referred to in this report. CS may provide, or may solicit or accept from any source of information, advice or investment services in relation to the investment concerned or a related investment. Additional information is, subject to duties of confidentiality, available on request. Some investments referred to in this report will be offered solely by a single entity and in the case of some investments solely by CS, or an associate of CS or CS may be the only market maker in such investments. Past performance should not be taken as an indication or guarantee of future performance, and no representation or warranty, express or implied, is made regarding future performance. Information, opinions and estimates contained in this report reflect a judgement at its original date of publication by CS and are subject to change without notice. The price, value of and income from any of the securities or financial instruments mentioned in this report can fall as well as rise. The value of securities and financial instruments is subject to exchange rate fluctuations which may have a positive or adverse effect on the price or income of such securities or financial instruments. Investors in securities such as ADRs, the values of which are influenced by currency volatility, effectively assume this risk.

Structured securities are complex instruments, typically involve a high degree of risk and are intended for sale only to sophisticated investors who are capable of understanding and assessing the risks involved. The market value of any structured security may be affected by changes in economic, financial and political factors (including, but not limited to, spot and forward interest and exchange rates), time to maturity, market conditions and volatility, and the credit quality of any issuer or reference issuer. Any investor interested in purchasing a structured product should conduct their own investigation and analysis of the product and consult with their own professional advisers as to the risks involved in making such a purchase.

Some investors discussed in this report may have a high level of volatility. High volatility investments may experience sudden and large falls in their value causing losses when that investment is realised. Losses may equal your original investment. Indeed, in the case of some investments the potential losses may exceed the initial investment and, in such circumstances, you may be required to pay more money to support those losses. Income obtained from investments may fluctuate and, in consequence, initial capital paid to make the investment may be used as part of that income yield. Some investments may not be readily realisable and it may be difficult to sell or realise those investments, similarly it may prove difficult for CS to obtain information about the value, or risks, to which such an investment is exposed.

This report may provide the addresses of, or contain hyperlinks to, websites. Except to the extent that the report refers to website material of CS, or where CS is subject to any such site and takes no responsibility for the content contained therein. Such address or hyperlink (including addresses or hyperlinks to CS’s own website material) is provided solely for your convenience and information and the content of any such website does not in any way form part of this document. Accessing such website or following such link through this report or CS’s website shall be at your own risk.

This report is issued and distributed in Europe (except Switzerland) by Credit Suisse Securities (Europe) Limited, One Cabot Square, London E14 4QJ, England, which is regulated in the United Kingdom by The Financial Services Authority (“FSA”). This report is being distributed in Germany by Credit Suisse Securities (Europe) Limited Niederlassung Frankfurt am Main regulated by the Bundesanstalt fuer Finanzdienstleistungsaufsicht (“BaFin”). This report is being distributed in the United States and Canada by Credit Suisse Securities (USA) LLC in Switzerland by Credit Suisse, in Brazil by Banco de Investimentos Credit Suisse (Brazil) S.A. in Japan by Credit Suisse Securities (Japan) Limited, Financial Instruments Firm, Director-General of Financial Local Finance Bureau (AFMR) No. 66, a member of Japan Securities Dealers Association, The Financial Futures Association of Japan; elsewhere in Asia/Pacific by whichever of the following is the appropriately authorised entity in the relevant jurisdiction: Credit Suisse (Hong Kong) Limited, Credit Suisse Equities (Australia) Limited, Credit Suisse Securities (Thailand) Limited, Credit Suisse Securities (Malaysia) Sdn Bhd, Credit Suisse Singapore Branch, and elsewhere in the world by the relevant authorised representative of CS. Copyright © 2009 CREDIT SUISSE GROUP and/or its affiliates. All rights reserved.

Investment principal on bonds can be eroded due to changes in redemption amounts. Care is required when investing in such instruments.

When you purchase non-listed Japanese fixed income securities (Japanese government bonds, Japanese municipal bonds, Japanese government guaranteed bonds, Japanese corporate bonds) from CS as a seller, you will be requested to pay purchase price only.

Please note that this research was originally prepared and issued by CS for distribution to their market professional and institutional investor customers. Recipients who are not market professional or institutional investor customers of CS should seek the advice of their independent financial advisor prior to taking any investment decision based on this report or for any necessary explanation of its contents. This research may relate to investments or services of a person outside of the UK or to other matters which are not regulated by the FSA or in respect of which the protections of the FSA for private customers and/or the UK compensation scheme may not be available, and further details as to where this may be the case are available upon request in respect of such matters. Copyright © 2009 CREDIT SUISSE GROUP and/or its affiliates. All rights reserved.