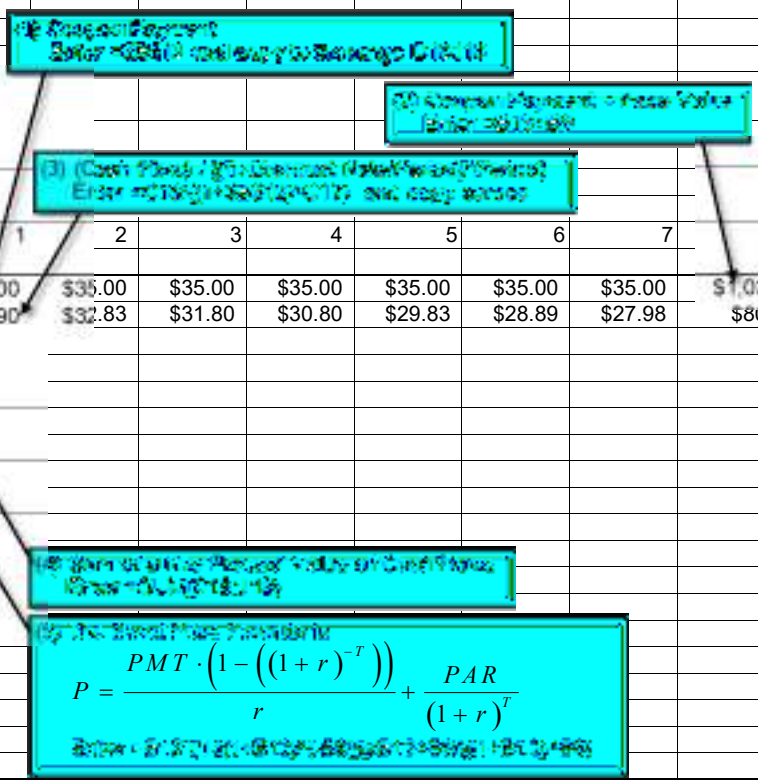
	A	B	C	D	E	F	G	H	I	J
1	**BOND PRICING**	**Annual Payments**								
2										
3										
4										
5										
6										
7	**Inputs**									
8	Number of Periods to Maturity (T)	8	8							
9	Face Value (PAR)	$1,000	20							
10										
11										
12	Discount Rate / Period (r)	3.25%	6							
13	Coupon Payment (PMT)	$35.00	7							
14										
15	**Bond Price using a Timeline**									
16	Period	0	1	2	3	4	5	6	7	8
17										
18	Cash Flows		$35.00	$35.00	$35.00	$35.00	$35.00	$35.00	$35.00	$1,035.00
19	Present Value of Cash Flows		$33.90	$32.83	$31.80	$30.80	$29.83	$28.89	$27.98	$801.35
20	Bond Price	$1,017.37								
21										
22	**Bond Price using the Formula**									
23	Bond Price (P)	$1,017.37								
24										
25	**Bond Price using the PV Function**									
26	Bond Price	$1,017.37								
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										



$$P = \frac{PMT \cdot \left(1 - \left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

Bond Pricing

EAR, APR, & Foreign Currencies

Currency: US Dollar

Exch Rate $1.00 =

Currency Number	4	
(Select from below)		
1 = Chinese Yuan	¥ 7.3790	
2 = European Euro	€ 0.6805	
3 = Indian Rupee	IDR 39.30	
4 = US Dollar	$1.00	

Inputs

Rate Convention	EAR / APR	2 Annual Percentage Rate
Annual Coupon Rate	4	
Yield to Maturity (Annualized)	1	
Number of Payments / Year		
Number of Periods to Maturity (T)		
Face Value (PAR)	$1	

Outputs

Discount Rate / Period (r)	
Coupon Payment (PMT)	

Bond Price using a Timeline

Period	2	3	4	5	6	7	8
Time (Years)	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Cash Flows	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$1,020.00
Present Value of Cash Flows	$19.66	$19.49	$19.32	$19.15	$18.99	$18.82	$951.71

Bond Price: $1,086.94

Bond Price using a Formula

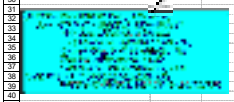
Bond Price: $1,086.94

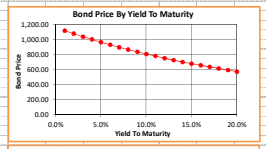
Bond Price using a Function

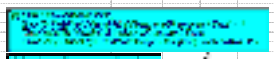
Bond Price: $1,086.60

Bond Price using the PRICE Function (under APR)

Bond Price: $1,086.94







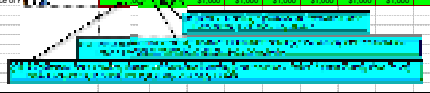
Data Table: Sensitivity of [illegible] Discount Rate / Period

	Input Values for Discount Rate / Period																		
Yield to Maturity (Annualized)	2.0%	3.0%	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%	19.0%	20.0%
Output Formula:	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%	8.5%	9.0%	9.5%	10.0%
Bond Price	$1,117	$1,077	$1,037	$1,000	$964	$930	$897	$865	$835	$806	$778	$752	$726	$701	$678	$655	$633	$613	$592	$573

(6) Create the bond price Data Table:
Select the range B64:V65, click on
ata | Data Tools | What-If Analysis | Data Table,
nter B12 in the Row Input Cell,

Bond Pricing By Calendar Time

Calendar Time (Years)	0	0.5	1	1.5	2	2.5	3	3.5	4
Time to Maturity (Years)	4	3.5	3	2.5	2	1.5	1	0.5	0
Number of Periods to Maturity (T)	8	7	6	5	4	3	2	1	0
Bond Price of Coupon Bond	$1,0[illegible]	$1,066	$1,056	$1,044	$1,033	$1,022	$1,011	$1,000	
Bond Price of F[illegible]	$1,0[illegible]	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	



BOND PRICING

Duration and Convexity

Currency:

Inputs

Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate	4.00%	8
Yield to Maturity (Annualized)	1.74%	3
Number of Payments / Year	2	2
Number of Periods to Maturity (T)	8	8
Face Value (PAR)	$1,000	20

Annual Percentage Rate

(1) Copy the Outputs & Timeline from the
Copy the range B12:J20 from the previ

Outputs

Discount Rate / Period (r)	0.9%
Coupon Payment (PMT)	$20

Bond Duration using a Timeline

Period	0	1	2	3	4	5
Time (Years)	0.0	0.5	1.0	1.5	2.0	2.5
Cash Flows		$20.00	$20.00	$20.00	$20.00	$20.00
Present Value of Cash Flows		$19.83	$19.66	$19.49	$19.32	$19.15
Weight		1.8%	1.8%	1.8%	1.8%	1.8%
Weight * Time		0.01	0.02	0.03	0.04	0.04

Bond Price using a Timeline	$1,086.96
Duration using a Timeline	3.75
Modified Duration using a Timeline	3.72

(2) PV of Cash Flow on Date t / Tota
Enter =C19/$B$20 and copy acr

(3) Weight * Time
Enter =C21*C17 and copy acros

(4) Sum of all the Weight * Times
Enter =SUM(C22:J22)

(5) Duration / (1+(Discount Rate / P
Enter =B23/(1+$B$12) and cop

(6) The Duration Formula is:

$$D = \frac{1+r}{r \cdot NOP} - \frac{1+r+T \cdot (CR$$

Enter =(1+B12)/(B12*B7)-(1+B12
/(B5*((1+B12)^B8-1)+B12*

Bond Duration using a Formula

Duration (D) using a Formula	3.75
Modified Duration using a Formula	3.72

Bond Duration using a Function (under APR)

Duration using a Function	3.75
Modified Duration using a Function	3.72

(7) DURATION (Settlement Date, Maturity Date, Annual Coupon Rate, Yield to Maturity, Number of Periods)
Enter =IF($C$4=1,"",DURATION(DATE(2000,1,1),DATE(2000+B8/B7,1,1),B5,B6,B7))

(8) MDURATION (Settlement Date, Maturity Date, Annual Coupon Rate, Yield to Maturity, Number of Periods)
Enter =IF($C$4=1,"",MDURATION(DATE(2000,1,1),DATE(2000+B8/B7,1,1),B5,B6,B7))

Bond Convexity

Weight * (Time^2+Time)	0.01	0.04	0.07	0.11	0.15

Convexity using a Timeline	18.06
Convexity using a Formula	18.06

(9) Weight * (Time^2 + Time)
Enter =C21*(C17^2+C17) and co

(10) (Sum of Weight * (Time ^ 2 + Ti
/ ((1 + Yield to Maturity / Numbe
Enter =SUM(C43:J43)/((1+B6/B7

(11) The Convexity Formula is:

$$\frac{\left(\begin{array}{l} CR\cdot(1+r)^{1+T}\cdot(r\cdot(NOP+1)+2) \\ -CR\cdot(r^2\cdot(NOP+T+1)\cdot(T+1)+r\cdot(NOP+2\cdot T+3)+2)+r^3\cdot NOP\cdot T\cdot(NOP+T \end{array}\right.}{r^2\cdot NOP^2\cdot\left(CR\cdot(1+r)^T-CR+r\cdot NOP\right)}$$

```
Enter =((B5*((1+B12)^(1+B8))*(B12*(B7+1)+2)-B5*(B12^2*(B7+B8+1)*(B8+1)+B12*(B7+2*B8+3)+
      /(B12^2*B7^2*(B5*(1+B12)^B8-B5+B12*B7)))/((1+B12)^2))
```

US Dollar | Exch Rate $1.00 = $1.00

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00

previous sheet
ious sheet to B12

6	7	8
3.0	3.5	4.0
$20.00	$20.00	$1,020.00
$18.99	$18.82	$951.71
1.7%	1.7%	87.6%
0.05	0.06	3.50

al PV of all Cash Flows
oss

ss

eriod))
y to cell B28

$$/ NOP - r)$$
$$1) + r \cdot NOP$$

+B8*(B5/B7-B12))
B7)

0.21	0.27	17.51

opy across

ime))
r of Payments) ^ 2)
)^2)

$$\frac{\left.\right)}{\left.\right)} \div \left((1+r)^2 \right)$$

+2)+B12^3*B7*B8*(B7+B8))

BOND PRICING

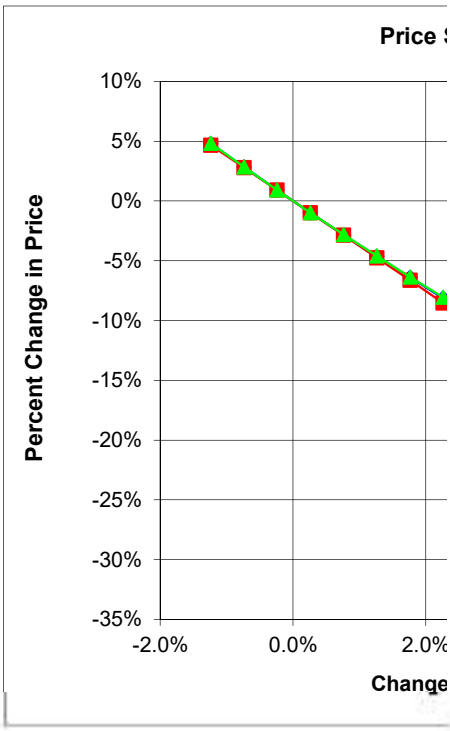
Price Sensitivity

Inputs

	Annual Percentage Rate	
Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate (CR)	3.00%	6
Yield to Maturity (Annualized)	1.74%	3
Number of Payments / Year (NOP)	2	2
Number of Periods to Maturity (T)	8	8
Face Value	$1,000	20

Outputs

Discount Rate / Period (r)	0.9%
Coupon Payment	$15



(1) If Rate Convention = EAR,
Then (1+Yield To Maturity)
^(1 / (Number of Payments / Year)) - 1
Else (Yield To Maturity) / Number of Payment / Year)
Enter =IF($C$4=1,((1+B21)^(1/$B$7))-1,B21/$B$7)
and copy across

Chart Outputs

Yield to Maturity (Annualized)	0.50%	1.00%	1.50%	2.00%	2.50%
Discount Rate / Period	0.3%	0.5%	0.8%	1.0%	1.3%
Change in Yield to Maturity	-1.2%	-0.7%	-0.2%	0.3%	0.8%
Actual Bond Price	$1,099	$1,078	$1,058	$1,038	$1,019
Current Bond Price	$1,048	$1,048	$1,048	$1,048	$1,048
Actual Percent Change in Price	4.8%	2.8%	0.9%	-1.0%	-2.8%
Modified Duration	3.77	3.77	3.77	3.77	3.77
Duration Approximation	4.7%	2.8%	0.9%	-1.0%	-2.9%
Convexity	18.41	18.41	18.41	18.41	18.41
Duration and Convexity Approx.	4.8%	2.8%	0.9%	-1.0%	-2.8%

(5) (Actual Bond Price
- Current Bond Price)
/ Current Bond Price
Enter =(B24-B25)/B25
and copy across

(6) The Modified Duration Formula is:

$$D^* = \left(\frac{1+r}{r \cdot NOP} - \frac{1+r+T \cdot (CR/NOP - r)}{CR \cdot \left((1+r)^T - 1 \right) + r \cdot NOP} \right) \div (1+r)$$

Enter =((1+$B$12)/($B$12*$B$7)
-(1+$B$12+$B$8*($B$5/$B$7-$B$12))
/($B$5*((1+$B$12)^$B$8-1)+$B$12*$B$7))/(1+$B$12)
and copy across

(9) Duration Approximation
+ (1/2) * Convexity * (Change in YTM)^2
Enter =B28+(1/2)*B29*B23^2 and copy across

(3) -

(4) -P

Ent
and

(7) -Modi
* Cha
Enter
and co

(8) The Convexity Formula is:

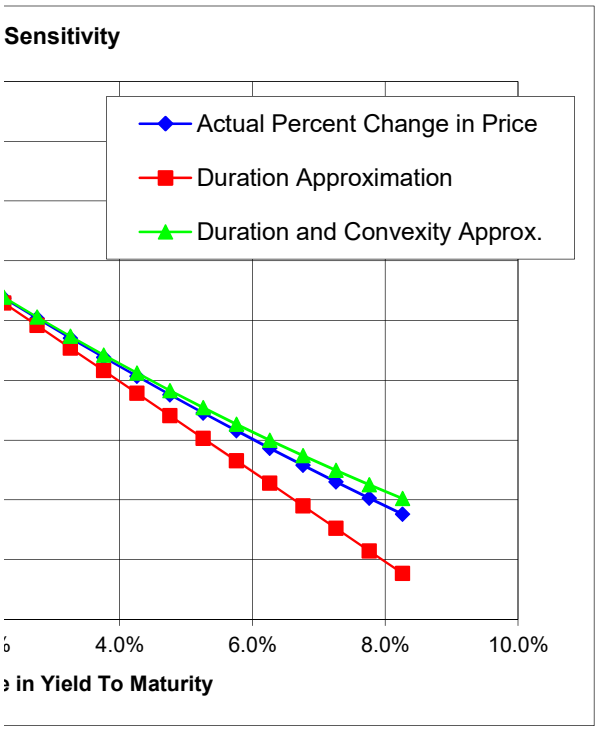
(b) The Convexity Formula is:

$$\frac{\left(\begin{array}{l} CR\cdot(1+r)^{1+T}\cdot\left(r\cdot(NOP+1)+2\right) \\ -CR\cdot\left(r^2\cdot(NOP+T+1)\cdot(T+1)+r\cdot(NOP+2\cdot T+3)+2\right)+r^3\cdot NOP\cdot T\cdot(NOP+T)\end{array}\right)}{r^2\cdot NOP^2\cdot\left(CR\cdot(1+r)^T-CR+r\cdot NOP\right)}\div\left((1\right.$$

Enter =(($B$5*((1+$B$12)^(1+$B$8))*($B$12*($B$7+1)+2)-$B$5*($B$12^2*($B$7+$B$8+1)*($B$8
+$B$12*($B$7+2*$B$8+3)+2)+$B$12^3*$B$7*$B$8*($B$7+$B$8))/($B$12^2*$B$7^2*
($B$5*(1+$B$12)^$B$8-$B$5+$B$12*$B$7)))/((1+$B$12)^2) and copy across

Currency: US Dollar **Exch Rate $1.00 = $1.00**

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00



	3.00%	3.50%	4.00%	4.50%	5.00%	5.50%	6.00%	6.50%
	1.5%	1.8%	2.0%	2.3%	2.5%	2.8%	3.0%	3.3%
	1.3%	1.8%	2.3%	2.8%	3.3%	3.8%	4.3%	4.8%
	$1,000	$981	$963	$946	$928	$911	$895	$878
	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048
	-4.6%	-6.4%	-8.1%	-9.8%	-11.5%	-13.1%	-14.7%	-16.2%
	3.77	3.77	3.77	3.77	3.77	3.77	3.77	3.77
	-4.8%	-6.6%	-8.5%	-10.4%	-12.3%	-14.2%	-16.1%	-18.0%
	18.41	18.41	18.41	18.41	18.41	18.41	18.41	18.41
	-4.6%	-6.4%	-8.1%	-9.7%	-11.3%	-12.9%	-14.4%	-15.9%

(2) New YTM - Current YTM
Enter =B21-$B$6 and copy across

PV(Actual Discount Rate / Period,
Number of Periods to Maturity,
Coupon Payment, Face Value)
nter =-PV(B22,$B$8,$B$13,$B$9)
nd copy across

/(Current Discount Rate / Period,
Number of Periods to Maturity,
Coupon Payment, Face Value)
er =-PV($B$12,$B$8,$B$13,$B$9)
copy across

fied Duration
ange in YTM
=-B27*B23
opy across

$+r)^2\Big)$

$+1$

7.00%	7.50%	8.00%	8.50%	9.00%	9.50%	10.00%
3.5%	3.8%	4.0%	4.3%	4.5%	4.8%	5.0%
5.3%	5.8%	6.3%	6.8%	7.3%	7.8%	8.3%
$863	$847	$832	$817	$802	$788	$774
$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048
-17.7%	-19.2%	-20.7%	-22.1%	-23.5%	-24.9%	-26.2%
3.77	3.77	3.77	3.77	3.77	3.77	3.77
-19.8%	-21.7%	-23.6%	-25.5%	-27.4%	-29.3%	-31.2%
18.41	18.41	18.41	18.41	18.41	18.41	18.41
-17.3%	-18.7%	-20.0%	-21.3%	-22.5%	-23.7%	-24.9%

BOND PRICING

Immunization

Inputs

Rate Convention	○ EAR ◉ APR	2	**Annual Percentage Rate**
Yield to Maturity (Annualized)	1.74%		
Number of Payments / Year	2		

	Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
Bond 1	1.50%	4	$1,000	1,783
Bond 2	2.00%	8	$1,000	2,042
Bond 3	0.90%	2	$1,000	0
Bond 4	1.50%	4	$1,000	0
Bond 5	1.90%	6	$1,000	0
Bond 6	2.30%	8	$1,000	0
Bond 7	1.90%	6	$1,000	0
Bond 8	2.30%	8	$1,000	0

Outputs

Discount Rate / Period (r) 0.9%

(3) Copy the Present Value & Duratic
Copy the range B19:J24 from the

Bond Present Value, Duration, and Convexity using a Timeline

Period		0	1	2	3
Time (Years)		0.0	0.5	1.0	1.5
Liabilities			$0	$0	$0
Present Value of Liabilities			$0	$0	$0
Total Present Value of Liabilities	$3,797,413				
Weight			0.0%	0.0%	0.0%
Weight * Time			0.00	0.00	0.00
Duration of Liabilities	3.00				
Modified Duration of Liabilities	2.97				
Weight * (Time^2+Time)			0.00	0.00	0.00
Convexity of Liabilities	11.79				

(5) (Sum of Weight * (Time ^ 2 + Time)
/ ((1 + Yield to Maturity / Number of Payme
Enter =SUM(C30:J30)/((1+B18)^2)

Assets				
Bond 1		$13,371	$13,371	$13,371
Bond 2		$15,313	$15,313	$15,313
Bond 3		$0	$0	$0
Bond 4		$0	$0	$0
Bond 5		$0	$0	$0
Bond 6		$0	$0	$0
Bond 7		$0	$0	$0
Bond 8		$0	$0	$0
Total Assets		$28,685	$28,685	$28,685
Present Value of Assets		[illegible]	$28,192	$27,949
Total Present Value of Assets	$3,797,413			
Weight		[illegible]	0.7%	0.7%
Weight * Time		[illegible]	0.01	0.01
Duration of Assets	[illegible]			
Modified Duration of Assets	[illegible]			
Weight * (Time^2+Time)		[illegible]	0.01	0.03

Convexity of Assets	12.84			
Differences				
Total Assets - Liabilities		$28,685	$28,685	$28,685
PV of Assets - PV of Liabilities	$0			
Duration of Assets - Duration of Liab	0.00			
Convexity of Assets - Convexity of Liab	1.04			

(6) Copy the Present Value,
Copy the range B24:J31

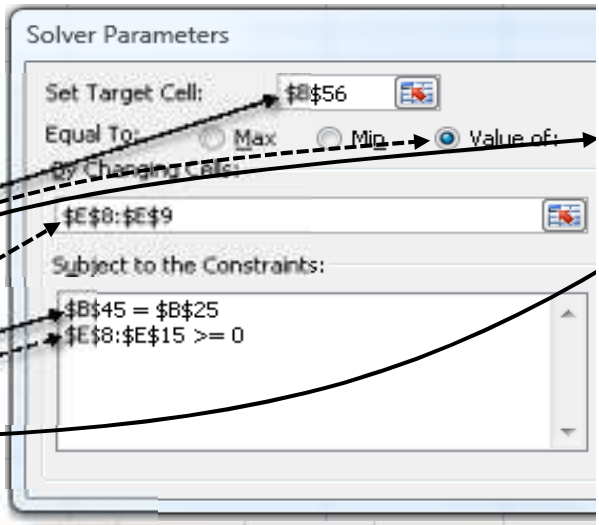
(7) Total Assets - Liabilities
Enter =C43-C23 and cop

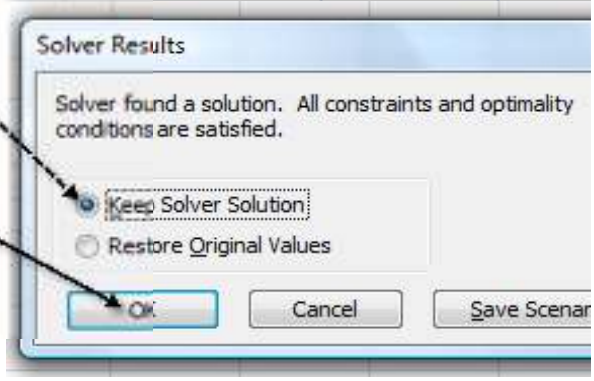
(8) Compute the differences between Assets a
Enter =B45-B25 in B55, =B48-B28 in B56,

To solve the first problem
when there is a single liability to immunize

(9a) Use Solver to determine the number of both Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E9** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* and click on **Solve**.

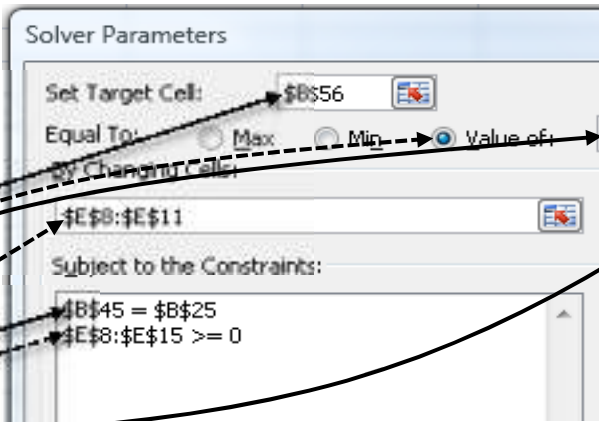
When Solver finds a solution,
* click on the **Keep *Solver Solution*** button
* and click on **OK**



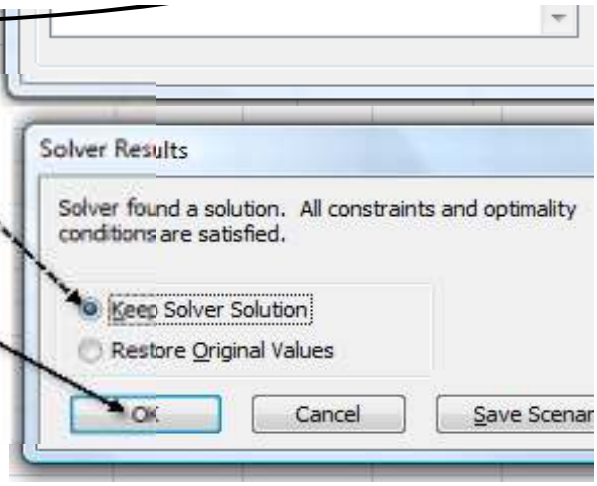


To solve the second problem
when there is a series of liabilities to immunize

(9b) Use Solver to determine the number of all four Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E11** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0

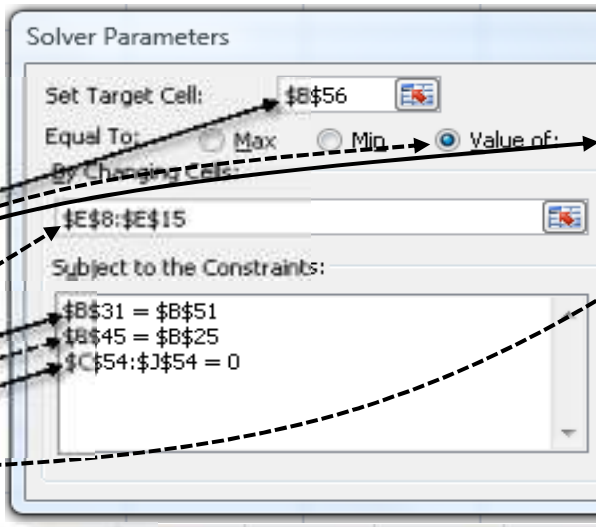


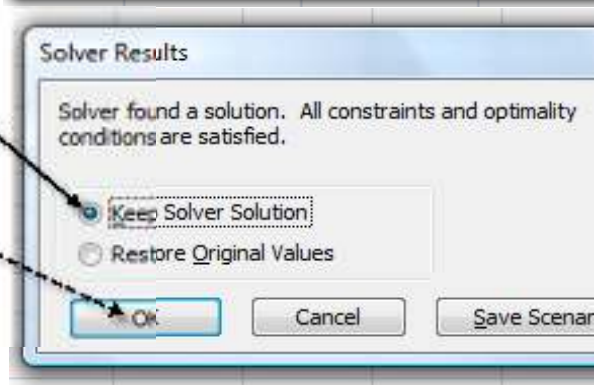
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**



To solve the third problem when there is a series of liabilities to immunize with cash flow matching

(9c) Use Solver to determine the number of all four Treasury bonds.
* Click on **Data | Analysis | Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E15** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* click **Add** and enter C54:J54 = 0
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**





Currency: US Dollar

Exch Rate $1.00 = $1.00

Coupon Payment (PMT)	
$8	(1) Coupon Rate * Face Value / (Number of Payments / Year) Enter =B8*D8/$B$6 and copy down
$10	
$5	
$8	
$10	
$12	(2) If Rate Convention = EAR, Then (1+Yield To Maturity)^(1 / (Number of Payments / Year)) - 1 Else (Yield To Maturity) / Number of Payment / Year) Enter =IF(C4=1,((1+B5)^(1/B6))-1,B5/B6)
$10	
$12	

on formulas from the Duration and Convexity sheet
Duration and Convexity sheet to B24

4	5	6	7	8
2.0	2.5	3.0	3.5	4.0
$0	$0	$4,000,000	$0	$0
$0	$0	$3,797,413	$0	$0
0.0%	0.0%	100.0%	0.0%	0.0%
0.00	0.00	3.00	0.00	0.00
0.00	0.00	12.00	0.00	0.00

(4) Weight * (Time^2 + Time)
Enter =C26*(C22^2+C22) and copy across

ents) ^ 2)

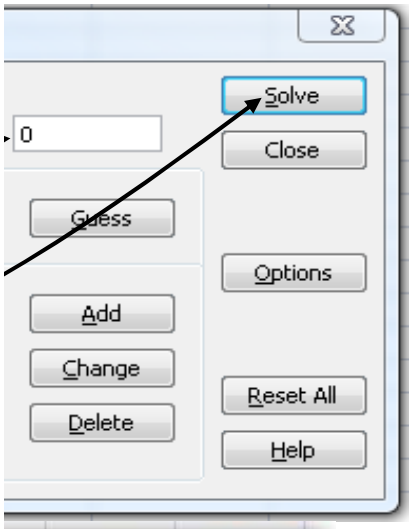
$1,796,227	$0	$0	$0	$0
$15,313	$15,313	$15,313	$15,313	$2,057,101
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$1,811,540	$15,313	$15,313	$15,313	$2,057,101
$1,749,846	$14,664	$14,538	$14,412	$1,919,374
46.1%	0.4%	0.4%	0.4%	50.5%
0.92	0.01	0.01	0.01	2.02
2.76	0.03	0.05	0.06	10.11

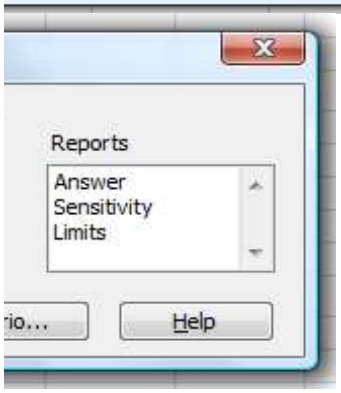
Duration, and Convexity formulas from above to B44

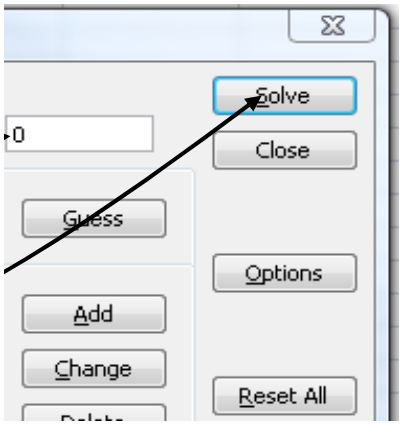
$1,811,540	$15,313	($3,984,687)	$15,313	$2,057,101

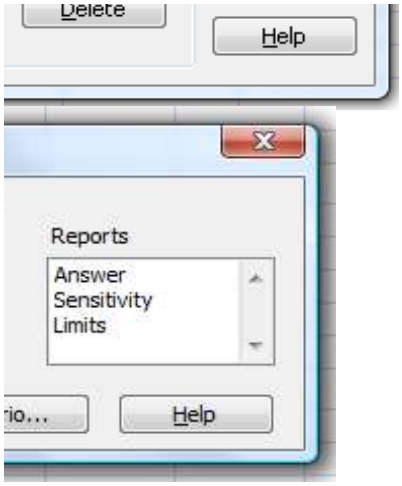
by across

and Liabilities in Present Value, Duration, and Convexity and =B51-B31 in B57








Delete
Help
Reports
Answer
Sensitivity
Limits
Help


Solve
0
Close
Guess
Options
Add
Change
Reset All
Delete
Help
Reports
Answer
Sensitivity
Limits
Help

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
1.50%	4	$1,000	1,783
2.00%	8	$1,000	2,042
0.90%	2	$1,000	6,038
1.50%	4	$1,000	5,937
1.90%	6	$1,000	7,017
2.30%	8	$1,000	8,068

0	1	2	3
0.0	0.5	1.0	1.5
	$0	$0	$0
	$2,000,000	$2,200,000	$2,500,000

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
0.00%	1	$1,000	2,000
0.00%	2	$1,000	2,200
0.00%	3	$1,000	2,500
0.00%	4	$1,000	3,200
0.00%	5	$1,000	3,700
0.00%	6	$1,000	4,300
0.00%	7	$1,000	4,700
0.00%	8	$1,000	5,100

4	5	6	7	8
2.0	2.5	3.0	3.5	4.0
$0	$0	$4,000,000	$0	$0
$3,200,000	$3,700,000	$4,300,000	$4,700,000	$5,100,000

BOND PRICING

System of Five Bond Variables

Currency: US Dollar | Exch Rate $1.00 = $1.00

Inputs	Annual Percentage Rate	
Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate	4.00%	
Yield to Maturity (Annualized)	1.74%	
Number of Payments / Year	2	
(1) Number of Periods to Maturity (T)	0	
(2) Face Value (PAR)	$1,000.00	
(3) Discount Rate / Period (r)	0.87%	
(4) Coupon Payment (PMT)	$20.00	
(5) Bond Price (P)	$1,086.66	
(1) Number of Periods to Maturity (T) from the other four variables		
Number of Periods to Maturity using NPER Function	0	
(2) Face Value (PAR) from the other four variables		
Face Value using the FV Function	$1,000.00	
Face Value using the Formula	$1,000.00	
(3) Discount Rate / Period (r) from the other four variables		
Discount Rate / Period using the RATE Function	0.87%	
(4) Coupon Payment (PMT) from the other four variables		
Coupon Payment using the PMT Function	$20.00	
Coupon Payment using the Formula	$20.00	
(5) Bond Price (P) from the other four variables		
Bond Price using the PV Function	$1,086.66	
Bond Price using the Formula	$1,086.66	

(1) NPER(Discount Rate / Period, Coupon Payment, -Bond Price, Face Value)
Enter =NPER(D12,D11,-D12,D9)

(2) FV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, -Bond Price)
Enter =FV(D10,D8,D11,-D12)

(2) The Face Value Formula is

$$PAR = P \cdot (1+r)^{T} - \frac{PMT \cdot \left(\left((1+r)^{T}\right) - 1\right)}{r}$$

Enter =D12*(1+D10)^D8-D11*((1+D12)^D8-1)/D10

(4) PMT(Discount Rate / Period, Number of Periods to Maturity, Bond Price, Face Value)
Enter =PMT(D10,D8,-D12,D9)

(3) The Bond Price Formula is

$$P = \frac{PMT \cdot \left(1 - \left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

Enter =D11*(1-((1+D10)^(-D8)))/D10+D9/((1+D10)^D8)

(4) The Coupon Payment Formula is

$$PMT = \frac{P - PAR/(1+r)^{T}}{\left(1 - \left((1+r)^{-T}\right)\right)/r}$$

Enter =(D12-D9/((1+D10)^D8))/((1-1/((1+D10)^D8))/D10)

(5) PV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, Face Value)
Enter =PV(D10,D8,D11,D9)

	A	B	C	D	E	F	G	H	I	J
1	**BOND PRICING**	**Annual Payments**								
2										
3										
4										
5										
6										
7	**Inputs**									
8	Number of Periods to Maturity (T)	8	8							
9	Face Value (PAR)	$1,000	20							
10										
11										
12	Discount Rate / Period (r)	4.37%	8							
13	Coupon Payment (PMT)	$12.00	2							
14										
15	**Bond Price using a Timeline**									
16	Period	0	1	2	3	4	5	6	7	8
17										
18	Cash Flows		$12.00	$12.00	$12.00	$12.00	$12.00	$12.00	$12.00	$1,012.00
19	Present Value of Cash Flows		$11.50	$11.02	$10.55	$10.11	$9.69	$9.28	$8.90	$718.75
20	Bond Price	$789.80								
21										
22	**Bond Price using the Formula**									
23	Bond Price (P)	$789.80								
24										
25	**Bond Price using the PV Function**									
26	Bond Price	$789.80								
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										

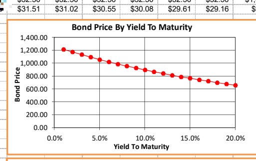
$$P = \frac{PMT \cdot \left(1 - \left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

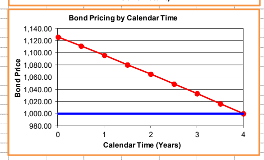
Bond Pricing — EAR, APR, & Foreign Currencies

Currency: US Dollar | Exch Rate $1.00 = $1.00

	A	B	C	D	E	F	G	H	I	J
3	**Inputs**									
4	Rate Convention	● EAR ○ APR	1	Effective Annual Rate						
5	Annual Coupon Rate	6.[illegible]								
6	Yield to Maturity (Annualized)	3.[illegible]								
7	Number of Payments / Year	[illegible]								
8	Number of Periods to Maturity (T)	[illegible]								
9	Face Value (PAR)	$1,[illegible]								
11	**Outputs**									
12	Discount Rate / Period (r)	1[illegible]								
13	Coupon Payment (PMT)	[illegible]								
15	**Bond Price using a Timeline**									
16	Period	[illegible]	[illegible]	2	3	4	5	6	7	8
17	Time (Years)	[illegible]	[illegible]	1.0	1.5	2.0	2.5	3.0	3.5	4.0
18	Cash Flows		[illegible]	$32.50	$32.50	$32.50	$32.50	$32.50	$32.50	$1,032.50
19	Present Value of Cash Flows		[illegible]	$31.51	$31.02	$30.55	$30.08	$29.61	$29.16	$912.04
20	Bond Price	$1,125.96								
22	**Bond Price using a Formula**									
23	Bond Price	$1,125.96								
25	**Bond Price using a Function**									
26	Bond Price	$1,125.96								
28	**Bond Price using the PRICE Function (under APR)**									
29	Bond Price									

	L	M
2	Currency Number	4
3	(Select from below)	
4	1 = Chinese Yuan	¥9.5350
5	2 = European Euro	€ 0.4206
6	3 = Indian Rupee	IDR 52.75
7	4 = US Dollar	$1.00





	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
60	Yield to Maturity (Annualized)		[illegible]	2.0%	3.0%	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%	19.0%	20.0%
62	**Data Table: Sensitivity of [illegible] Disc[illegible]ate / Period**																					
63				Input Values for Discount Rate / Period																		
64	**Output Formula:**		[illegible]	1.0%	1.5%	2.0%	2.5%	3.0%	3.4%	3.9%	4.4%	4.9%	5.4%	5.8%	6.3%	6.8%	7.2%	7.7%	8.2%	8.6%	9.1%	9.5%
65	Bond Price	[illegible]6	$1,215	$1,173	$1,132	$1,093	$1,056	$1,021	$987	$955	$924	$894	$866	$839	$813	$788	$764	$741	$719	$698	$678	$659

(8) Create the bond price Data Table.
Select the range B64:V65, click on
[D]ata | Data Tools | What-If Analysis | Data Table,
[e]nter B12 in the Row Input Cell,

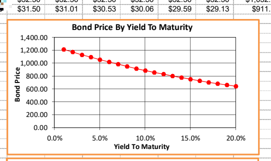
	A	B	C	D	E	F	G	H	I	J
76	**Bond Pricing By Calendar Time**									
77	Calendar Time (Years)	0	0.5	1	1.5	2	2.5	3	3.5	4
78	Time to Maturity (Years)	4	3.5	3	2.5	2	1.5	1	0.5	0
79	Number of Periods to Maturity (T)	[illegible]	[illegible]	6	5	4	3	2	1	0
80	Bond Price of Coupon Bond	$1,12[illegible]	[illegible]	$1,096	$1,081	$1,065	$1,049	$1,033	$1,017	$1,000
81	Bond Price of F[illegible]	[illegible]	[illegible]	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000

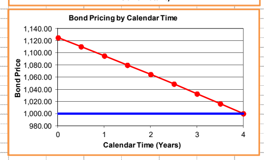
BOND PRICING — EAR, APR, & Foreign Currencies

Currency: US Dollar | Exch Rate $1.00 = $1.00

	A	B	C	D	E	F	G	H	I	J
3	**Inputs**									
4	Rate Convention	EAR / APR	2	Annual Percentage Rate						
5	Annual Coupon Rate	6.[illegible]								
6	Yield to Maturity (Annualized)	3.[illegible]								
7	Number of Payments / Year	[illegible]								
8	Number of Periods to Maturity (T)	[illegible]								
9	Face Value (PAR)	$1,[illegible]								
11	**Outputs**									
12	Discount Rate / Period (r)	1[illegible]								
13	Coupon Payment (PMT)	[illegible]								
15	**Bond Price using a Timeline**									
16	Period	[illegible]	[illegible]	2	3	4	5	6	7	8
17	Time (Years)	[illegible]	[illegible]	1.0	1.5	2.0	2.5	3.0	3.5	4.0
18	Cash Flows	[illegible]	[illegible]	$32.50	$32.50	$32.50	$32.50	$32.50	$32.50	$1,032.50
19	Present Value of Cash Flows	[illegible]	[illegible]	$31.50	$31.01	$30.53	$30.06	$29.59	$29.13	$911.16
20	Bond Price	$1,124.98								
22	**Bond Price using a Formula**									
23	Bond Price	$1,124.98								
25	**Bond Price using a Function**									
26	Bond Price	$1,124.98								
28	**Bond Price using the PRICE Function (under APR)**									
29	Bond Price	[illegible]124.98								

L	M
Currency Number	4
(Select from below)	
1 = Chinese Yuan	¥ 9.5350
2 = European Euro	€ 0.4206
3 = Indian Rupee	IDR 52.75
4 = US Dollar	$1.00





Row	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
60	Yield to Maturity (Annualized)		[illegible]	2.0%	3.0%	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%	19.0%	20.0%
62	**Data Table: Sensitivity of [illegible] Disc[illegible]ate / Period**																					
63					Input Values for Discount Rate / Period																	
64	**Output Formula:**		[illegible]	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%	8.5%	9.0%	9.5%	10.0%
65	Bond Price	[illegible]5	$1,215	$1,172	$1,131	$1,092	$1,054	$1,018	$983	$950	$918	$887	$857	$829	$802	$776	$751	$727	$704	$682	$660	$640

(8) Create the bond price Data Table.
Select the range B64:V65, click on
[illegible]ata | Data Tools | What-If Analysis | Data Table,
[illegible]nter B12 in the Row Input Cell,

Row	A	B	C	D	E	F	G	H	I	J
76	**Bond Pricing By Calendar Time**									
77	Calendar Time (Years)	0	0.5	1	1.5	2	2.5	3	3.5	4
78	Time to Maturity (Years)	4	3.5	3	2.5	2	1.5	1	0.5	0
79	Number of Periods to Maturity (T)	[illegible]	[illegible]	6	5	4	3	2	1	0
80	Bond Price of Coupon Bond	$1,12[illegible]	[illegible]	$1,095	$1,080	$1,064	$1,049	$1,033	$1,016	$1,000
81	Bond Price of [illegible]	[illegible],00[illegible]	[illegible]	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000

BOND PRICING

Duration and Convexity

Currency:

Inputs

Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate	3.20%	6
Yield to Maturity (Annualized)	2.53%	5
Number of Payments / Year	2	2
Number of Periods to Maturity (T)	8	8
Face Value (PAR)	$1,000	20

Annual Percentage Rate

(1) Copy the Outputs & Timeline from the
Copy the range B12:J20 from the previ

Outputs

Discount Rate / Period (r)	1.3%
Coupon Payment (PMT)	$16

Bond Duration using a Timeline

Period	0	1	2	3	4	5
Time (Years)	0.0	0.5	1.0	1.5	2.0	2.5
Cash Flows		$16.00	$16.00	$16.00	$16.00	$16.00
Present Value of Cash Flows		$15.80	$15.60	$15.41	$15.22	$15.03
Bond Price using a Timeline	$1,025.34					
Weight		1.5%	1.5%	1.5%	1.5%	1.5%
Weight * Time		0.01	0.02	0.02	0.03	0.04
Duration using a Timeline	3.79					
Modified Duration using a Timeline	3.74					

(2) PV of Cash Flow on Date t / Tota
Enter =C19/$B$20 and copy acr

(3) Weight * Time
Enter =C21*C17 and copy acros

(4) Sum of all the Weight * Times
Enter =SUM(C22:J22)

(5) Duration / (1+(Discount Rate / P
Enter =B23/(1+$B$12) and cop

(6) The Duration Formula is:

$$D = \frac{1+r}{r \cdot NOP} - \frac{1+r+T \cdot (CR$$

Enter =(1+B12)/(B12*B7)-(1+B12
/(B5*((1+B12)^B8-1)+B12*

Bond Duration using a Formula

Duration (D) using a Formula	3.79
Modified Duration using a Formula	3.74

Bond Duration using a Function (under APR)

Duration using a Function	3.79
Modified Duration using a Function	3.74

(7) DURATION (Settlement Date, Maturity Date, Annual Coupon Rate, Yield to Maturity, Number of Periods)
Enter =IF($C$4=1,"",DURATION(DATE(2000,1,1), DATE(2000+B8/B7,1,1),B5,B6,B7))

(8) MDURATION (Settlement Date, Maturity Date, Annual Coupon Rate, Yield to Maturity, Number of Periods)
Enter =IF($C$4=1,"",MDURATION(DATE(2000,1,1), DATE(2000+B8/B7,1,1),B5,B6,B7))

Bond Convexity

Weight * (Time^2+Time)		0.01	0.03	0.06	0.09	0.13
Convexity using a Timeline	18.17					
Convexity using a Formula	18.17					

(9) Weight * (Time^2 + Time)
Enter =C21*(C17^2+C17) and co

(10) (Sum of Weight * (Time ^ 2 + Ti
/ ((1 + Yield to Maturity / Numbe
Enter =SUM(C43:J43)/((1+B6/B7

(11) The Convexity Formula is:

$$\frac{\left(\begin{array}{l} CR\cdot(1+r)^{1+T}\cdot(r\cdot(NOP+1)+2) \\ -CR\cdot(r^2\cdot(NOP+T+1)\cdot(T+1)+r\cdot(NOP+2\cdot T+3)+2)+r^3\cdot NOP\cdot T\cdot(NOP+T \end{array}\right.}{r^2\cdot NOP^2\cdot\left(CR\cdot(1+r)^T-CR+r\cdot NOP\right)}$$

```
Enter =((B5*((1+B12)^(1+B8))*(B12*(B7+1)+2)-B5*(B12^2*(B7+B8+1)*(B8+1)+B12*(B7+2*B8+3)+
      /(B12^2*B7^2*(B5*(1+B12)^B8-B5+B12*B7)))/((1+B12)^2))
```

US Dollar | Exch Rate $1.00 = $1.00

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00

previous sheet
ious sheet to B12

6	7	8
3.0	3.5	4.0
$16.00	$16.00	$1,016.00
$14.84	$14.65	$918.80
1.4%	1.4%	89.6%
0.04	0.05	3.58

al PV of all Cash Flows
oss

ss

eriod))
y to cell B28

$/NOP - r)$
$1) + r \cdot NOP$
+B8*(B5/B7-B12))
B7)

0.17	0.23	17.92

opy across

ime))
r of Payments) ^ 2)
)^2)

$$\frac{\left.\right)}{\left.\right)} \div \left((1+r)^2 \right)$$

+2)+B12^3*B7*B8*(B7+B8))

BOND PRICING

Duration and Convexity

Currency:

Inputs

Rate Convention	EAR / APR	1
Annual Coupon Rate	3.20%	6
Yield to Maturity (Annualized)	2.53%	5
Number of Payments / Year	2	2
Number of Periods to Maturity (T)	8	8
Face Value (PAR)	$1,000	20

Effective Annual Rate

(1) Copy the Outputs & Timeline from the
Copy the range B12:J20 from the previ

Outputs

Discount Rate / Period (r)	1.3%
Coupon Payment (PMT)	$16

Bond Duration using a Timeline

Period	0	1	2	3	4	5
Time (Years)	0.0	0.5	1.0	1.5	2.0	2.5
Cash Flows		$16.00	$16.00	$16.00	$16.00	$16.00
Present Value of Cash Flows		$15.80	$15.61	$15.41	$15.22	$15.03
Bond Price using a Timeline	$1,025.94					
Weight		1.5%	1.5%	1.5%	1.5%	1.5%
Weight * Time		0.01	0.02	0.02	0.03	0.04
Duration using a Timeline	3.79					
Modified Duration using a Timeline	3.74					

(2) PV of Cash Flow on Date t / Tota
Enter =C19/$B$20 and copy acr

(3) Weight * Time
Enter =C21*C17 and copy acros

(4) Sum of all the Weight * Times
Enter =SUM(C22:J22)

(5) Duration / (1+(Discount Rate / P
Enter =B23/(1+$B$12) and cop

(6) The Duration Formula is:

$$D = \frac{1+r}{r \cdot NOP} - \frac{1+r+T \cdot (CR$$

Enter =(1+B12)/(B12*B7)-(1+B12
/(B5*((1+B12)^B8-1)+B12*

Bond Duration using a Formula

Duration (D) using a Formula	3.79
Modified Duration using a Formula	3.74

Bond Duration using a Function (under APR)

Duration using a Function	
Modified Duration using a Function	

(7) DURATION (Settlement Date, Maturity Date, Annual Coupon Rate, Yield to Maturity, Number of Periods)
Enter =IF($C$4=1,"",DURATION(DATE(2000,1,1),DATE(2000+B8/B7,1,1),B5,B6,B7))

(8) MDURATION (Settlement Date, Maturity Date, Annual Coupon Rate, Yield to Maturity, Number of Periods)
Enter =IF($C$4=1,"",MDURATION(DATE(2000,1,1),DATE(2000+B8/B7,1,1),B5,B6,B7))

Bond Convexity

Weight * (Time^2+Time)		0.01	0.03	0.06	0.09	0.13
Convexity using a Timeline	18.17					
Convexity using a Formula	18.18					

(9) Weight * (Time^2 + Time)
Enter =C21*(C17^2+C17) and co

(10) (Sum of Weight * (Time ^ 2 + Ti
/ ((1 + Yield to Maturity / Numbe
Enter =SUM(C43:J43)/((1+B6/B7

(11) The Convexity Formula is:

$$\frac{\left(\begin{array}{l} CR\cdot(1+r)^{1+T}\cdot(r\cdot(NOP+1)+2) \\ -CR\cdot(r^2\cdot(NOP+T+1)\cdot(T+1)+r\cdot(NOP+2\cdot T+3)+2)+r^3\cdot NOP\cdot T\cdot(NOP+T \end{array}\right.}{r^2\cdot NOP^2\cdot\left(CR\cdot(1+r)^T-CR+r\cdot NOP\right)}$$

```
Enter =((B5*((1+B12)^(1+B8))*(B12*(B7+1)+2)-B5*(B12^2*(B7+B8+1)*(B8+1)+B12*(B7+2*B8+3)+
      /(B12^2*B7^2*(B5*(1+B12)^B8-B5+B12*B7)))/((1+B12)^2))
```

US Dollar | Exch Rate $1.00 = $1.00

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00

previous sheet
ious sheet to B12

6	7	8
3.0	3.5	4.0
$16.00	$16.00	$1,016.00
$14.84	$14.66	$919.37
1.4%	1.4%	89.6%
0.04	0.05	3.58

al PV of all Cash Flows
oss

ss

eriod))
y to cell B28

$/NOP - r)$
$1) + r \cdot NOP$
+B8*(B5/B7-B12))
B7)

0.17	0.23	17.92

opy across

ime))
r of Payments) ^ 2)
)^2)

$$\frac{\left.\right)}{\left.\right)} \div \left((1+r)^2 \right)$$

+2)+B12^3*B7*B8*(B7+B8))

Bond Pricing

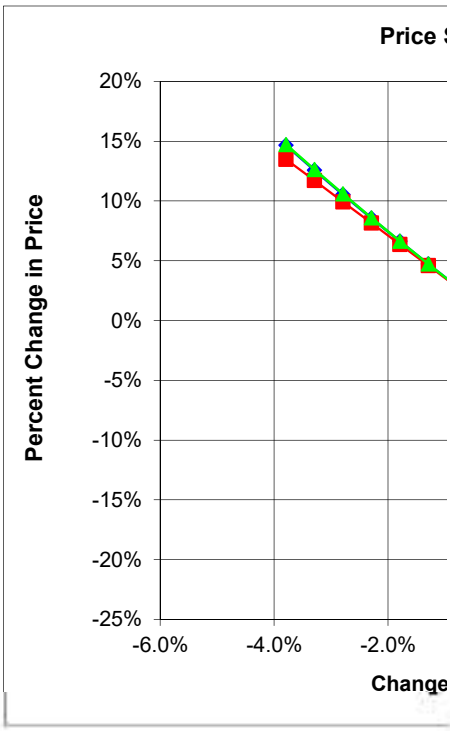
Price Sensitivity

Inputs

	Annual Percentage Rate	
Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate (CR)	5.80%	11
Yield to Maturity (Annualized)	4.29%	8
Number of Payments / Year (NOP)	2	2
Number of Periods to Maturity (T)	8	8
Face Value	$1,000	20

Outputs

Discount Rate / Period (r)	2.1%
Coupon Payment	$29



(1) If Rate Convention = EAR,
Then (1+Yield To Maturity)
^(1 / (Number of Payments / Year)) - 1
Else (Yield To Maturity) / Number of Payment / Year)
Enter =IF($C$4=1,((1+B21)^(1/$B$7))-1,B21/$B$7)
and copy across

Chart Outputs

Yield to Maturity (Annualized)	0.50%	1.00%	1.50%	2.00%	2.50%
Discount Rate / Period	0.3%	0.5%	0.8%	1.0%	1.3%
Change in Yield to Maturity	-3.8%	-3.3%	-2.8%	-2.3%	-1.8%
Actual Bond Price	$1,210	$1,188	$1,166	$1,145	$1,125
Current Bond Price	$1,055	$1,055	$1,055	$1,055	$1,055
Actual Percent Change in Price	14.7%	12.6%	10.6%	8.6%	6.6%
Modified Duration	3.56	3.56	3.56	3.56	3.56
Duration Approximation	13.5%	11.7%	9.9%	8.2%	6.4%
Convexity	16.93	16.93	16.93	16.93	16.93
Duration and Convexity Approx.	14.7%	12.6%	10.6%	8.6%	6.6%

(5) (Actual Bond Price
- Current Bond Price)
/ Current Bond Price
Enter =(B24-B25)/B25
and copy across

(6) The Modified Duration Formula is:

$$D^* = \left(\frac{1+r}{r \cdot NOP} - \frac{1+r+T \cdot (CR/NOP - r)}{CR \cdot \left((1+r)^T - 1 \right) + r \cdot NOP} \right) \div (1+r)$$

Enter =((1+$B$12)/($B$12*$B$7)
-(1+$B$12+$B$8*($B$5/$B$7-$B$12))
/($B$5*((1+$B$12)^$B$8-1)+$B$12*$B$7))/(1+$B$12)
and copy across

(3) -

(4) -P

(7) -Modi
* Cha
Enter
and co

(9) Duration Approximation
+ (1/2) * Convexity * (Change in YTM)^2
Enter =B28+(1/2)*B29*B23^2 and copy across

(8) The Convexity Formula is:

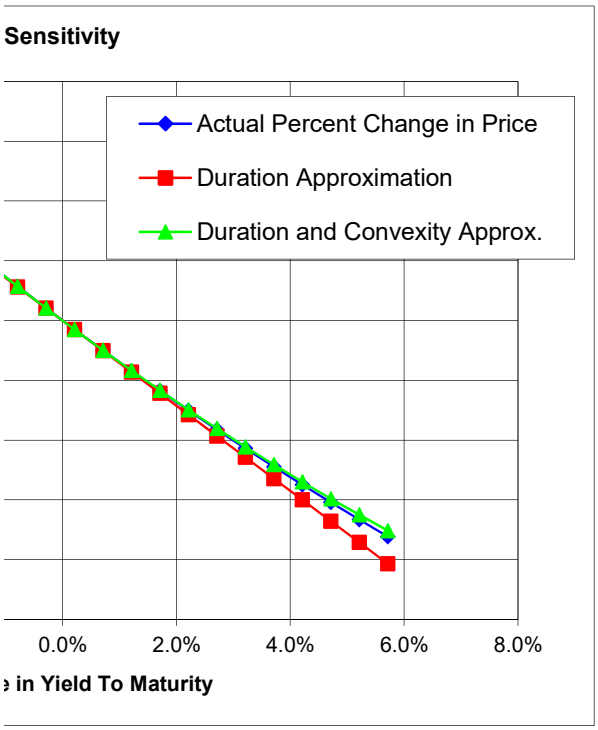
(b) The Convexity Formula is:

$$\frac{\left(\begin{array}{l} CR\cdot(1+r)^{1+T}\cdot\left(r\cdot(NOP+1)+2\right) \\ -CR\cdot\left(r^2\cdot(NOP+T+1)\cdot(T+1)+r\cdot(NOP+2\cdot T+3)+2\right)+r^3\cdot NOP\cdot T\cdot(NOP+T)\end{array}\right)}{r^2\cdot NOP^2\cdot\left(CR\cdot(1+r)^T-CR+r\cdot NOP\right)}\div\left((1\right.$$

Enter =(($B$5*((1+$B$12)^(1+$B$8))*($B$12*($B$7+1)+2)-$B$5*($B$12^2*($B$7+$B$8+1)*($B$8
+$B$12*($B$7+2*$B$8+3)+2)+$B$12^3*$B$7*$B$8*($B$7+$B$8))/($B$12^2*$B$7^2*
($B$5*(1+$B$12)^$B$8-$B$5+$B$12*$B$7)))/((1+$B$12)^2) and copy across

Currency: US Dollar **Exch Rate $1.00 = $1.00**

Currency Number (Select from below)	4
1 = Chinese Yuan	¥7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00



3.00%	3.50%	4.00%	4.50%	5.00%	5.50%	6.00%	6.50%
1.5%	1.8%	2.0%	2.3%	2.5%	2.8%	3.0%	3.3%
-1.3%	-0.8%	-0.3%	0.2%	0.7%	1.2%	1.7%	2.2%
$1,105	$1,085	$1,066	$1,047	$1,029	$1,011	$993	$976
$1,055	$1,055	$1,055	$1,055	$1,055	$1,055	$1,055	$1,055
4.7%	2.9%	1.0%	-0.7%	-2.5%	-4.2%	-5.9%	-7.5%
3.56	3.56	3.56	3.56	3.56	3.56	3.56	3.56
4.6%	2.8%	1.0%	-0.7%	-2.5%	-4.3%	-6.1%	-7.9%
16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93
4.7%	2.9%	1.0%	-0.7%	-2.5%	-4.2%	-5.8%	-7.5%

(2) New YTM - Current YTM
Enter =B21-$B$6 and copy across

PV(Actual Discount Rate / Period,
Number of Periods to Maturity,
Coupon Payment, Face Value)
nter =-PV(B22,$B$8,$B$13,$B$9)
nd copy across

/(Current Discount Rate / Period,
Number of Periods to Maturity,
Coupon Payment, Face Value)
er =-PV($B$12,$B$8,$B$13,$B$9)
copy across

fied Duration
ange in YTM
=-B27*B23
opy across

$+r)^2\Big)$

$+1$

7.00%	7.50%	8.00%	8.50%	9.00%	9.50%	10.00%
3.5%	3.8%	4.0%	4.3%	4.5%	4.8%	5.0%
2.7%	3.2%	3.7%	4.2%	4.7%	5.2%	5.7%
$959	$942	$926	$910	$894	$879	$864
$1,055	$1,055	$1,055	$1,055	$1,055	$1,055	$1,055
-9.1%	-10.7%	-12.2%	-13.7%	-15.2%	-16.7%	-18.1%
3.56	3.56	3.56	3.56	3.56	3.56	3.56
-9.7%	-11.4%	-13.2%	-15.0%	-16.8%	-18.6%	-20.3%
16.93	16.93	16.93	16.93	16.93	16.93	16.93
-9.0%	-10.6%	-12.1%	-13.5%	-14.9%	-16.3%	-17.6%

BOND PRICING

Immunization

Inputs

Rate Convention	○ EAR ◉ APR	2	**Annual Percentage Rate**
Yield to Maturity (Annualized)	3.17%		
Number of Payments / Year	2		

	Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
Bond 1	3.25%	4	$1,000	2,838
Bond 2	4.25%	8	$1,000	3,789
Bond 3	0.90%	2	$1,000	0
Bond 4	1.50%	4	$1,000	0
Bond 5	1.90%	6	$1,000	0
Bond 6	2.30%	8	$1,000	0
Bond 7	1.90%	6	$1,000	0
Bond 8	2.30%	8	$1,000	0

Outputs

Discount Rate / Period (r) 1.6%

(3) Copy the Present Value & Duratic
Copy the range B19:J24 from the

Bond Present Value, Duration, and Convexity using a Timeline

Period	0	1	2	3
Time (Years)	0.0	0.5	1.0	1.5
Liabilities		$0	$0	$0
Present Value of Liabilities		$0	$0	$0
Total Present Value of Liabilities	$6,642,711			
Weight		0.0%	0.0%	0.0%
Weight * Time		0.00	0.00	0.00
Duration of Liabilities	3.00			
Modified Duration of Liabilities	2.95			
Weight * (Time^2+Time)		0.00	0.00	0.00
Convexity of Liabilities	11.63			

(5) (Sum of Weight * (Time ^ 2 + Time)
/ ((1 + Yield to Maturity / Number of Payme
Enter =SUM(C30:J30)/((1+B18)^2)

Assets				
Bond 1		$46,123	$46,123	$46,123
Bond 2		$61,567	$61,567	$61,567
Bond 3		$0	$0	$0
Bond 4		$0	$0	$0
Bond 5		$0	$0	$0
Bond 6		$0	$0	$0
Bond 7		$0	$0	$0
Bond 8		$0	$0	$0
Total Assets		$107,689	$107,689	$107,689
Present Value of Assets		[illegible]	$104,355	$102,727
Total Present Value of Assets	$6,642,711			
Weight		[illegible]	1.6%	1.5%
Weight * Time		[illegible]	0.02	0.02
Duration of Assets	[illegible]			
Modified Duration of Assets	[illegible]			
Weight * (Time^2+Time)		[illegible]	0.03	0.06

Convexity of Assets	12.72			
Differences				
Total Assets - Liabilities		$107,689	$107,689	$107,689
PV of Assets - PV of Liabilities	$0			
Duration of Assets - Duration of Liab	0.00			
Convexity of Assets - Convexity of Liab	1.09			

(6) Copy the Present Value,
Copy the range B24:J31

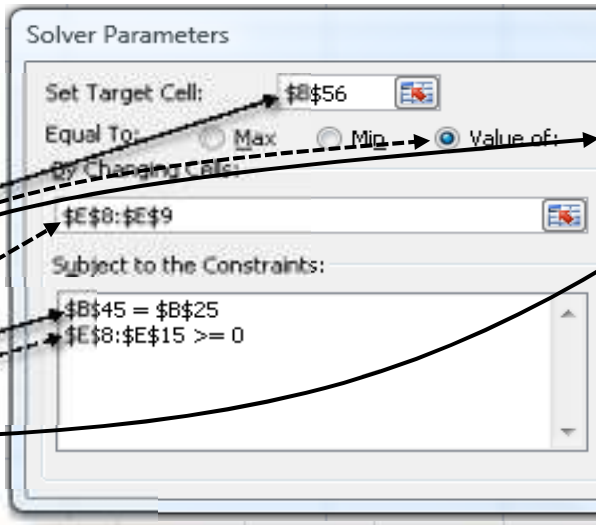
(7) Total Assets - Liabilities
Enter =C43-C23 and cop

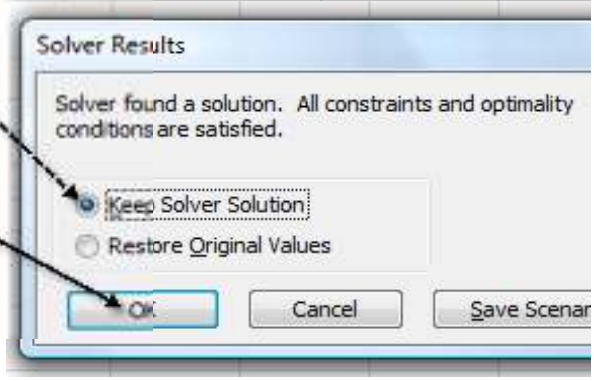
(8) Compute the differences between Assets a
Enter =B45-B25 in B55, =B48-B28 in B56,

To solve the first problem
when there is a single liability to immunize

(9a) Use Solver to determine the number of both Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E9** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* and click on **Solve**.

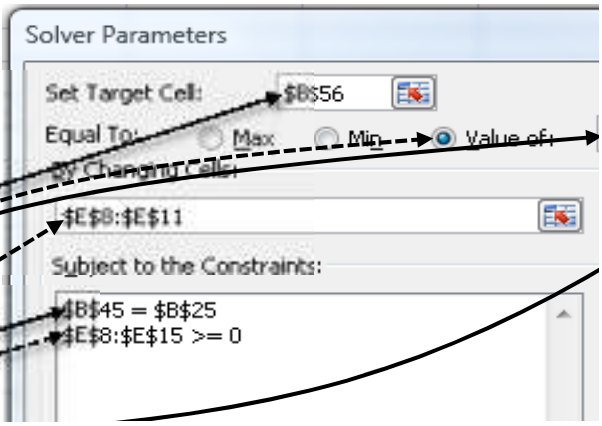
When Solver finds a solution,
* click on the **Keep *Solver Solution*** button
* and click on **OK**



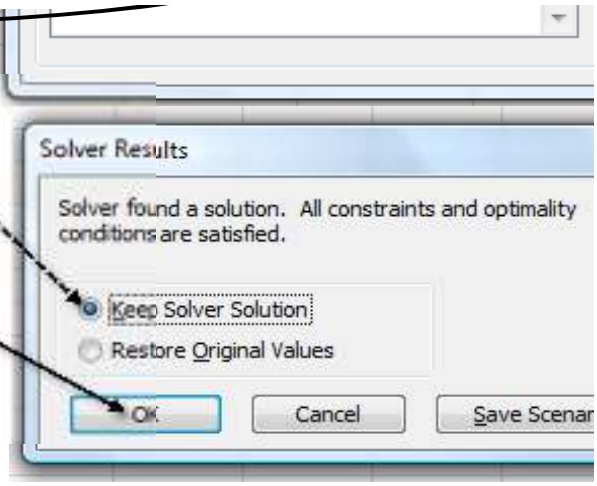


To solve the second problem
when there is a series of liabilities to immunize

(9b) Use Solver to determine the number of all four Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E11** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0

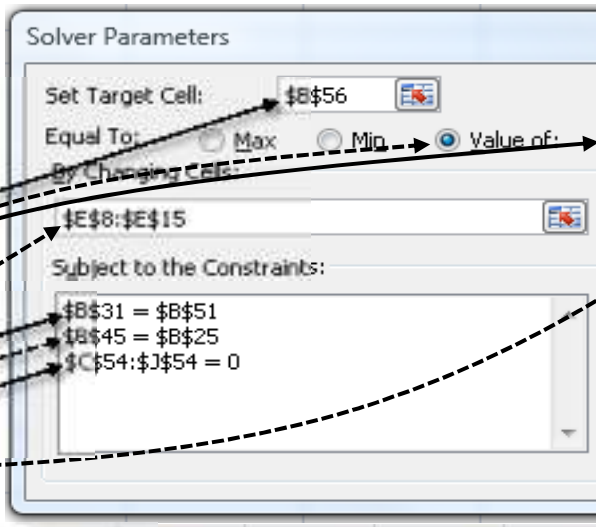


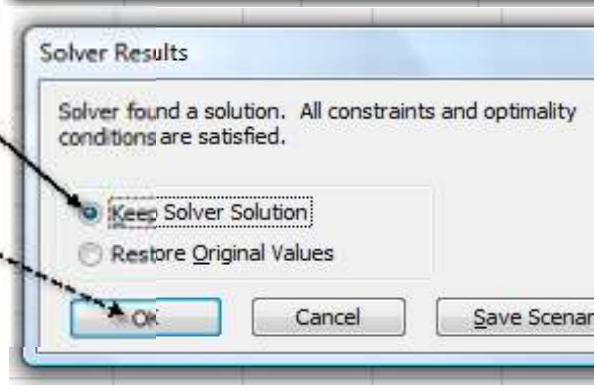
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**



To solve the third problem when there is a series of liabilities to immunize with cash flow matching

(9c) Use Solver to determine the number of all four Treasury bonds.
* Click on **Data | Analysis | Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E15** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* click **Add** and enter C54:J54 = 0
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**





Currency: US Dollar

Exch Rate $1.00 = $1.00

Coupon Payment (PMT)					
$16					
$21					
$5					
$8					
$10					
$12					
$10					
$12					

(1) Coupon Rate * Face Value / (Number of Payments / Year)
Enter =B8*D8/$B$6 and copy down

(2) If Rate Convention = EAR,
Then (1+Yield To Maturity)^(1 / (Number of Payments / Year)) - 1
Else (Yield To Maturity) / Number of Payment / Year)
Enter =IF(C4=1,((1+B5)^(1/B6))-1,B5/B6)

on formulas from the Duration and Convexity sheet
Duration and Convexity sheet to B24

	4	5	6	7	8
	2.0	2.5	3.0	3.5	4.0
	$0	$0	$7,300,000	$0	$0
	$0	$0	$6,642,711	$0	$0
	0.0%	0.0%	100.0%	0.0%	0.0%
	0.00	0.00	3.00	0.00	0.00
	0.00	0.00	12.00	0.00	0.00
	$2,884,451	$0	$0	$0	$0
	$61,567	$61,567	$61,567	$61,567	$3,850,280
	$0	$0	$0	$0	$0
	$0	$0	$0	$0	$0
	$0	$0	$0	$0	$0
	$0	$0	$0	$0	$0
	$0	$0	$0	$0	$0
	$0	$0	$0	$0	$0
	$2,946,017	$61,567	$61,567	$61,567	$3,850,280
	$2,766,413	$56,911	$56,023	$55,149	$3,395,124
	41.6%	0.9%	0.8%	0.8%	51.1%
	0.83	0.02	0.03	0.03	2.04
	2.50	0.07	0.10	0.13	10.22

(4) Weight * (Time^2 + Time)
Enter =C26*(C22^2+C22) and copy across

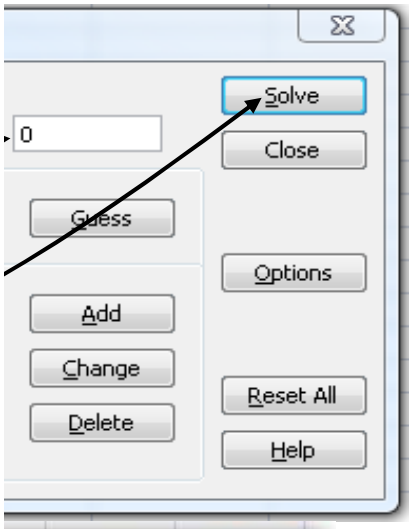
ents) ^ 2)

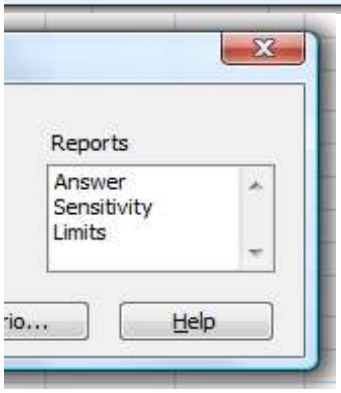
Duration, and Convexity formulas from above to B44

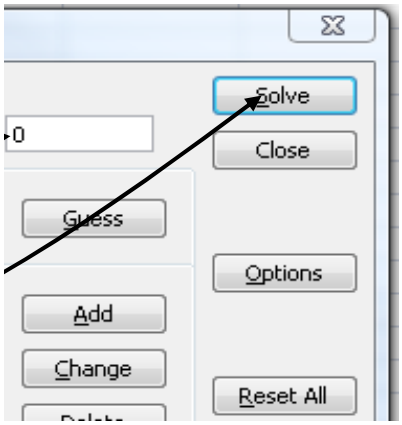
$2,946,017	$61,567	($7,238,433)	$61,567	$3,850,280

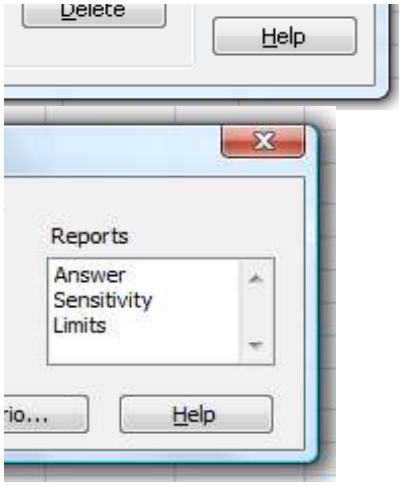
by across

and Liabilities in Present Value, Duration, and Convexity and =B51-B31 in B57








Delete
Help
Reports
Answer
Sensitivity
Limits
Help


Solve
0
Close
Guess
Options
Add
Change
Reset All
Delete
Help
Reports
Answer
Sensitivity
Limits
Help

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
3.25%	4	$1,000	1,783
4.25%	8	$1,000	2,042
0.90%	2	$1,000	6,038
1.50%	4	$1,000	5,937
1.90%	6	$1,000	7,017
2.30%	8	$1,000	8,068

0	1	2	3
0.0	0.5	1.0	1.5
	$0	$0	$0
	$2,000,000	$2,200,000	$2,500,000

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
0.00%	1	$1,000	2,000
0.00%	2	$1,000	2,200
0.00%	3	$1,000	2,500
0.00%	4	$1,000	3,200
0.00%	5	$1,000	3,700
0.00%	6	$1,000	4,300
0.00%	7	$1,000	4,700
0.00%	8	$1,000	5,100

4	5	6	7	8
2.0	2.5	3.0	3.5	4.0
$0	$0	$4,000,000	$0	$0
$3,200,000	$3,700,000	$4,300,000	$4,700,000	$5,100,000

BOND PRICING

Immunization

Inputs

Rate Convention	○ EAR ◉ APR	2	**Annual Percentage Rate**
Yield to Maturity (Annualized)	3.17%		
Number of Payments / Year	2		

	Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
Bond 1	1.50%	2	$1,000	0
Bond 2	2.70%	4	$1,000	34,996
Bond 3	2.90%	6	$1,000	5,073
Bond 4	3.20%	8	$1,000	10,046
Bond 5	1.90%	6	$1,000	0
Bond 6	2.30%	8	$1,000	0
Bond 7	1.90%	6	$1,000	0
Bond 8	2.30%	8	$1,000	0

Outputs

Discount Rate / Period (r) 1.6%

(3) Copy the Present Value & Duratic
Copy the range B19:J24 from the

Bond Present Value, Duration, and Convexity using a Timeline

Period	0	1	2	3
Time (Years)	0.0	0.5	1.0	1.5
Liabilities		$4,500,000	$5,100,000	$5,600,000
Present Value of Liabilities		$4,429,788	$4,942,094	$5,341,943
Total Present Value of Liabilities	$48,127,151			
Weight		9.2%	10.3%	11.1%
Weight * Time		0.05	0.10	0.17
Duration of Liabilities	2.44			
Modified Duration of Liabilities	2.40			
Weight * (Time^2+Time)		0.07	0.21	0.42
Convexity of Liabilities	9.37			

(5) (Sum of Weight * (Time ^ 2 + Time))
/ ((1 + Yield to Maturity / Number of Payme
Enter =SUM(C30:J30)/((1+B18)^2)

Assets				
Bond 1		$0	$0	$0
Bond 2		$262,469	$262,469	$262,469
Bond 3		$38,044	$38,044	$38,044
Bond 4		$75,346	$75,346	$75,346
Bond 5		$0	$0	$0
Bond 6		$0	$0	$0
Bond 7		$0	$0	$0
Bond 8		$0	$0	$0
Total Assets		$375,859	$375,859	$375,859
Present Value of Assets		[illegible]	$364,222	$358,539
Total Present Value of Assets	$48,124,2[illegible]			
Weight		[illegible]	0.8%	0.7%
Weight * Time		[illegible]	0.01	0.01
Duration of Assets	[illegible]			
Modified Duration of Assets	[illegible]			
Weight * (Time^2+Time)		[illegible]	0.02	0.03

Convexity of Assets	8.83			
Differences				
Total Assets - Liabilities		($4,124,141)	($4,724,141)	($5,224,141)
PV of Assets - PV of Liabilities	($2,865)			
Duration of Assets - Duration of Liab	0.01			
Convexity of Assets - Convexity of Liab	-0.54			

(6) Copy the Present Value,
Copy the range B24:J31

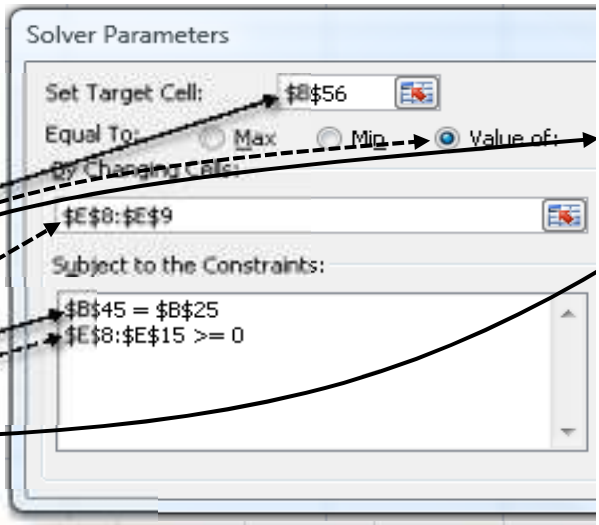
(7) Total Assets - Liabilities
Enter =C43-C23 and cop

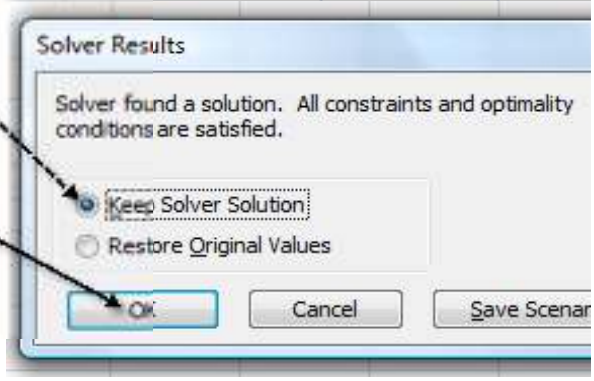
(8) Compute the differences between Assets a
Enter =B45-B25 in B55, =B48-B28 in B56,

To solve the first problem
when there is a single liability to immunize

(9a) Use Solver to determine the number of both Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E9** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* and click on **Solve**.

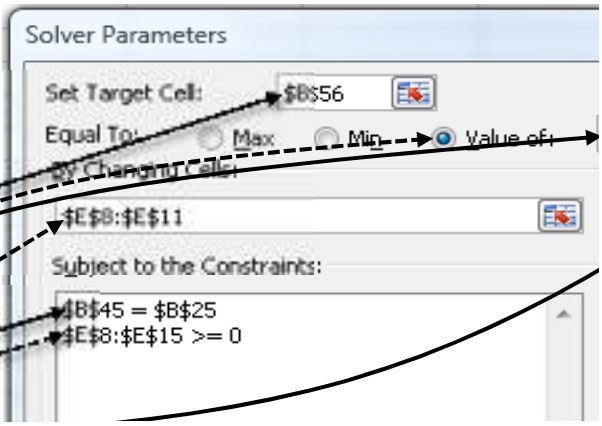
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**



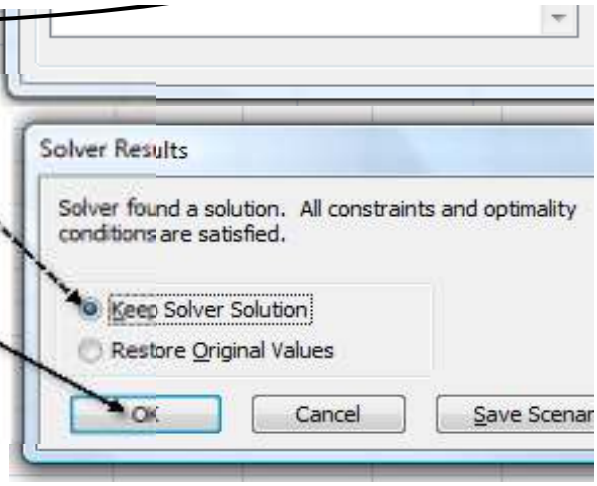


To solve the second problem
when there is a series of liabilities to immunize

(9b) Use Solver to determine the number of all four Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E11** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0

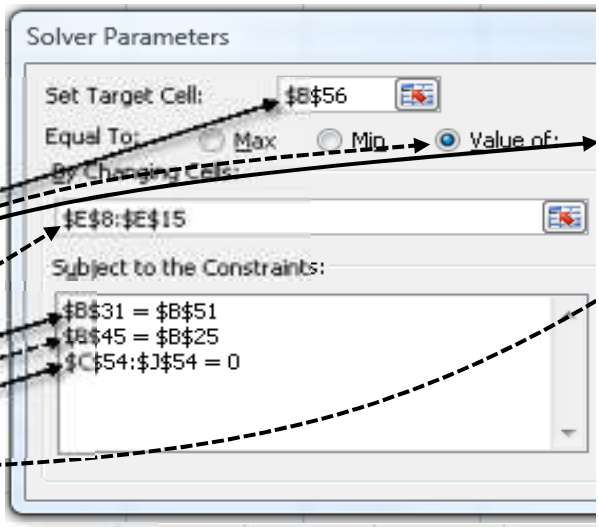


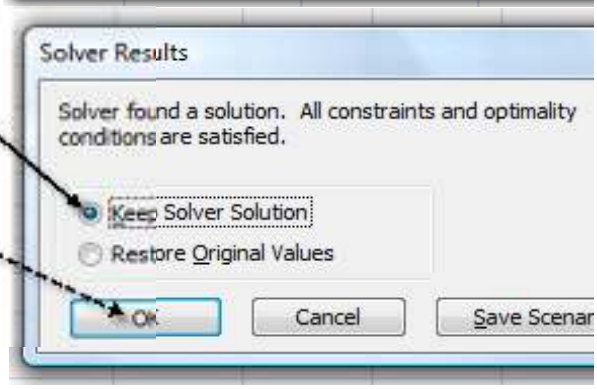
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**



To solve the third problem when there is a series of liabilities to immunize with cash flow matching

(9c) Use Solver to determine the number of all four Treasury bonds.
* Click on **Data | Analysis | Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E15** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* click **Add** and enter C54:J54 = 0
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**





Currency: US Dollar

Exch Rate $1.00 = $1.00

Coupon Payment (PMT)
$8
$14
$15
$16
$10
$12
$10
$12

(1) Coupon Rate * Face Value / (Number of Payments / Year)
Enter =B8*D8/$B$6 and copy down

(2) If Rate Convention = EAR,
Then (1+Yield To Maturity)^(1 / (Number of Payments / Year)) - 1
Else (Yield To Maturity) / Number of Payment / Year)
Enter =IF(C4=1,((1+B5)^(1/B6))-1,B5/B6)

on formulas from the Duration and Convexity sheet
Duration and Convexity sheet to B24

4	5	6	7	8
2.0	2.5	3.0	3.5	4.0
$6,300,000	$6,800,000	$7,200,000	$7,900,000	$8,600,000
$5,915,919	$6,285,806	$6,551,715	$7,076,524	$7,583,362
12.3%	13.1%	13.6%	14.7%	15.8%
0.25	0.33	0.41	0.51	0.63
0.74	1.14	1.63	2.32	3.15

(4) Weight * (Time^2 + Time)
Enter =C26*(C22^2+C22) and copy across

ents) ^ 2)

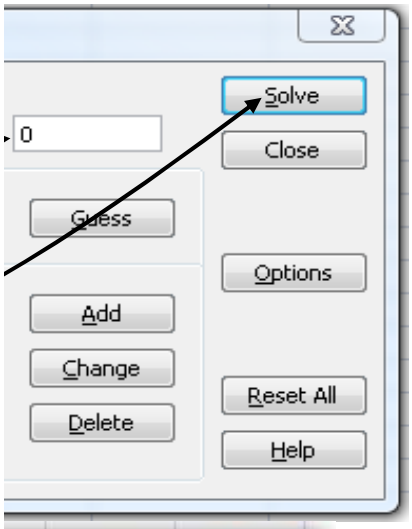
$0	$0	$0	$0	$0
$35,258,310	$0	$0	$0	$0
$38,044	$38,044	$5,110,580	$0	$0
$75,346	$75,346	$75,346	$75,346	$10,121,479
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$35,371,700	$113,390	$5,185,926	$75,346	$10,121,479
$33,215,255	$104,816	$4,718,987	$67,492	$8,924,981
69.0%	0.2%	9.8%	0.1%	18.5%
1.38	0.01	0.29	0.00	0.74
4.14	0.02	1.18	0.02	3.71

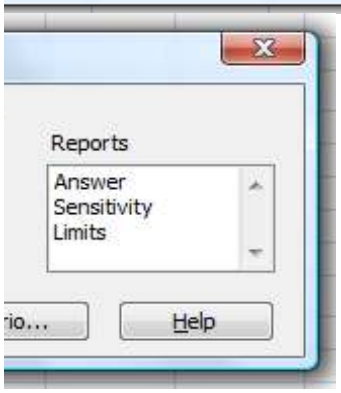
Duration, and Convexity formulas from above to B44

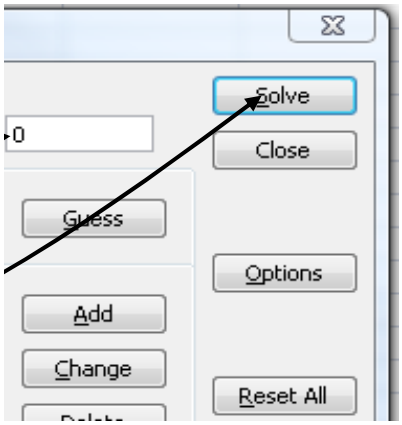
$29,071,700	($6,686,610)	($2,014,074)	($7,824,654)	$1,521,479

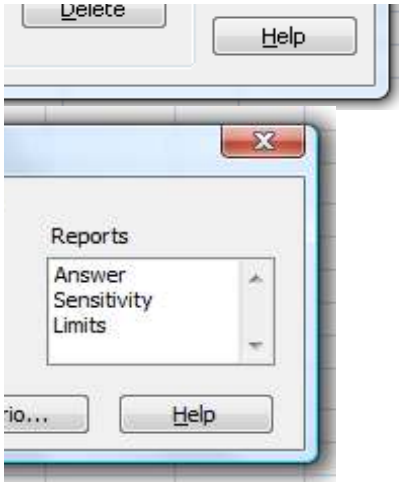
y across

and Liabilities in Present Value, Duration, and Convexity and =B51-B31 in B57








Delete
Help
Reports
Answer
Sensitivity
Limits
Help


Solve
0
Close
Guess
Options
Add
Change
Reset All
Delete
Help
Reports
Answer
Sensitivity
Limits
Help

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
1.50%	4	$1,000	1,783
2.00%	8	$1,000	2,042
0.90%	2	$1,000	6,038
1.50%	4	$1,000	5,937
1.90%	6	$1,000	7,017
2.30%	8	$1,000	8,068

0	1	2	3
0.0	0.5	1.0	1.5
	$0	$0	$0
	$2,000,000	$2,200,000	$2,500,000

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
0.00%	1	$1,000	2,000
0.00%	2	$1,000	2,200
0.00%	3	$1,000	2,500
0.00%	4	$1,000	3,200
0.00%	5	$1,000	3,700
0.00%	6	$1,000	4,300
0.00%	7	$1,000	4,700
0.00%	8	$1,000	5,100

4	5	6	7	8
2.0	2.5	3.0	3.5	4.0
$0	$0	$4,000,000	$0	$0
$3,200,000	$3,700,000	$4,300,000	$4,700,000	$5,100,000

Bond Pricing

Immunization

Inputs

Rate Convention	○ EAR ◉ APR	2	**Annual Percentage Rate**
Yield to Maturity (Annualized)	3.17%		
Number of Payments / Year	2		

	Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
Bond 1	0.00%	1	$1,000	4,500
Bond 2	0.00%	2	$1,000	5,100
Bond 3	0.00%	3	$1,000	5,600
Bond 4	0.00%	4	$1,000	6,300
Bond 5	0.00%	5	$1,000	6,800
Bond 6	0.00%	6	$1,000	7,200
Bond 7	0.00%	7	$1,000	7,900
Bond 8	0.00%	8	$1,000	8,600

Outputs

Discount Rate / Period (r) 1.6%

(3) Copy the Present Value & Duratic
Copy the range B19:J24 from the

Bond Present Value, Duration, and Convexity using a Timeline

Period	0	1	2	3
Time (Years)	0.0	0.5	1.0	1.5
Liabilities		$4,500,000	$5,100,000	$5,600,000
Present Value of Liabilities		$4,429,788	$4,942,094	$5,341,943
Total Present Value of Liabilities	$48,127,151			
Weight		9.2%	10.3%	11.1%
Weight * Time		0.05	0.10	0.17
Duration of Liabilities	2.44			
Modified Duration of Liabilities	2.40			
Weight * (Time^2+Time)		0.07	0.21	0.42
Convexity of Liabilities	9.37			

(5) (Sum of Weight * (Time ^ 2 + Time)
/ ((1 + Yield to Maturity / Number of Payme
Enter =SUM(C30:J30)/((1+B18)^2)

Assets				
Bond 1		$4,500,000	$0	$0
Bond 2		$0	$5,100,000	$0
Bond 3		$0	$0	$5,600,000
Bond 4		$0	$0	$0
Bond 5		$0	$0	$0
Bond 6		$0	$0	$0
Bond 7		$0	$0	$0
Bond 8		$0	$0	$0
Total Assets		$4,500,000	$5,100,000	$5,600,000
Present Value of Assets		$4,429,788	$4,942,094	$5,341,943
Total Present Value of Assets	$48,127,151			
Weight		9.2%	10.3%	11.1%
Weight * Time		0.05	0.10	0.17
Duration of Assets	2.44			
Modified Duration of Assets	2.40			
Weight * (Time^2+Time)		0.07	0.21	0.42

Convexity of Assets	9.37			
Differences				
Total Assets - Liabilities		$0	$0	$0
PV of Assets - PV of Liabilities	$0			
Duration of Assets - Duration of Liab	0.00			
Convexity of Assets - Convexity of Liab	0.00			

(6) Copy the Present Value,
Copy the range B24:J31

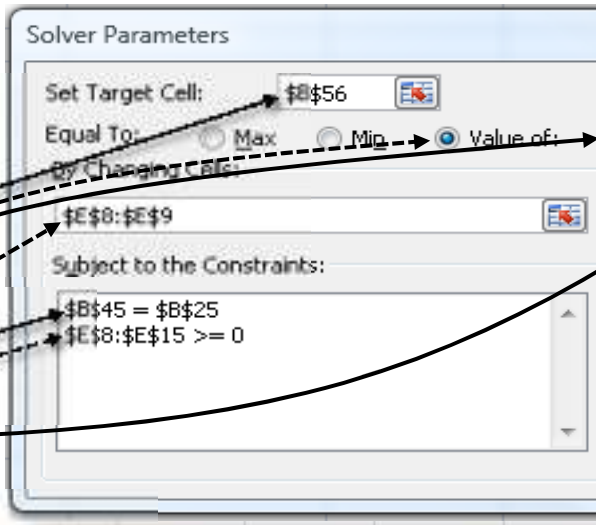
(7) Total Assets - Liabilities
Enter =C43-C23 and cop

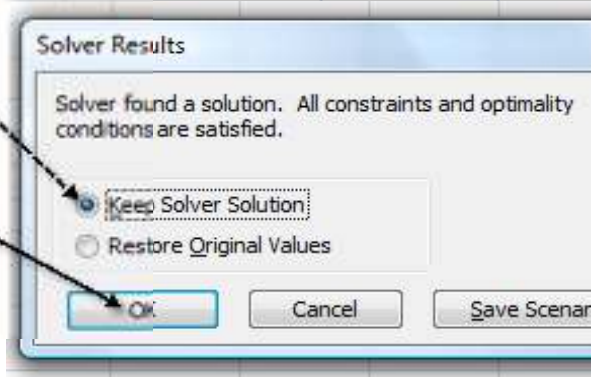
(8) Compute the differences between Assets a
Enter =B45-B25 in B55, =B48-B28 in B56,

To solve the first problem
when there is a single liability to immunize

(9a) Use Solver to determine the number of both Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E9** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* and click on **Solve**.

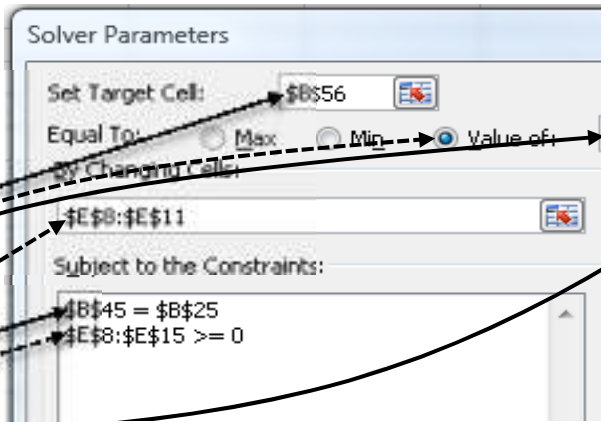
When Solver finds a solution,
* click on the **Keep *Solver Solution*** button
* and click on **OK**



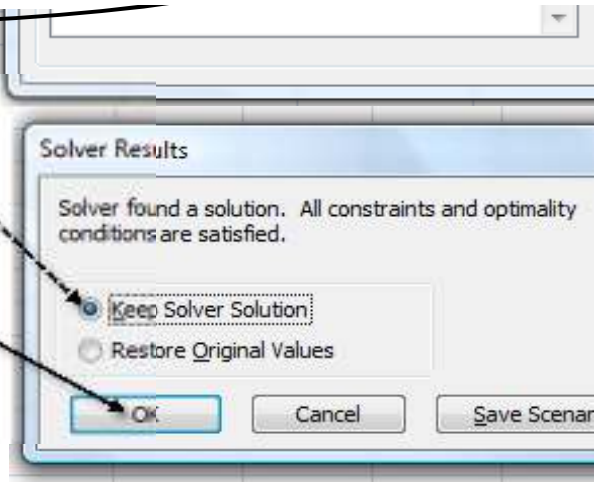


To solve the second problem
when there is a series of liabilities to immunize

(9b) Use Solver to determine the number of all four Treasury bonds
* Click on **Data** | **Analysis** | **Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E11** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0

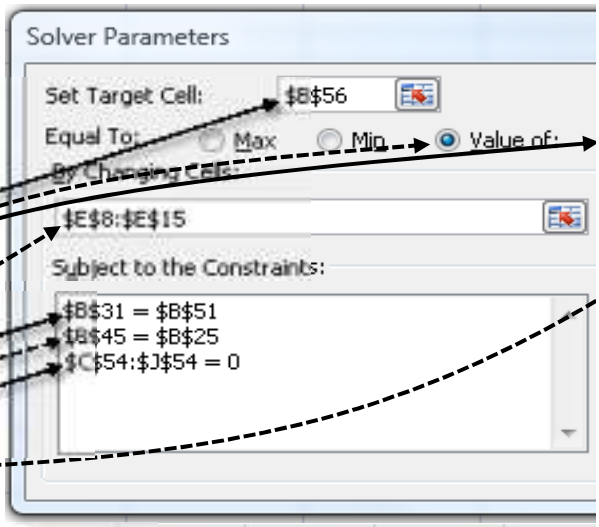


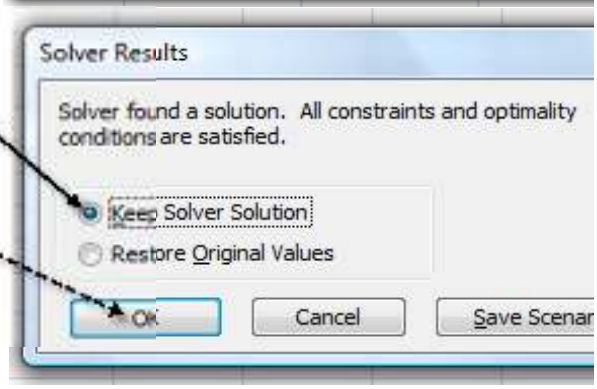
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**



To solve the third problem when there is a series of liabilities to immunize with cash flow matching

(9c) Use Solver to determine the number of all four Treasury bonds.
* Click on **Data | Analysis | Solver**
* enter **B56** in Set Target Cell,
* click on the **Value Of** button
* enter **0** in the adjacent box,
* enter **E8:E15** in By Changing Cells,
* click on **Add** and enter B45 = B25,
* click **Add** and enter E8:E15 >=0
* click **Add** and enter C54:J54 = 0
* and click on **Solve**.
When Solver finds a solution,
* click on the **Keep Solver Solution** button
* and click on **OK**





Currency: US Dollar

Exch Rate $1.00 = $1.00

Coupon Payment (PMT)

(1) Coupon Rate * Face Value / (Number of Payments / Year)
Enter =B8*D8/$B$6 and copy down

(2) If Rate Convention = EAR,
Then (1+Yield To Maturity)^(1 / (Number of Payments / Year)) - 1
Else (Yield To Maturity) / Number of Payment / Year)
Enter =IF(C4=1,((1+B5)^(1/B6))-1,B5/B6)

on formulas from the Duration and Convexity sheet
Duration and Convexity sheet to B24

(4) Weight * (Time^2 + Time)
Enter =C26*(C22^2+C22) and copy across

ents) ^ 2)

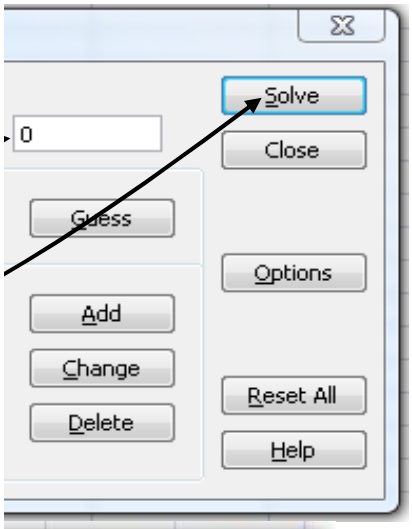
4	5	6	7	8
2.0	2.5	3.0	3.5	4.0
$6,300,000	$6,800,000	$7,200,000	$7,900,000	$8,600,000
$5,915,919	$6,285,806	$6,551,715	$7,076,524	$7,583,362
12.3%	13.1%	13.6%	14.7%	15.8%
0.25	0.33	0.41	0.51	0.63
0.74	1.14	1.63	2.32	3.15
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$0	$0	$0	$0	$0
$6,300,000	$0	$0	$0	$0
$0	$6,800,000	$0	$0	$0
$0	$0	$7,200,000	$0	$0
$0	$0	$0	$7,900,000	$0
$0	$0	$0	$0	$8,600,000
$6,300,000	$6,800,000	$7,200,000	$7,900,000	$8,600,000
$5,915,919	$6,285,806	$6,551,715	$7,076,524	$7,583,362
12.3%	13.1%	13.6%	14.7%	15.8%
0.25	0.33	0.41	0.51	0.63
0.74	1.14	1.63	2.32	3.15

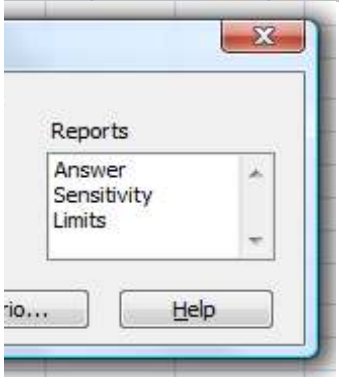
Duration, and Convexity formulas from above to B44

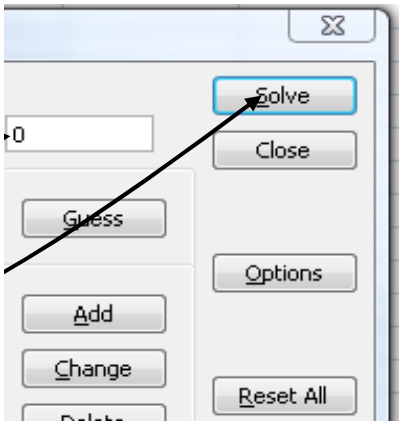
	$0	$0	$0	$0	$0

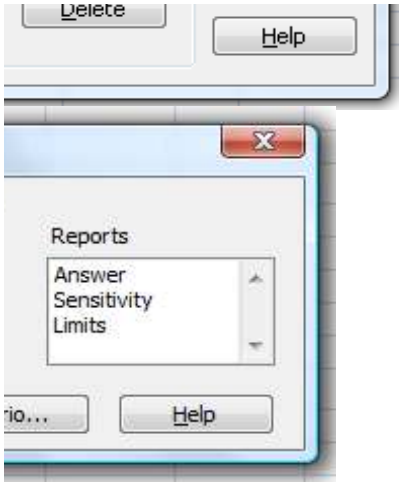
by across

and Liabilities in Present Value, Duration, and Convexity and =B51-B31 in B57








Delete
Help
Reports
Answer
Sensitivity
Limits
Help


Solve
0
Close
Guess
Options
Add
Change
Reset All
Delete
Help
Reports
Answer
Sensitivity
Limits
Help

Currency Number (Select from below)	4
1 = Chinese Yuan	¥ 7.3790
2 = European Euro	€ 0.6805
3 = Indian Rupee	IDR 39.30
4 = US Dollar	$1.00

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
1.50%	4	$1,000	1,783
2.00%	8	$1,000	2,042
0.90%	2	$1,000	6,038
1.50%	4	$1,000	5,937
1.90%	6	$1,000	7,017
2.30%	8	$1,000	8,068

0	1	2	3
0.0	0.5	1.0	1.5
	$0	$0	$0
	$2,000,000	$2,200,000	$2,500,000

Annual Coupon Rate	Number of Periods to Maturity (T)	Face Value (PAR)	Number of Bonds
0.00%	1	$1,000	2,000
0.00%	2	$1,000	2,200
0.00%	3	$1,000	2,500
0.00%	4	$1,000	3,200
0.00%	5	$1,000	3,700
0.00%	6	$1,000	4,300
0.00%	7	$1,000	4,700
0.00%	8	$1,000	5,100

4	5	6	7	8
2.0	2.5	3.0	3.5	4.0
$0	$0	$4,000,000	$0	$0
$3,200,000	$3,700,000	$4,300,000	$4,700,000	$5,100,000

BOND PRICING

System of Five Bond Variables

Currency: US Dollar | Exch Rate $1.00 = $1.00

Inputs	Annual Percentage Rate
Rate Convention	○ EAR ◉ APR 2
Annual Coupon Rate	8.00%
Yield to Maturity (Annualized)	6.54%
Number of Payments / Year	2
(1) Number of Periods to Maturity (T)	10
(2) Face Value (PAR)	$1,000.00
(3) Discount Rate / Period (r)	3.27%
(4) Coupon Payment (PMT)	$40.00
(5) Bond Price (P)	$1,061.42

(1) Number of Periods to Maturity (T) from the other four variables	
Number of Periods to Maturity using NPER Function	10
(2) Face Value (PAR) from the other four variables	
Face Value using the FV Function	$1,000.00
Face Value using the Formula	$1,000.00
(3) Discount Rate / Period (r) from the other four variables	
Discount Rate / Period using the RATE Function	3.27%
(4) Coupon Payment (PMT) from the other four variables	
Coupon Payment using the PMT Function	$40.00
Coupon Payment using the Formula	$40.00
(5) Bond Price (P) from the other four variables	
Bond Price using the PV Function	$1,061.42
Bond Price using the Formula	$1,061.42

(1) NPER(Discount Rate / Period, Coupon Payment, -Bond Price, Face Value)
Enter =NPER(D12,D11,-D13,D9)

(2) FV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, -Bond Price)
Enter =FV(D12,D10,D11,-D13)

(2) The Face Value Formula is

$$PAR = P \cdot (1+r)^{T} - \frac{PMT \cdot \left(\left((1+r)^{T}\right) - 1\right)}{r}$$

Enter =D13*(1+D12)^D10-D11*(((1+D12)^D10)-1)/D12

(4) RATE(Number of Periods to Maturity, Coupon Payment, -Bond Price, Face Value)
Enter =RATE(D10,D11,-D13,D9)

(4) PMT(Discount Rate / Period, Number of Periods to Maturity, Bond Price, Face Value)
Enter =-PMT(B12,B8,-B13,B9)

(4) The Coupon Payment Formula is

$$PMT = \frac{P - PAR/(1+r)^{T}}{\left(1 - \left((1+r)^{-T}\right)\right)/r}$$

Enter =(D13-D9/(1+D12)^D10)/((1-(1+D12)^-D10)/D12)

(5) PV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, Face Value)
Enter =-PV(D12,D10,D11,D9)

(5) The Bond Price Formula is

$$P = \frac{PMT \cdot \left(1 - \left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

Enter =B11*(1-((1+B12)^(-B8)))/B12+B9/((1+B12)^B8)

BOND PRICING

System of Five Bond Variables

Currency: US Dollar | Exch Rate $1.00 = $1.00

Inputs	Annual Percentage Rate	
Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate	5.44%	
Yield to Maturity (Annualized)	9.08%	
Number of Payments / Year	2	
(1) Number of Periods to Maturity (T)	10	
(2) Face Value (PAR)	$1,000.00	
(3) Discount Rate / Period (r)	4.54%	
(4) Coupon Payment (PMT)	$27.20	
(5) Bond Price (P)	$880.00	
(1) Number of Periods to Maturity (T) from the other four variables		
Number of Periods to Maturity using NPER Function	10	
(2) Face Value (PAR) from the other four variables		
Face Value using the FV Function	$1,000.00	
Face Value using the Formula	$1,000.00	
(3) Discount Rate / Period (r) from the other four variables		
Discount Rate / Period using the RATE Function	4.54%	
(4) Coupon Payment (PMT) from the other four variables		
Coupon Payment using the PMT Function	$27.20	
Coupon Payment using the Formula	$27.20	
(5) Bond Price (P) from the other four variables		
Bond Price using the PV Function	$880.00	
Bond Price using the Formula	$880.00	

(1) NPER(Discount Rate / Period, Coupon Payment, -Bond Price, Face Value)
Enter =NPER(D12,D11,-D13,D9)

(2) FV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, -Bond Price)
Enter =FV(D12,D10,D11,-D13)

(2) The Face Value Formula is

$$PAR = P \cdot (1+r)^{T} - \frac{PMT \cdot \left(\left((1+r)^{T}\right)-1\right)}{r}$$

Enter =D13*(1+D12)^D10-D11*(((1+D12)^D10)-1)/D12

(3) RATE(Number of Periods to Maturity, Coupon Payment, -Bond Price, Face Value)
Enter =RATE(D10,D11,-D13,D9)

(4) PMT(Discount Rate / Period, Number of Periods to Maturity, Bond Price, Face Value)
Enter =-PMT(B12,B8,-B13,B9)

(4) The Coupon Payment Formula is

$$PMT = \frac{P - PAR/(1+r)^{T}}{\left(1-\left((1+r)^{-T}\right)\right)/r}$$

Enter =(D13-D9/(1+D12)^D10)/((1-(1+D12)^-D10)/D12)

(5) The Bond Price Formula is

$$P = \frac{PMT \cdot \left(1-\left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

Enter =B11*(1-((1+B12)^-B10))/B12+B9/((1+B12)^B10)

(5) PV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, Face Value)
Enter =-PV(D12,D10,D11,D9)

BOND PRICING

System of Five Bond Variables

Currency: US Dollar | Exch Rate $1.00 = $1.00

Inputs	Annual Percentage Rate	
Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate	6.00%	
Yield to Maturity (Annualized)	11.44%	
Number of Payments / Year	2	
(1) Number of Periods to Maturity (T)	8	
(2) Face Value (PAR)	$1,000.00	
(3) Discount Rate / Period (r)	5.72%	
(4) Coupon Payment (PMT)	$30.00	
(5) Bond Price (P)	$865.00	
(1) Number of Periods to Maturity (T) from the other four variables		
Number of Periods to Maturity using NPER Function	8	
(2) Face Value (PAR) from the other four variables		
Face Value using the FV Function	$1,000.00	
Face Value using the Formula	$1,000.00	
(3) Discount Rate / Period (r) from the other four variables		
Discount Rate / Period using the RATE Function	5.72%	
(4) Coupon Payment (PMT) from the other four variables		
Coupon Payment using the PMT Function	$30.00	
Coupon Payment using the Formula	$30.00	
(5) Bond Price (P) from the other four variables		
Bond Price using the PV Function	$865.00	
Bond Price using the Formula	$865.00	

(1) NPER(Discount Rate / Period, Coupon Payment, -Bond Price, Face Value)
Enter =NPER(D12,D11,-D13,D9)

(2) FV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, -Bond Price)
Enter =FV(D12,D10,D11,-D13)

(2) The Face Value Formula is

$$PAR = P \cdot (1+r)^{T} - \frac{PMT \cdot \left(\left((1+r)^{T}\right) - 1\right)}{r}$$

Enter =D13*(1+D12)^D10-D11*(((1+D12)^D10)-1)/D12

(3) RATE(Number of Periods to Maturity, Coupon Payment, -Bond Price, Face Value)
Enter =RATE(D10,D11,-D13,D9)

(4) PMT(Discount Rate / Period, Number of Periods to Maturity, Bond Price, Face Value)
Enter =-PMT(D12,D8,-D13,D9)

(4) The Coupon Payment Formula is

$$PMT = \frac{P - PAR/(1+r)^{T}}{\left(1 - \left((1+r)^{-T}\right)\right)/r}$$

Enter =(D13-D9/(1+D12)^D10)/((1-(1+D12)^-D10)/D12)

(5) The Bond Price Formula is

$$P = \frac{PMT \cdot \left(1 - \left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

Enter =D11*((1-((1+D12)^-D10))/D12)+D9/((1+D12)^D10)

(5) PV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, Face Value)
Enter =-PV(D12,D10,D11,D9)

BOND PRICING

System of Five Bond Variables

Currency: US Dollar | Exch Rate $1.00 = $1.00

Inputs	Annual Percentage Rate	
Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate	11.78%	
Yield to Maturity (Annualized)	7.62%	
Number of Payments / Year	2	
(1) Number of Periods to Maturity (T)	10	
(2) Face Value (PAR)	$764.99	
(3) Discount Rate / Period (r)	3.81%	
(4) Coupon Payment (PMT)	$45.00	
(5) Bond Price (P)	$872.00	
(1) Number of Periods to Maturity (T) from the other four variables		
Number of Periods to Maturity using NPER Function	10	
(2) Face Value (PAR) from the other four variables		
Face Value using the FV Function	$764.99	
Face Value using the Formula	$764.99	
(3) Discount Rate / Period (r) from the other four variables		
Discount Rate / Period using the RATE Function	3.81%	
(4) Coupon Payment (PMT) from the other four variables		
Coupon Payment using the PMT Function	$45.00	
Coupon Payment using the Formula	$45.00	
(5) Bond Price (P) from the other four variables		
Bond Price using the PV Function	$872.00	
Bond Price using the Formula	$872.00	

(1) NPER(Discount Rate / Period, Coupon Payment, -Bond Price, Face Value)
Enter =NPER(D12,D11,-D12,D9)

(2) FV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, -Bond Price)
Enter =FV(D10,D9,D11,-D12)

(2) The Face Value Formula is

$$PAR = P \cdot (1+r)^{T} - \frac{PMT \cdot \left(\left((1+r)^{T}\right) - 1\right)}{r}$$

Enter =D12*(1+D10)^D9-D11*(((1+D10)^D9)-1)/D10

(3) RATE(Number of Periods to Maturity, Coupon Payment, -Bond Price, Face Value)
Enter =RATE(D9,D11,-D12,D9)

(4) PMT(Discount Rate / Period, Number of Periods to Maturity, Bond Price, Face Value)
Enter =-PMT(B10,B8,-B12,B9)

(4) The Coupon Payment Formula is

$$PMT = \frac{P - PAR/(1+r)^{T}}{\left(1 - \left((1+r)^{-T}\right)\right)/r}$$

Enter =D12-D9/(1+D10)^D9/((1-1/(1+D10)^D9)/D10)

(5) The Bond Price Formula is

$$P = \frac{PMT \cdot \left(1 - \left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

Enter =B11*((1-(1/(1+B12)^B8))/B12)+B9/(1+B12)^B8

(5) PV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, Face Value)
Enter =-PV(D10,D9,D11,D9)

BOND PRICING

System of Five Bond Variables

Currency: US Dollar | Exch Rate $1.00 = $1.00

Inputs	Annual Percentage Rate	
Rate Convention	○ EAR ◉ APR	2
Annual Coupon Rate	7.40%	
Yield to Maturity (Annualized)	8.70%	
Number of Payments / Year	2	
(1) Number of Periods to Maturity (T)	30	
(2) Face Value (PAR)	$1,000.00	
(3) Discount Rate / Period (r)	4.35%	
(4) Coupon Payment (PMT)	$37.00	
(5) Bond Price (P)	$887.00	
(1) Number of Periods to Maturity (T) from the other four variables		
Number of Periods to Maturity using NPER Function	30.00	
(2) Face Value (PAR) from the other four variables		
Face Value using the FV Function	$1,000.00	
Face Value using the Formula	$1,000.00	
(3) Discount Rate / Period (r) from the other four variables		
Discount Rate / Period using the RATE Function	4.35%	
(4) Coupon Payment (PMT) from the other four variables		
Coupon Payment using the PMT Function	$37.00	
Coupon Payment using the Formula	$37.00	
(5) Bond Price (P) from the other four variables		
Bond Price using the PV Function	$887.00	
Bond Price using the Formula	$887.00	

(1) NPER(Discount Rate / Period, Coupon Payment, -Bond Price, Face Value)
Enter =NPER(D12,D11,-D12,D9)

(2) FV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, -Bond Price)
Enter =FV(D10,D8,D11,-D12)

(2) The Face Value Formula is

$$PAR = P \cdot (1+r)^{T} - \frac{PMT \cdot \left(\left((1+r)^{T}\right) - 1\right)}{r}$$

Enter =D12*(1+D10)^D8-D11*((1+D10)^D8-1)/D10

(4) RATE(Number of Periods to Maturity, Coupon Payment, -Bond Price, Face Value)
Enter =RATE(D8,D11,-D12,D9)

(4) PMT(Discount Rate / Period, Number of Periods to Maturity, Bond Price, Face Value)
Enter =-PMT(B10,B8,-B12,B9)

(4) The Coupon Payment Formula is

$$PMT = \frac{P - PAR/(1+r)^{T}}{\left(1-\left((1+r)^{-T}\right)\right)/r}$$

Enter =(D12-D9/(1+D10)^D8)/((1-1/(1+D10)^D8)/D10)

(5) PV(Discount Rate / Period, Number of Periods to Maturity, Coupon Payment, Face Value)
Enter =-PV(D10,D8,D11,D9)

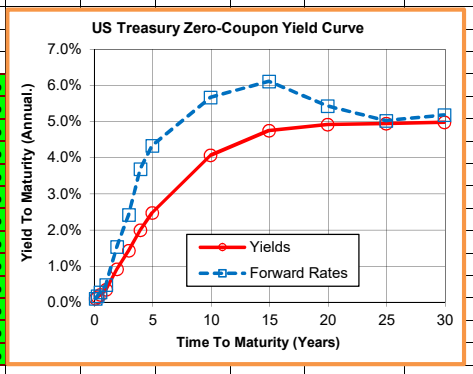
(5) The Bond Price Formula is

$$P = \frac{PMT \cdot \left(1-\left((1+r)^{-T}\right)\right)}{r} + \frac{PAR}{(1+r)^{T}}$$

Enter =B11*(1-(1/(1+B10)^B8))/B10+B9/(1+B10)^B8

THE YIELD CURVE — Obtaining and Using It

Yield Curve Inputs	Maturity Date	Time To Maturity	Yield To Maturity	Forward Rates
Today's Date	3/11/2010			
One Month Treasury Bill	4/15/2010	0.09	0.101%	0.01%
Three Month Treasury Bill	6/10/2010	0.25	0.147%	0.75%
Six Month Treasury Bill	9/9/2010	0.49	0.211%	0.75%
One Year Treasury Strip	3/10/2011	1.00	0.349%	0.85%
Two Year Treasury Strip	2/15/2012	1.93	0.920%	1.36%
Three Year Treasury Strip	2/15/2013	2.93	1.430%	2.20%
Four Year Treasury Strip	2/15/2014	3.93	2.000%	3.87%
Five Year Treasury Strip	2/15/2015	4.93	2.470%	4.37%
Ten Year Treasury Strip	2/15/2020	9.93	4.070%	5.71%
Fifteen Year Treasury Bond	2/15/2025	14.93	4.750%	6.13%
Twenty Year Treasury Bond	2/15/2030	19.93	4.920%	5.29%
Twenty Five Year Treasury Bond	2/15/2035	24.93	4.940%	5.20%
Thirty Year Treasury Bond	2/15/2040	29.93	4.980%	5.80%



(1) Maturity Date = Today's Date + Enter =YEARFRAC($B$4,B5) and copy down

(2) Forward Rate formula: $f_{T-t} = \left((1+y_T)^T / (1+y_t)^t\right)^{1/(T-t)} - 1$

Enter =(((1+C5)^C5/(1+C4)^C4)^(1/(C5-C4)))-1 and copy down

Notation:
- t = an earlier date
- T = a later date
- y_t = date t yield
- y_T = date T yield
- $f_{t,T}$ = forward rate from date t to date T

Bond Inputs	Effective Annual Rate
Rate Convention	(•) EAR ( ) APR
Annual Coupon Rate	3.5%
Number of Payments / Year	2
Number of Periods to Maturity	8
Face Value	$1,000
Outputs	
Coupon Payment	$17.50

(3) Coupon Rate * Face Value / (Number of Payments/Year)
Enter =B7*B30/B28

(4) Periods 1 - 7 = Coupon Payment
Enter =B$33 and copy across

(5) Period 8 = Coupon Payment + Face Value
Enter =B33+B30

(6) Corresponding yield on the yield curve
Enter =D7 in C39, =D8 in D39, =D9 in F39, =D10 in H39, =D11 in J39
Enter =(D9+D8)/2 in E39, =(D10+D9)/2 in G39, =(D11+D9)/2 in I39

Bond Price and Yield To Maturity using a Timeline

Period	0	1	2	3	4	5	6	7	8
Time (Years)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Cash Flows		$17.50	$17.50	$17.50	$17.50	$17.50	$17.50	$17.50	$1,017.50
Yield to Maturity (Annualized)		0.21%	0.35%	0.63%	0.92%	1.18%	1.43%	1.72%	2.00%
Discount Rate / Period		0.11%	0.17%	0.32%	0.46%	0.59%	0.71%	0.85%	1.00%
Present Value of Cash Flow		$17.48	$17.44	$17.33	$17.18	$17.00	$16.77	$16.49	$940.01

Coupon Bond Price	$1,059.71
Coupon Bond Discount Rate / Period	0.97%
Coupon Bond Yield to Maturity	1.95%

(7) If Rate Convention = EAR,
Then ((1+Yield To Maturity)^(1 / Number of Payments / Year)) - 1
Else (Yield To Maturity) / (Number of Payments / Year)
Enter =IF($C$26=1,(1+C39)^(1/$C$28)-1,C39/$C$28)
and copy across

(8) (Cash Flow) / (1+Discount Rate / Period) ^ Period
Enter =B33/(1+B42)^B35 and copy across

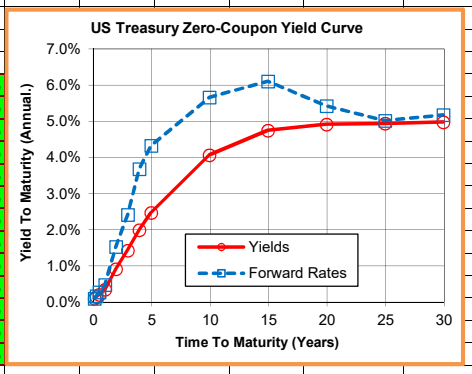
(9) Sum of all the Present Value of Cash Flows
Enter =SUM(B41:J41)

(10) RATE(Number of Periods to Maturity, Coupon Bond, -Bond Price, Par Value)
Enter =RATE(C28,C30,-C43,C30)

(11) If Rate Convention = EAR
Then (1+Discount Rate / Period)^(Number of Payments / Year) - 1
Else (Discount Rate / Period) * (Number of Payments / Year)
Enter =IF($C$26=1,((1+B43)^($C$28)-1),B43*$C$28)

THE YIELD CURVE — Obtaining and Using It

Yield Curve Inputs	Maturity Date	Time To Maturity	Yield To Maturity	Forward Rates
Today's Date	3/11/2010			
One Month Treasury Bill	4/15/2010	0.09	0.101%	0.01%
Three Month Treasury Bill	6/10/2010	0.25	0.147%	0.75%
Six Month Treasury Bill	9/9/2010	0.49	0.211%	0.75%
One Year Treasury Strip	3/10/2011	1.00	0.349%	0.85%
Two Year Treasury Strip	2/15/2012	1.93	0.920%	1.36%
Three Year Treasury Strip	2/15/2013	2.93	1.430%	2.20%
Four Year Treasury Strip	2/15/2014	3.93	2.000%	3.87%
Five Year Treasury Strip	2/15/2015	4.93	2.470%	4.37%
Ten Year Treasury Strip	2/15/2020	9.93	4.070%	5.71%
Fifteen Year Treasury Bond	2/15/2025	14.93	4.750%	6.13%
Twenty Year Treasury Bond	2/15/2030	19.93	4.920%	5.29%
Twenty Five Year Treasury Bond	2/15/2035	24.93	4.940%	5.20%
Thirty Year Treasury Bond	2/15/2040	29.93	4.980%	5.80%



(1) Maturity Date = Today's Date + Enter =YEARFRAC($B$4,B8) and copy down

(2) Forward Rate formula: $f_{T-t} = \left((1+y_T)^T / (1+y_t)^t\right)^{1/(T-t)} - 1$

Enter =(((1+D5)^C5/(1+D4)^C4)^(1/(C5-C4)))-1 and copy down

Notation:
t = an earlier date
T = a later date
y_t = date t yield
y_T = date T yield
$f_{t,T}$ = forward rate from date t to date T

Bond Inputs	Effective Annual Rate
Rate Convention	(•) EAR ( ) APR
Annual Coupon Rate	4.2%
Number of Payments / Year	2
Number of Periods to Maturity	8
Face Value	$2,000
Outputs	
Coupon Payment	$42

(3) Coupon Rate * Face Value / (Number of Payments/Year)
Enter =B27*B30/B28

(4) Periods 1 - 7 = Coupon Payment
Enter =B$33 and copy across

(5) Period 8 = Coupon Payment + Face Value
Enter =B33+B30

(6) Corresponding yield on the yield curve
Enter =D7 in C39, =D8 in D39, =D9 in F39, =D10 in H39, =D11 in J39
Enter =(D39+E39)/2 in E39, =(E39+F39)/2 in G39, =(G39+H39)/2 in I39

Bond Price and Yield To Maturity using a Timeline									
Period	0	1	2	3	4	5	6	7	8
Time (Years)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Cash Flows		$42.00	$42.00	$42.00	$42.00	$42.00	$42.00	$42.00	$2,042.00
Yield to Maturity (Annualized)		0.21%	0.35%	0.63%	0.92%	1.18%	1.43%	1.72%	2.00%
Discount Rate / Period		0.11%	0.17%	0.32%	0.46%	0.59%	0.71%	0.85%	1.00%
Present Value of Cash Flow		$41.96	$41.85	$41.60	$41.24	$40.79	$40.25	$39.57	$1,886.49
Coupon Bond Price	$2,173.76								
Coupon Bond Discount Rate / Period	0.97%								
Coupon Bond Yield to Maturity	1.94%								

(7) If Rate Convention = EAR,
Then ((1+Yield To Maturity)^(1 / Number of Payments / Year)) - 1
Else (Yield To Maturity) / (Number of Payments / Year)
Enter =IF($C$26=1,(1+C39)^(1/$B$28)-1,C39/$B$28)
and copy across

(8) (Cash Flow) / (1+Discount Rate / Period) ^ Periods
Enter =C33/(1+C42)^C$28 and copy across

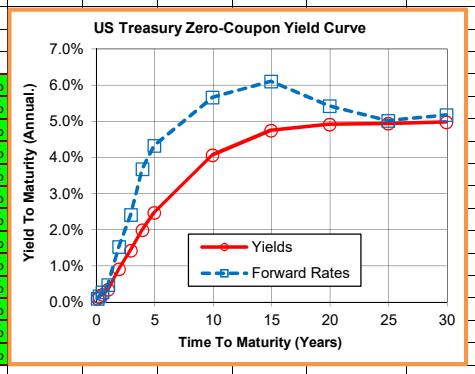
(9) Sum of all the Present Value of Cash Flows
Enter =SUM(C41:J41)

(10) RATE(Number of Periods to Maturity, Coupon Bond, -Bond Price, Par Value)
Enter =RATE(J28,J33,-B42,J30)

(11) If Rate Convention = EAR
Then (1+Discount Rate / Periods)^(Number of Payments / Year) - 1
Else (Discount Rate / Period) * (Number of Payments / Year)
Enter =IF($C$26=1,((1+B43)^(B28))-1,B43*B28)

THE YIELD CURVE — Obtaining and Using It

Yield Curve Inputs	Maturity Date	Time To Maturity	Yield To Maturity	Forward Rates
Today's Date	3/11/2010			
One Month Treasury Bill	4/15/2010	0.09	0.101%	0.01%
Three Month Treasury Bill	6/10/2010	0.25	0.147%	0.75%
Six Month Treasury Bill	9/9/2010	0.49	0.211%	0.75%
One Year Treasury Strip	3/10/2011	1.00	0.349%	0.85%
Two Year Treasury Strip	2/15/2012	1.93	0.920%	1.36%
Three Year Treasury Strip	2/15/2013	2.93	1.430%	2.20%
Four Year Treasury Strip	2/15/2014	3.93	2.000%	3.87%
Five Year Treasury Strip	2/15/2015	4.93	2.470%	4.37%
Ten Year Treasury Strip	2/15/2020	9.93	4.070%	5.71%
Fifteen Year Treasury Bond	2/15/2025	14.93	4.750%	5.13%
Twenty Year Treasury Bond	2/15/2030	19.93	4.920%	5.29%
Twenty Five Year Treasury Bond	2/15/2035	24.93	4.940%	5.20%
Thirty Year Treasury Bond	2/15/2040	29.93	4.980%	5.80%



(1) Maturity Date = Today's Date + Enter =YEARFRAC($B$4,B5) and copy down

(2) Forward Rate formula for time T

$$f_{T-t} = \left((1+y_T)^T / (1+y_t)^t\right)^{\frac{1}{(T-t)}} - 1$$

Enter =(((1+D5)^C5/(1+D4)^C4)^(1/(C5-C4)))-1 and copy down

Notation:
t = an earlier date
T = a later date
y_t = date t yield
y_T = date T yield
$f_{t,T}$ = forward rate from date t to date T

Bond Inputs	Annual Percentage Rate
Rate Convention	○ EAR ◉ APR
Annual Coupon Rate	4.2%
Number of Payments / Year	2
Number of Periods to Maturity	8
Face Value	$2,000
Outputs	
Coupon Payment	$42

(3) Coupon Rate * Face Value / (Number of Payments/Year)
Enter =B27*B30/B28

(4) Periods 1 - 7 = Coupon Payment
Enter =B$33 and copy across

(5) Period 8 = Coupon Payment + Face Value
Enter =B33+B30

(6) Corresponding yield on the yield curve
Enter =D7 in C39, =D8 in D39, =D9 in E39, =D10 in F39, =D11 in J39
Enter =(D9+D10)/2 in C39, =(D10+D11)/2 in D39, =(D10+D11)/2 in E39

Bond Price and Yield To Maturity using a Timeline									
Period	0	1	2	3	4	5	6	7	8
Time (Years)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Cash Flows		$42.00	$42.00	$42.00	$42.00	$42.00	$42.00	$42.00	$2,042.00
Yield to Maturity (Annualized)		0.21%	0.35%	0.63%	0.92%	1.18%	1.43%	1.72%	2.00%
Discount Rate / Period		0.11%	0.17%	0.32%	0.46%	0.59%	0.72%	0.86%	1.00%
Present Value of Cash Flow		$41.96	$41.85	$41.60	$41.24	$40.79	$40.24	$39.56	$1,885.75
Coupon Bond Price	$2,172.99								
Coupon Bond Discount Rate / Period	0.97%								
Coupon Bond Yield to Maturity	1.94%								

(7) If Rate Convention = EAR,
Then ((1+Yield To Maturity)^(1 / (Number of Payments / Year))) - 1
Else (Yield To Maturity) / (Number of Payments / Year)
Enter =IF($C$26="EAR",((1+C39)^(1/$B$28))-1,C39/$B$28)
and copy across

(8) (Cash Flow) / (1+Discount Rate / Period) ^ Periods
Enter =C33/((1+C42)^C$28) and copy across

(9) Sum of all the Present Value of Cash Flows
Enter =SUM(C41:J41)

(10) RATE(Number of Periods to Maturity, Coupon Bond, -Bond Price, Par Value)
Enter =RATE(B28,B30,-B43,B30)

(11) If Rate Convention = EAR
Then ((1+Discount Rate / Period)^(Number of Payments / Year)) - 1
Else (Discount Rate / Period) * (Number of Payments / Year)
Enter =IF($C$26="EAR",((1+B43)^(B28))-1,B43*B28)