CMTA Conference Track 2
April 15th, 2015
Recent Interest Rate Changes, Effective Duration and Effect on Your Portfolio

Presented by:
Jessica Burruss, Director, BondEdge Sales
BondEdge is a leading provider of fixed income portfolio analytics to institutional investors with over 30 years expertise working with a client base that includes more than 400 investment managers, banks, insurance companies, state and local government agencies, brokerage firms, depository institutions, and pension funds
Agenda

Review of recent interest rate movements
Specific examples of analytic measures that matter
Forward looking simulations - BondEdge best practices
Are shifts parallel ....?
Recent Shifts in the US Yield Curve

Yield Curve Graph Coupon

Yield Curve Graph Coupon

Yield Curve Graph Coupon

Yield (%)
Maturity Years

Yield (%)
Dynamic Risk Measures

- Dynamic risk measures were developed to overcome the limitations inherent in static risk measures

- Dynamic risk measures include, but are not limited to:
  - Option-adjusted spread (OAS)
  - Option-adjusted duration (OAD)
  - Option-adjusted convexity (OAC)
  - Key rate durations (KRD)
  - Spread Duration

- Dynamic risk measures are a “probabilistic” combination of static outcomes
Dynamic Risk Measures – Price Sensitivity

Effective Duration

- Option-adjusted measure of a bond’s sensitivity to changes in interest rates. Calculated as the average percentage change in a bond's value (price plus accrued interest) under parallel shifts of the Treasury curve.

- Incorporates the effect of embedded options for corporate bonds and changes in prepayments for mortgage-backed securities (including pass-throughs, CMOs and ARMs). For Municipal Variable Rate Demand Notes (VRDNs), Effective Duration is calculated based on cash flows to the next reset date.

- BondEdge uses +/- 100 bps, then derives two new spot curves from the shifted par curves. These spot curves are used to value the security in the higher and lower rate environments, holding the security's initial OAS constant.
Dynamic Risk Measures – Price Sensitivity

Convexity

- The percentage change in a bond's price not explained by Effective Duration. Positive convexity indicates that the bond's duration increases as interest rates fall, and decreases when interest rates rise. This means the bond's price will rise/(fall) at an increasing (decreasing) rate as interest rates fall/(rise). Negative convexity produces the opposite effect.
Callable Agency – Risk Measures/Return Profile
US Treasury Security – Risk Measures/Return Profile


Analytics

Cashflow

Returns

History

Pricing Method: BondEdge Pricing

Current Price: 99.938

Yield to Maturity: 0.533

Yield to Worst Call: 0.000

Yield to Put: 0.000

Yield Value of 32nd: 0.016

Current Yield: 0.550

Average Life (Years): 1.517

Modified Duration: 1.904

Local Duration: 1.904

Duration to Worst: 0.018

DV01: 0.018

Effective Duration (Par): 1.904

Convexity (Par): 0.024

OAS (Govt Curve): -2

LIBOR OAS: -26

Nominal Spread: -1

Option Value ($): 0.000

Accrued Interest: 0.042

User-defined Analytics

Interest Rate Changes (BP)
FNMA Mortgage Pool – Risk Measures/Return Profile
12 Month Total Return Comparison
US Treasury (Buy)/Callable Agency Security (Sell)
Historical Example

Actual Evolution of Two Securities with Nearly Equal Option-Adjusted Duration as of January 31, 2012

<table>
<thead>
<tr>
<th>Security</th>
<th>As of January 31, 2012</th>
<th>As of March 16, 2012</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price</td>
<td>YTW</td>
<td>OAD</td>
</tr>
<tr>
<td>FHLB 1.25% FEB 2017</td>
<td>100.13</td>
<td>0.78</td>
<td>1.88</td>
</tr>
<tr>
<td>U.S. TSY 1.50% DEC 2013</td>
<td>102.45</td>
<td>0.22</td>
<td>1.89</td>
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</tbody>
</table>

Notation:
YTW: Yield to Worst
OAD: Option-Adjusted Duration
OAC: Option Adjusted Convexity

Explanation: Negative convexity due to the presence of a call option.

Price changes were dramatically different.

Similar initial OAD.
Forward Looking Simulations

Total return (and book value) scenario analysis, given parallel interest rate shifts

<table>
<thead>
<tr>
<th>Yield Chg</th>
<th>Total Return</th>
<th>Income Return</th>
<th>Price Return</th>
<th>Ending Avg Life</th>
<th>Ending Eff Dur</th>
<th>Ending Conv</th>
<th>Mkt Val (USD 000)</th>
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</thead>
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<tr>
<td>-100</td>
<td>2.207</td>
<td>1.137</td>
<td>2.150</td>
<td>2.975</td>
<td>2.051</td>
<td>-0.016</td>
<td>90,264</td>
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<tr>
<td>0</td>
<td>1.523</td>
<td>1.264</td>
<td>0.260</td>
<td>2.949</td>
<td>2.139</td>
<td>-0.021</td>
<td>88,723</td>
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<tr>
<td>100</td>
<td>-0.131</td>
<td>1.530</td>
<td>-1.662</td>
<td>2.917</td>
<td>2.218</td>
<td>0.003</td>
<td>87,277</td>
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<td>200</td>
<td>-1.814</td>
<td>1.775</td>
<td>-3.594</td>
<td>2.886</td>
<td>2.246</td>
<td>0.030</td>
<td>85,802</td>
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<tr>
<td>300</td>
<td>-3.493</td>
<td>2.004</td>
<td>-5.497</td>
<td>2.846</td>
<td>2.226</td>
<td>0.047</td>
<td>84,339</td>
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<tr>
<td>400</td>
<td>-5.114</td>
<td>2.222</td>
<td>-7.335</td>
<td>2.800</td>
<td>2.174</td>
<td>0.056</td>
<td>82,922</td>
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<tr>
<td>500</td>
<td>-6.659</td>
<td>2.430</td>
<td>-9.090</td>
<td>2.750</td>
<td>2.106</td>
<td>0.058</td>
<td>81,572</td>
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<td>600</td>
<td>-8.122</td>
<td>2.632</td>
<td>-10.754</td>
<td>2.696</td>
<td>2.036</td>
<td>0.055</td>
<td>80,294</td>
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Forward Looking Simulations
Total return (and book value) scenario analysis, given non-parallel interest rate shifts and credit spread changes

<table>
<thead>
<tr>
<th></th>
<th>Bearish (%)</th>
<th>Bullish (%)</th>
<th>Credit Tighten (%)</th>
<th>Credit Widen (%)</th>
<th>Bear Flattener (%)</th>
<th>Bull Flattener (%)</th>
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<tbody>
<tr>
<td>BEGIN</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>10.00</td>
<td>10.00</td>
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<td>PROBABILITY (%)</td>
<td></td>
<td></td>
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<tr>
<td>PORTFOLIO:</td>
<td></td>
<td></td>
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<tr>
<td>Income Return</td>
<td>0.265</td>
<td>1.515</td>
<td>1.174</td>
<td>1.174</td>
<td>1.292</td>
<td>0.918</td>
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<tr>
<td>Price Return</td>
<td>4.147</td>
<td>-3.502</td>
<td>0.586</td>
<td>-0.847</td>
<td>-1.152</td>
<td>1.299</td>
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<tr>
<td>Price Return - Chg in Parallel Rates</td>
<td>4.643</td>
<td>-4.653</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.621</td>
<td>1.572</td>
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<tr>
<td>Price Return - Chg in Slope</td>
<td>-0.497</td>
<td>0.951</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.532</td>
<td>-0.273</td>
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<td>Price Return - Yield Curve Roll</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td>Price Return - Chg in Spreads</td>
<td>0.000</td>
<td>0.000</td>
<td>0.586</td>
<td>-0.847</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td>Price Return - Chg in Credit Spreds</td>
<td>0.000</td>
<td>0.000</td>
<td>0.347</td>
<td>-0.847</td>
<td>0.000</td>
<td>0.000</td>
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<td>Price Return - Chg in Mortgage Spreds</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.261</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td>Total Return</td>
<td>4.611</td>
<td>-1.868</td>
<td>1.759</td>
<td>0.327</td>
<td>0.139</td>
<td>2.217</td>
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<td>6 Month</td>
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<td>-0.15</td>
<td>0.50</td>
<td>0.00</td>
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<td>10.00</td>
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<tr>
<td>1 Year</td>
<td>0.15</td>
<td>-0.18</td>
<td>0.58</td>
<td>0.00</td>
<td>0.00</td>
<td>9.50</td>
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<td>2 Year</td>
<td>0.36</td>
<td>-0.29</td>
<td>0.73</td>
<td>0.00</td>
<td>0.00</td>
<td>7.50</td>
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<td>3 Year</td>
<td>0.65</td>
<td>-0.44</td>
<td>0.88</td>
<td>0.00</td>
<td>0.00</td>
<td>6.50</td>
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<td>5 Year</td>
<td>1.40</td>
<td>-0.82</td>
<td>1.19</td>
<td>0.00</td>
<td>0.00</td>
<td>4.50</td>
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<tr>
<td>7 Year</td>
<td>1.94</td>
<td>-1.32</td>
<td>1.49</td>
<td>0.00</td>
<td>0.00</td>
<td>3.50</td>
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<tr>
<td>10 Year</td>
<td>2.49</td>
<td>-2.00</td>
<td>1.95</td>
<td>0.00</td>
<td>0.00</td>
<td>2.50</td>
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<tr>
<td>20 Year</td>
<td>3.30</td>
<td>-2.87</td>
<td>3.47</td>
<td>0.00</td>
<td>0.00</td>
<td>1.50</td>
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<tr>
<td>30 Year</td>
<td>3.51</td>
<td>-3.11</td>
<td>5.00</td>
<td>0.00</td>
<td>0.00</td>
<td>5.00</td>
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</table>
Challenging Intuition

- The yield of a bond priced at par is always the coupon rate
  ‣ FALSE
  ‣ Several factors can cause the yield of a bond priced at par to be different from the coupon rate
    - Accrued Interest and Daycount
      In the price/yield relationship, cash flows are discounted using geometric compounding of the yield. However the accrued interest, which affects the price of the bond, grows linearly with the daycount
    - Payment frequency
      If the payment frequency is monthly, quarterly, or annual, the bond equivalent yield will not be equal to the coupon
BondEdge Solutions
Additional Information

- Jessica Burruss, Director Western Region
  jessica.burruss@interactivedata.com

- BondEdge Solutions: (310) 479-9715

- Interactive Data Website: www.interactivedata.com

- For BondEdge clients, please contact your Consultant: (310) 479-9715
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