Structured Finance: Fixed Income

Prof. Ian Giddy
New York University

Structured Finance

- Asset-backed securitization
- Corporate financial restructuring
- Structured financing techniques
Motivations for Issuing Hybrid Bonds

- Company has a view
- There are constraints on what the company can issue
- The company can arbitrage to save money
- Always ask: given my goal, is there an alternative way of achieving the same effect (e.g., using derivatives?)

“Hybrid” Features of A Bond Issue

- Example: callable bonds
- Call Feature
  - Call price - par value = call premium
  - Call feature can be valued independently
  - The call feature is advantageous to the issuer, but it comes at a price
### Treasury Bonds

<table>
<thead>
<tr>
<th>Size</th>
<th>Win</th>
<th>Issue</th>
<th>Coupon</th>
<th>Maturity</th>
<th>Yield</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>FON</td>
<td>7.875</td>
<td>11-15-2017</td>
<td>3.748</td>
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<tr>
<td>200</td>
<td>FON</td>
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<td>04-15-2018</td>
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<tr>
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<td>FON</td>
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<td>02-15-2018</td>
<td>4.016</td>
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<td>100.706</td>
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<tr>
<td>300</td>
<td>FON</td>
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<td>01-15-2019C</td>
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<td>05-15-2019C</td>
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<td>05-15-2020C</td>
<td>7.701</td>
<td>117.203</td>
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</table>

Source: bondsonline.com (May 3 2002)

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**Note:** The charts and data are from the [StockCharts.com](http://stockcharts.com) website.
Treasury Bond Options

http://futures.tradingcharts.com/

http://www.numa.com/derivs/ref/calculat/calculat.htm

http://www.numa.com/derivs/ref/calculat/calculat.htm

THE DERIVATIVES LABORATORY

The WWW's Original Webulators

Calculators: Option | Multi-Option | Convertible Bond | Warrant

Calculator Descriptions

OPTIONS

Analyzes European options, and calculates implied volatility on fair value, delta, gamma, theta, vega, and rho. An explanation of these indicators is given with each calculation, along with appropriate examples. Finally, a share price table is computed to illustrate the changes in option value for a range of share prices. One of the more difficult areas of option valuation concerns volatility, and so we have a brief discussion of option volatility. Output is formatted using tables, so browsers must be table-compatible.
Callable Bonds and Hybrid Securities

General Principle:
Callable bonds and other hybrid securities are simple or complex combinations of other individual securities.

General Method:
1. Identify investor’s or issuer’s needs, constraints and views.
2. Break up bond into components and find value of the total.
3. Compare this with realistic alternatives. Is this the best way to satisfy investor’s and issuer’s needs and views?
A Call to Guernsey

Which bond, priced at par, offers the best value?

- A 4-year Sony Eurodollar bond paying 8.50%, callable at 100.25 in two years.
- A 4-year BASF Eurodollar bond paying 8.48%, callable at 100.50 in three years.
- A 4-year SNCF noncallable Eurodollar bond, paying 8.44%.

Guernsey: Rates

<table>
<thead>
<tr>
<th>March 24, 1996</th>
<th>U.S. TREASURY YIELD CURVE</th>
<th>AA CORPORATE YIELDS</th>
<th>VOLATILITY OF TREASURY YIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 MONTHS</td>
<td>5.97</td>
<td>6.30</td>
<td>9.5%</td>
</tr>
<tr>
<td>1 YEAR</td>
<td>6.28</td>
<td>7.40</td>
<td>9.6%</td>
</tr>
<tr>
<td>2 YEARS</td>
<td>7.27</td>
<td>7.90</td>
<td>10%</td>
</tr>
<tr>
<td>3 YEARS</td>
<td>7.52</td>
<td>8.34</td>
<td>11.2%</td>
</tr>
<tr>
<td>4 YEARS</td>
<td>7.55</td>
<td>8.44</td>
<td>9.9%</td>
</tr>
<tr>
<td>5 YEARS</td>
<td>7.76</td>
<td>8.72</td>
<td>9.7%</td>
</tr>
<tr>
<td>10 YEARS</td>
<td>8.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 YEARS</td>
<td>8.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A Call to Guernsey

- Install the disk files into a directory called AKA
- Run AKA
- Use Valuation/Callable bonds
- Put in the data; enter 999 for years where there is no call option.

Forward Interest Rates

Borrow for 6 months at 5%
Invest for 3 months at 4%
Lock in cost at ? Ans: 6%

[Diagram showing forward interest rates]
Calculating Implied Forward Rates

I can buy a 2-year note or buy a 1-year note and reinvest it at some "forward" rate $f$:

$$ (1+y_2)^2=(1+y_1)(1+f) $$

Find $f$!

FRA Mechanics

- Borrow for 6 months at 5%
- Invest for 3 months at 4%
- Lock in cost at 6%

**SET RATE AT 6%**

**IF LIBOR > 6%, B PAYS H**
**IF LIBOR < 6%, H PAYS B**
**HOW MUCH?**

$$ PV[(LIBOR-6%)/4] $$
**FRA Valuation**

- How does the FRA’s value change over time?
- It depends on what happens to Libor.

\[
\text{PV}\left[\frac{\text{LIBOR}-6\%}{4}\right]
\]

**Swaps: Mechanics and Valuation**

- GE: Fixed 8%
- Chase: Floating USD Libor

Periodic exchanges of interest payments are made during the life of the swap. (The principal amount is not exchanged.)
Interest Rate Swap: An Extended FRA

The typical interest-rate swap is an exchange of a fixed for a floating interest rate for a period of time. Effectively, it involves paying the difference between a fixed rate and Libor, like a FRA:

Swaps

Ongoing short term funding
**Interest Rate Swap Valuation**

- How does a swap's value change over time?
- It depends on what happens to the fixed rate (the “swap rate”)

![Diagram of GE and Chase with 8% fixed rate and 3-mo Libor, floating rate]

**Swaps: Applications of Valuation**

- Valuation
- Off-market swaps
- Cancellation
- Counterparty exposure
- Hedging swap positions

![Diagram of Labatt's and RBC with fixed 9% and floating Libor]
Swaptions

Swaption is an option on a swap:
- The right to enter into a new swap at a given date in the future, or
- The right to cancel an existing swap, or
- The right to extend an existing swap.

Swap Valuation and Swaptions

The value of a swap equals the "net worth" of the swap cash flows expressed as a balance sheet.

```
Labatt's

"ASSETS"
- Receiving floating 6-mo USD Libor
- Semi-annual for 5 years
- Principal US$100m

"LIABILITIES"
- Paying fixed 9%
- Annual for 5 years
- Principal US$100m
- Like a 5-year bond

Fixed USD 9%

Floating USD Libor s.a.

Bank
```
**Swap Valuation and Swaptions**

Labatt’s swap:  
Receive floating, pay fixed

<table>
<thead>
<tr>
<th>“ASSETS”</th>
<th>“LIABILITIES”</th>
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</thead>
<tbody>
<tr>
<td>Receiving floating</td>
<td>Paying fixed 9%</td>
</tr>
<tr>
<td>6-mo US$ Libor</td>
<td>Annual for 5 years</td>
</tr>
<tr>
<td>Semi-annual for 5 years</td>
<td>Principal US$100m</td>
</tr>
<tr>
<td>Principal US$100m</td>
<td>Like a 5-year bond</td>
</tr>
<tr>
<td>Like a 5-year US$ FRN</td>
<td></td>
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</table>

**From Swap to Swaption**

- What if Labatt's had the right to cancel this swap after 3 years?
- To Labatt's, this would be exactly like a callable bond. In other words, swaptions are substitutes for callable bonds
- *Hence swaptions are priced like options on fixed rate bonds.*
### Swaption Quotations

<table>
<thead>
<tr>
<th>Years</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>4th Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.60-0.70</td>
<td>1.30-1.40</td>
<td>1.40-1.45</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>1.20-1.30</td>
<td>2.50-2.60</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>1.70-1.90</td>
<td></td>
</tr>
</tbody>
</table>

Customer receives fixed 9%

<table>
<thead>
<tr>
<th>Years</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>4th Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.50-0.60</td>
<td>1.00-1.10</td>
<td>1.70-1.75</td>
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</tr>
<tr>
<td>3</td>
<td>-</td>
<td>0.80-0.90</td>
<td>2.00-2.10</td>
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<td>5</td>
<td>-</td>
<td>-</td>
<td>2.10-2.20</td>
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</table>

### Swaption Symmetry

- Put-call parity says: “A put option plus a long position in the underlying is the same as a call option”

- The bank is “long the underlying swap” (receiving fixed). If it has the right to cancel the swap (pay fixed 9%) after 5 years, this combination is the same as the right to receive fixed 9% from years 5 to 7.
**Using Options Technology in Investment and Financing**

Caps, collars, swaps, swaptions can be used in a number of ways to enhance financing:

- To hedge an asset. Eg floating rate borrowing + cap to hedge capped consumer loans.
- With a debt issue, to "strip" a feature off the bond. Eg issue callable bond, sell a swaption to a bank.
- To take a view on the direction or volatility of interest rates. Eg. sell a swaption.

**Caps and Floors**

An interest-rate collar involves buying a cap and selling a floor:

- **Rate Diagram**
  - **TIME**
  - **RATE**
  - **5%**
  - **7%**

<table>
<thead>
<tr>
<th>RATE</th>
<th>TIME</th>
</tr>
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<tbody>
<tr>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>7%</td>
<td></td>
</tr>
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</table>
Caps, Floors and Collars

- **Cap**: Agreement to compensate buyer when interest rate exceeds a specified ceiling.
- **Floor**: Agreement to compensate buyer when interest rate falls below a specified floor.
- **Collar**: A simultaneous purchase of a cap and sale of a floor. Net cost is the price of the cap less the value of the floor. Example:
  - If LIBOR > 12% cap, bank pays borrower the difference
  - If LIBOR < 4% floor, borrower pays bank the difference
- **Swaption**: Option on a swap.

Decomposing Option Products:
Example of an Interest Rate Cap
Cap Pricing Model

<table>
<thead>
<tr>
<th>No.</th>
<th>Days to Exp.</th>
<th>Fut. or Forward Rate</th>
<th>T-Bill rate</th>
<th>Call Price (in %)</th>
<th>Put Price (in %)</th>
<th>Floor Price (in %)</th>
<th>Cap Price (in %)</th>
<th>Put Hedge Ratio</th>
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<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>8.36</td>
<td>7.06</td>
<td>0.9</td>
<td>0.0</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0%</td>
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<td>2</td>
<td>121</td>
<td>8.85</td>
<td>7.56</td>
<td>0.77</td>
<td>0.0</td>
<td>1.67</td>
<td>0.0</td>
<td>0.2%</td>
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<td>7.82</td>
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<td>0.0</td>
<td>2.33</td>
<td>0.01</td>
<td>3.5%</td>
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<td>4</td>
<td>303</td>
<td>9.69</td>
<td>8.1</td>
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<td>0.0</td>
<td>2.89</td>
<td>0.03</td>
<td>10.7%</td>
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<td>394</td>
<td>10.06</td>
<td>8.4</td>
<td>0.5</td>
<td>0.05</td>
<td>3.39</td>
<td>0.08</td>
<td>18.8%</td>
</tr>
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<td>6</td>
<td>485</td>
<td>10.4</td>
<td>8.55</td>
<td>0.45</td>
<td>0.09</td>
<td>3.84</td>
<td>0.17</td>
<td>26.1%</td>
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<td>7</td>
<td>576</td>
<td>10.72</td>
<td>8.84</td>
<td>0.42</td>
<td>0.14</td>
<td>4.26</td>
<td>0.31</td>
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<tr>
<td>8</td>
<td>667</td>
<td>11.02</td>
<td>8.96</td>
<td>0.39</td>
<td>0.18</td>
<td>4.65</td>
<td>0.49</td>
<td>37.2%</td>
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</table>

Factors Influencing Cap Prices

- **Length**
- **Steepness of yield curve**
- **Volatility**
Medium-Term Notes: Anatomy of a Deal

Anatomy of a Deal

Issuer:
- Looking for large amounts of floating-rate USD and DEM funding for its loan portfolio.
- Wants low-cost funds: target CP-.10
- Is not too concerned about specific timing of issue, amount or maturity
- Is willing to consider hybrid structures.
Anatomy of a Deal

**Investor:**
- Has distinctive preference for high grade investments
- Looking for investments that will improve portfolio returns relative to relevant indexes
- Invests in both floating rate and fixed rate sterling and dollar securities
- Can buy options to hedge portfolio but cannot sell options

**Intermediary:**
- Has experience and technical and legal background in structure finance
- Has active swap and option trading and positioning capabilities
- Has clients looking for caps and other forms of interest rate protection.
The Deal

1. Initiate medium term note programme for the borrower, allowing for a variety of currencies, maturities and special structures
2. Structuring a MTN in such a way as to meet the investor's needs and constraints
3. Line up all potential counterparties and negotiate numbers acceptable to all sides
4. Upon issuer's and investor's approval, place the securities

The Deal / 2

5. For the issuer, swap and strip the issue into the form of funding that he requires
6. Offer a degree of liquidity to the issuer by standing willing to buy back the securities at a later date.
The Issue

- Issuer: Deutsche Bank AG
- Amount: US$ 40 Million
- Coupon:
  - First three years: semi-annual
    - LIBOR + 3/8% p.a., paid semi-annually
  - Last 5 years: 8.35%
- Price: 100
- Maturity: February 10, 2000
- Call: Issuer may redeem the notes in full at par on February 10, 1995
- Fees: 30 bp
- Arranger: Credit Swiss First Boston

The Parties in the Deal

DEUTSCHE  SCOTTISH LIFE

CSFB
What’s Really Going On?

Note:

- Issuer has agreed to pay an above-market rate on both the floating rate note and the fixed rate bond segment of the issue
  FRN portion: .75 % above normal cost
  Fixed portion: .50% above normal cost
- Issuer has in effect purchased the right to pay a fixed rate of 8.35% on a five-year bond to be issued in three years time.

Structured Notes

- Bundling and unbundling basic instruments
- Exploiting market imperfections (sometimes temporary)
- Creating value added for investor and issuer by tailoring securities to their particular needs

Key: For the innovation to work, it must provide value added to both issuer and investor.
Contact Info

Ian H. Giddy
NYU Stern School of Business
Tel 212-998-0426; Fax 212-995-4233
ian.giddy@nyu.edu
http://giddy.org