Swaptions

Concepts and Buzzwords

- Swaps
- Swaptions
- Connection to Callable Bonds
- Callable Swaps
- Receiver swaption
- Payer swaption
- Putable swap
- Callable swap

Reading

- Veronesi, Chapter 12
- Tuckman, Chapter 19
Review of Interest Rate Swaps

• A plain vanilla semi-annual swap is a contract to receive a fixed interest rate and pay a floating interest rate on a given notional par amount every 6 months until maturity.

• A $T$-year swap with notional par amount $N$ and fixed rate $k$ is the same as the portfolio
  • long $N$ par of $T$-year fixed rate bonds with coupon rate $k$ and
  • short $N$ par of $T$-year floaters.
• Swap value = bond value minus par.

Class Problem: 2-Year 5.5% Swap

• Each node lists the ex-coupon price a 5.5%-coupon bond maturing at time 2.
• Fill in the tree of ex-payment values of $100$ par of the 5.5% swap maturing at time 2.

<table>
<thead>
<tr>
<th>Time 0</th>
<th>Time 0.5</th>
<th>Time 1</th>
<th>Time 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.0019</td>
<td>99.0890</td>
<td>98.6063</td>
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<tr>
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</tbody>
</table>
Swaptions

Swap-Based Products

• A swaption is an option on a swap, usually with strike price zero.

• I.e., it is the right to enter into a swap with a pre-specified fixed rate at no cost on a future date.
  
  • A receiver swaption is the right to enter into a swap as the fixed rate receiver—a call on a swap.

  • A payer swaption is the right to enter into a swap as the fixed rate payer—a put on a swap.

• A cancelable swap is a swap with an embedded swaption.

  • Putable swap: The fixed interest receiver has the right to cancel the swap before maturity.

  • Callable swap: The fixed interest payer has the right to cancel the swap before maturity.

Class Problem: Receiver Swaption

• Consider an American call on $100 notional of a 5.5% swap maturing at time 2.

• The swaption has strike price 0 and is exercisable on any payment date, ex-payment.

• Fill in the tree of values of this swaption.

<table>
<thead>
<tr>
<th>Time 0</th>
<th>Time 0.5</th>
<th>Time 1</th>
<th>Time 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Swaptions and Bond Options

- Notice that this swaption is the same as the option embedded in the 2-year 5.5%-coupon bond callable at par.
- In general, in the absence of default risk, a call with strike price zero on a swap with maturity $T$, and swap rate $k$, = a par call on bond with maturity $T$ and coupon rate $k$.
- They have the same exercise value:
  Receiver swaption exercise value
  \[= \text{swap value} - 0\]
  \[= (\text{bond value} - \text{floater value}) - 0\]
  \[= \text{bond value} – \text{par}\]
  \[= \text{exercise value of call on bond with par strike}\]
- Therefore, they also have the same wait values if they have the same exercise dates, because wait values are just functions of future exercise values.

Swaptions and Callable Bonds

- If a callable bond issuer’s borrowing rates track swap rates closely, then the issuer can try to monetize the value of the option embedded in its callable bond by selling a receiver swaption.
- The idea is that if the rates decline, and the swaption holder exercises against the issuer, the issuer can call the old bonds, sell new noncallable bonds with the same coupon and maturity, and use the refunding profit to cover the cost of the swaption exercise.
- However, there is basis risk between swap rates and the issuer’s borrowing rates. If the issuer’s borrowing rates don’t fall as much as swap rates, the refunding profit may not be sufficient to cover the cost of the swaption exercise.
- Thus, by buying the call embedded in its bond from investors and selling a swaption, the issuer is essentially betting on continued or improved credit quality.
Swaptions and Cancelable Swaps

• Cancelable swap = swap +/- option to cancel
• Could be either a callable swap or putable swap, depending on who has the right to cancel.
• Callable swap = swap - receiver (call) swaption
  • Fixed payer has the option to cancel.
  • The option to cancel is a receiver swaption.
• Putable swap = swap + payer (put) swaption
  • Fixed receiver has the option to cancel.
  • He is long the swap and long the option to cancel.
  • The option to cancel is a payer swaption.

Class Problem: Callable Swap

• Suppose the 5.5% 2-year swap is cancelable, at no cost, at the option of the fixed payer, on any payment date, ex-payment.
• What is the time 0 value of $100 notional amount of this swap from the point of view of the fixed receiver?

• What is the value of the fixed payer’s position?
Class Problem: Payer Swaption

- Consider an American put on $100 notional of a 5.5% swap maturing at time 2. The swaption has strike price 0 and is exercisable on any payment date, ex-payment.

- Fill in the tree of values of this swaption.

Time 0  Time 0.5  Time 1  Time 1.5

- Putable Swap: What is the value of a 2-year, 5.5% swap that is cancelable on any payment date at the fixed receiver’s option?

Par Rate for Callables?
Bond and Option Prices for Different Coupon Rates:

<table>
<thead>
<tr>
<th>Coupon</th>
<th>Bond</th>
<th>Call</th>
<th>Callable Bond</th>
<th>Swap</th>
<th>Callable Swap</th>
</tr>
</thead>
<tbody>
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<td>$0.93</td>
<td>$100.00</td>
<td>$0.93</td>
<td>$0.00</td>
</tr>
</tbody>
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