513 Building Applications for Computational Finance

Final Examination Review

Agenda

1. Material Preparation
2. Final Examination Review Video
3. Review
4. Exercise
5. Key Points

Part I – Material Preparation

Slides

1. Financial Arithmetic
2. Money Market
3. Binomial Tree
4. FRA (Forward Rate Agreements) and IRF (Interest Rate Forward)
5. IRS (Interest Rate Swaps)
6. Curve Construction
7. XLL (DLL for Dynamic Link Library)

Excel

1. Introduction to Excel (2007)
2. Curve Construction Illustration
3. Introduction to VBA (2007)
4. XLOPER
5. Business Day Example

Assignment

1. Binomial Tree (100%)
2. Curve

Part II – Final Examination Review Video

- 70% financial concept
- 30% Excel and VBA
- Bring Calculator

Past Paper

1. Money Market Rate: 6M   4.000% - 4.125%   180days

                          12M   4.375% - 4.500%   360days

Calculate the highest 6 v 12 FRA price, above which it is possible to make a risk-free profit.

Answer:

    a. Borrow 100 for 12mo at 4.5%
    b. Lend 100 for 6mo at 4%
    c. Sell 6 v 12 FRA at
      ((100*(1+4.5%*360/360))/(100*(1+4%*180/360)-1)*360/180=5/102=4.901%

2. Value the IRS on 27 March 2002

Notional Amount:	10 million
Start of swap:	23 July 2001
Maturity of swap:	23 July 2004 (Note 2004 is a leap year)
Receive:	7.3% (semi-annual 30/360)
Pay:	LIBOR (semi-annual ACT/360)
Previous LIBOR fixing:	9.2% from 23 Jan 2002 to 23 Jul 2002

Zero-coupon discount factors from 27 Mar 2002:

23 Jul 2002:	0.9703	23 Jan 2003:	0.9249
23 Jul 2003:	0.8825	23 Jan 2004:	0.8415
23 Jul 2004:	0.8010		

    a. show the cashflows of the fixed leg:

        23 Jul 2002   10,000,000*7.3%*180/360 = 365,000
        23 Jan 2003   10,000,000*7.3%*180/360 = 365,000
        23 Jul 2003   10,000,000*7.3%*180/360 = 365,000
        23 Jan 2004   10,000,000*7.3%*180/360 = 365,000
        23 Jul 2004   10,000,000*7.3%*180/360 = 365,000

    b. From the zero-coupon discount factors, infer the market rates for the floating leg period.

        23 Jul 2002   23 Jan 2003   (0.9703/0.9249-1)*360/184=0.096039
        23 Jan 2003   23 Jul 2003   (0.9249/0.8825-1)*360/181=0.09556

    c. Using the market rates inferred in part b, calculate the cashflows of the float-leg

        23 Jul 2002   -10,000,000*9.2%*181/360=-462555.56
        23 Jan 2003   -10,000,000*9.6036%*184/360=-490863.88

    d. Calculate the NPV

Date	Fixed	Float	DF	
23 Jul 2002	365,000	462555.56	0.9703	-94658.16
23 Jan 2003	365,000	490863.88	0.9249	116411.50
23 Jul 2003	365,000	480453.26	0.8825	101887.50

3. Curve Construction
   a. Identify the dates for cash key points and calculate the discount factors for the key points.
      2-May-06 $1/(1+0.0725*1/365)=0.999801409$
      3-May-06 $0.999801409/(1+0.0725*1/365)=0.999602858$
   b. Identify the starting future date and use exponential interpolation to calculate the discount factor for the starting future date.
      15-Jun-06 $0/.999602858*(0.981044717/0.999602858)^{(?/?)}=0.990885648$
   c. Identify the dates of key points for all futures and calculate the discount factor for all future key points. Given 15-Mar-07 the date for the last future key point.
      14-Sep-06 $0.99085648/(1+((100-92.57)/100)*(91/365))=0.972864205$
      14-Dec-06 $0.972864205/(1+((100-92.72)/100)*(91/365))=0.955521362$
      15-Mar-07 $0.955521362/(1+((100-93)/100)*(91/365))=0.939131586$
   d. Identify the dates of the key point for the 1Y Swaps.
      3-May-07
   e. Show the equation that the 1Y Swaps has to satisfy.
      $(-100*0.999602858)+(100*7.276\%*184/365*0.963296569) +$
      $(100+100*7./276\%*181/365*D)=0$
      $D=0.939131586$
4. Transfer VBA data to and from Worksheet
   Given an array with data as follows:
      Dim dArray(1, 3) As Double
      dArray(0, 0) = 1;   dArray(0, 1) = 2;   dArray(0, 2) = 3
      dArray(1, 0) =4;   dArray(1, 1) = 5;   dArray(1, 2) = 6
   a. Write one statement to transfer the array to the range B2:D3.
      Range("B2:D3") = dArray
   b. Write one statement to clear dArray, that is, fill dArray with 0s.
      Erase(dArray)
   c. Write code to transfer data from "data2x3", a 2 x 3 named range to dArray.
      For i = 0 To 1
            For j = 0 To 1
                  dArray(i, j) = Range("data2x3").Cells(i + 1, j + 1)
            Next j
      Next i
5. True or False
   a. In an IRS, one will gain while the other will lose.
      F. Two can benefit each other.
   b. Given a 5% nominal interest rate quoted for a 1-year deposit when the interest is paid all at maturity. The quarterly equivalent rate should be less than 5%.
      T.
   c. A zero coupon instrument A is quoted at discount basis of 5%. Another zero coupon instrument B is quoted at a yield basis of 5% with the same maturity as A. Instrument B has a better return.
      F.

d. If a trader sells an FRA to counterparty, he should by futures to cover his position.
F.

e. A flat yield curve indicates that the interest rate will drop in the future.
T.

6. Excel

a. Formula
Show the formula for the received fixed leg for 12-Sep-07. Your formula should be able to copy and paste to the rest of the cashflows.
=B1 * C6 * B10 / 365

b. Function
Given the following PMT function description from Excel:
PMT(rate, nper, pv)
Rate is the interest rate for the loan.
Nper is the total number of payments for the loan.
Pv is the present value, or the total amount that a series of future payments is worth now, also known as the principal.
For a home loan of $3,000,000 and an annual rate of 5%, in terms of PMT, the monthly payment for a loan term of 20 years.
PMT(5%/12, 240, 3000000)

7. IRR

Part V - Key point

1. Money Market Rate
   a. FRA

2. IRS
   a. Fixed Leg
   b. Floating Leg

3. Curve
   a. key dates
   b. 1Y Swap

4. VBA

5. True or False

6. Excel

7. IRR