Chapter 11
"An Analytical Approach to
Investments, Finance and Credit"

Secondary Debt Markets: Corporate Bonds

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Corporate Bonds

- In general, investing in bonds is safer than investing in stocks.
- The return is expected to be fixed assuming the investor holds the bonds until the contractual maturity, thus the risk is estimated to be lower than the equity's investment risk.
- What gets a little complicated with holding corporate bonds is that the market value of these bonds could fluctuate due to many factors such as
  - interest rates
  - credit risk
  - market liquidity
  - refinancing

Raising / Issuing Corporate Bonds

The companies issuing bonds in the public markets are required by the Securities and Exchange Commission (SEC) to be independently rated by at least two rating agencies before they are issued Secured Bonds

CORPORATE BOND RATING AGENCIES' SCALES

Description		Standard & Poor's	Moody's	Fitch
Highest Quality (Risk Free)	INVESTMENT GRADE	AAA	Aaa	AAA
High Quality	INVESTMENT GRADE	AA+ AA AA-	Aa1 Aa2 Aa3	AA+ AA AA-
Strong Payment Capacity	INVESTMENT GRADE	A+ A A-	A1 A2 A3	A+ A A-
Adequate Payment Capacity	INVESTMENT GRADE	BBB+ BBB BBB-	Baa1 Baa2 Baa3	BBB+ BBB BBB-
Likely to fullfill Obligations	NON-INVESTMENT GRADE (HIGH YEILD)	BB+ BB BB-	Ba1 Ba2 Ba3	BB+ BB BB-
High-risk Obligations	NON-INVESTMENT GRADE (HIGH YEILD)	B+ B B-	B1 B2 B3	B+ B B-
Current Vulnarable to Default	DISTRESS	CCC+ CCC CCC- CC C	Caa	CCC
Default	**DEFAULT**	D	D	DDD,DD,D

Figure 7.2

Secondary Bond Markets: An Overview

- The secondary market for publicly traded bonds takes place in over-the-counter transactions.
- Bonds need to register with the SEC and report all secondary trading activities in a centralized reporting platform called TRACE (trade reporting and compliance engine).
- The bonds are rated, as required by the SEC, by two independent rating agencies before they are issued. As a precaution, they continue to be monitored for upgrades or downgrades. The rating that is assigned to the bond security is an estimation on the probability of default.
- Bonds are basically traded in two separate markets: investment grade and non-investment grade (high yield).

Corporate Bond Money Terms Revisited

- Amount (Book Value Vs Market Value and other prices)
- Interest Rate (Coupon Rate Vs Yield)
- Maturity (Term of the bonds in years)
- Payment (Coupon Payments and Redemption Price)

1. AMOUNT

Bond Value / Prices Concepts

- **Face value (par value) – $1,000 or 100% of $1,000**
- **Market value/market price (clean price) – Trading at Discount, Premium, Par**
- **Invoice Price (Dirty Price)**
- **Redemption Price**
- **Call Price**
- **Original Issued Discount**

Market Value

- Secondary pricing starts on the day of issuance until the bonds are refinanced. When they say that the market price of a bond is trading at either a discount, at par, or at a premium, it indicates the bond can be bought below a percentage of $1,000, at $1,000, or above $1,000 per bond, respectively.
- For example, a bond that is trading at 98 means that you can trade it in the secondary market at 98% of a $1,000 or $980. This bond is considered to be trading at a discount. If a bond is trading at 103, then the secondary market value is 103% of $1,000, or $1,030 market price.
- FORMULA: $\mathrm{MV} = \sum_{1}^{n} \frac{\mathrm{CP}}{(1+\mathrm{YTM})^{n}} + \frac{\$1{,}000}{(1+\mathrm{YTM})^{n}}$ and MV/10 = MP

- **EXAMPLE:**
  - A 10-year Corporate Bond with a 4.5% annual coupon paid every six months (semi-annual) is yielding 4.74%. Find the Market Value of each bond. Also find the market price (% of Par)

$$\mathrm{MV} = \sum_{1}^{10} \frac{21.25}{(1+0.0474/2)^{10}} + \frac{\$1{,}000}{(1+.0474)^{10}} = 170.42 + 807.99 = 978.41$$

$$\mathrm{MP} = \frac{978.41}{10} = 97.841$$

Market Value/Price

EXAMPLE USING EXCEL:

A 10-year Corporate Bond with a 4.5% annual coupon paid every six months (semi-annual) is yielding 4.74%. Find the Market Value of each bond. Also find the market price (% of Par)

	B	C	D	E	F	G	H	I	J	H
2	**MARKET PRICE**									
3	**USING EXCEL FORMULAS**				**USING PRESENT VALUE CALCULATIONS**					
4										
5	Face Value =		1,000		**# Pmts**	**Coupon Dates**	**Coupon Payment (CP)**	**Present Value of (CP)**		
6	Settlement Date=		1/15/2019		0	1/15/2019			=+$D$8/2*$D$5	
7	Maturity Date=		1/15/2024		1	7/15/2019	21.25	20.76	=+H7/((1+$D$9/2)^F7)	
8	Coupon Rate=		4.250%		2	1/15/2020	21.25	20.28	or =PV($D$9/2,F7,0,H7)	
9	**Yield to Maturity=**		**4.740%**		3	7/15/2020	21.25	19.81		
10	Redemption value %=		100		4	1/15/2021	21.25	19.35		
11	Frequency (Coupon Pmts per year)=		2		5	7/15/2021	21.25	18.90		
12					6	1/15/2022	21.25	18.46		
13	**Market Price (% Par)**		**97.841**		7	7/15/2022	21.25	18.04		
14					8	1/15/2023	21.25	17.62		
15			=PRICE(D5,D6,D7,D8,D9,D10)		9	7/15/2023	21.25	17.21		
16			=PRICE(SD,MD,CR,YTM,R,F)		**10**	**1/15/2024**	**1,021.25**	**807.99**		
17										
18			**=+$D$8/2*$D$5+$D$5**				Market Value =	978.41	=SUM(I7:I16)	
19							**Market Price =**	**97.841**	=+I18/10	
20										

Figure 11.2

Reasons bond prices move up or down in the secondary market

- **Change of risk-free rate**
- **Rating downgrade/upgrade**
- **Refinancing**

Invoice Price

- **The invoice price or "dirty price" is the total price of the bond including the market price and accrued interest.**
- This is the amount that you would pay or receive if you purchase or sell the bond.
- Corporate bonds (and municipal bonds) are based on a 360-day year when calculating the accrued interest. In other words, every month has 30 days (day-count basis)—even February has 30 days when calculating the accrued interest
- The "regular way trade" (per SEC definition) is T+3 business days (trade day + 3 days) to calculate the settlement day
- <u>The invoice price is</u>

IP = MV+ Accrued interest

Where,

Accrued Interest = Semiannual CP x Days since last CP / 180 days

Invoice Price Example

- Market Price / Market value= 98.50 / $985.00.
- Coupon Rate = 7.5% or $75 per year coupon ($37.50 semi-annual payment)
- Coupon Dates = February 28, August 31
- Trade Day = Thursday, January 17
- Settlement Day (T+ 3 business Days): Tuesday, January 22
- Days since the last coupon payment is calculated at 142 days

  30 days in September + 30 days is October +30 days in November +30 days in December +
  17 days in January through the trade days +5 days = 142 Days
- 142/180 x $37.50 = $29.50.
- The invoice price is calculated $1,042.58, calculated as $985.00 + $29.50 = $1,014.58.

Invoice Price Example

MARKET PRICE / INVOICE PRICE

Manual Example:

Bought (Traded) F&A the 7.50% Corporate Bond at 98.50 on Thursday, January 17, 2019

INPUT

Trading Date	Thursday, January 17, 2019
Settlement Date (T+3 Business Days)	Tuesday, January 22, 2019
Market Price	98.50
Coupon Rate	7.500%
Coupon Dates	F&A (Feb 28 and Aug 31)
Semi-Annual Coupon Payment	$37.50
Face Value	$1,000
Accrued Basis	360 Days

=+M11+M14

OUTPUT

Market Price Paid	$985.00	$98.50 x 10
Accrued Expenses	$29.58	37.50 x (142 / 180) = $29.58
Invoice Price	$1,014.58	

Total Days	**142**

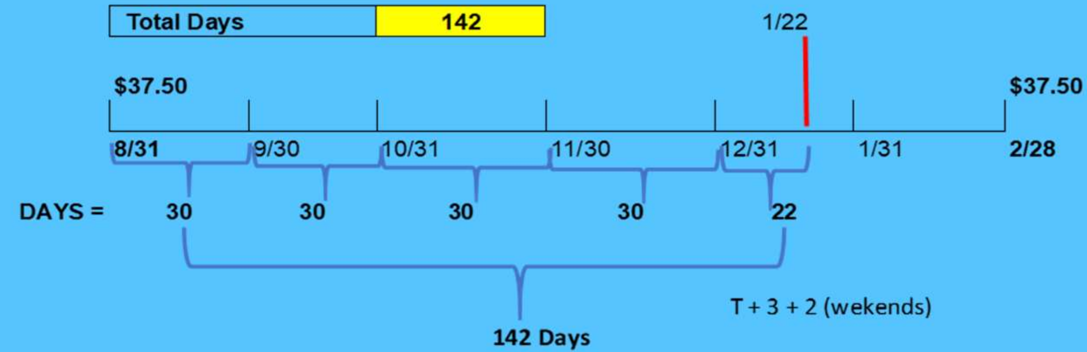

Figure 11.3

Example Practice – Calculating MV (Clean) and IP (Dirty)

Coupon Rate= 8.0%
Market Price = 96.50
Coupon Days = Mar 31, Sep 30
Trading Day = Tuesday, June 16
Accrued Basis = 360 days (Corp. Bond)

Market Value $ Per Bond =
Invoice Price $ =

First, need to find Settlement Day =
Second, need to find days since Last Coupon=
Third, need to calculate the accrued Interest=

Market Value and Invoice Price using Excel (given the yield)

	B	C	D	E	F
2	**MARKET PRICE & INVOICE PRICE CALCULATION**				
3					
4	CALCULATING THE PRICE				
5	Settlement Date=		3/15/2015		
6	Maturity Date=		1/15/2025		
7	Coupon Rate=		4.250%		
8	**Yield to Maturity=**		**4.740%**		
9	Redemption value %=		100		
10	Coupon Pmts per year=		2		
11					
12	**Market Price =**		**96.179**		=PRICE(D5,D6,D7,D8,D9,D10
13					
14	**Market Value =**		**$ 961.79**		=+D12*10
15					
16	Day since last coupon=		60		=COUPDAYBS(D5,D6,D10,0)
17	Days in coupon period=		180		=COUPDAYS(D5,D6,D10,0)
18	Accrued Interest=		$ 7.08		=(D16/D17)*D7*1000/2
19					
20	**Invoice Price=**		**$ 968.87**		=+D18+D14
21					

Figure 11.4

2. INTEREST RATE

Bond Interest % and Yields % Concepts

- Nominal yield (coupon rate)
- Accrued interest
- Yield to maturity (YTM)
- Yield to call (YTC)
- Yield to worst (YTW)
- Current yield (CY)

Calculating Yield to Maturity (using Formulas)

$$\frac{\text{Annual coupon or interest payment} \pm [\frac{\text{Discount or premium}}{\text{Years to maturity}}]}{\text{Average price of bonds}}$$

For example, assuming a 7-year Bond with a Coupon Rate of 4.25% that is trading at 96.179 and a redemption price a 100.

The annual coupon payment is $42.50 (4.25% x $1000); the discount is $38.21 (1,000 – 961.79); at 7 years until maturity with current price of the bonds is between $1,000 and $961.79 since issuance. Then, the rule of thumb yield to maturity is calculated as follows:

$$\frac{42.50 + [\frac{38.21}{7}]}{(961.79 + 1{,}000)/2} = \frac{42.50 + 5.46}{980.90} = 0.04889 = 4.9\%$$

Calculating Yield to Maturity (using Excel)

	B	C	D	E	F	G	H	I
2								
3	**Yield to Maturity Calculation**							
4								
5	**CALCULATING THE YTM**					**# pmts**	**Remaining Dates**	**Cash Flow**
6	Settlement Date (SD) =		**1/15/2018**					
7	Maturity Date (MD) =		1/15/2025			0		(961.79)
8	Coupon Rate (CR) =		4.250%			1	7/15/2018	21.25
9	**Market Price (MP) =**		**96.179**			2	1/15/2019	21.25
10	Redemption value % (R) =		100			3	7/15/2019	21.25
11	Coupon Pmts per year (Frequency (F) =		2			4	1/15/2020	21.25
12						5	7/15/2020	21.25
13	**Yield to Maturity (YTM) =**		**4.902%**	**=YIELD(D6,D7,D8,D9,D10,D11)**		6	1/15/2021	21.25
14				**= YIELD (SD,MD,CR,MP,R,F)**		7	7/15/2021	21.25
15						8	1/15/2022	21.25
16						9	7/15/2022	21.25
17						10	1/15/2023	21.25
18						11	7/15/2023	21.25
19						12	1/15/2024	21.25
20						13	7/15/2024	21.25
21						14	1/15/2025	1,021.25
22								
23							**IRR =**	**4.902%**
24								**=IRR(I7:I21)*2**

Figure 11.5

Calculating Yield to Call (YTC) and Yield to Worse (YTW)

	B	C	D	E	F	G	H	I	J	K	L
2	YIELD TO MAURITY (YTM), YIELD TO CALL (YTC), YIELD TO WORSE (YTW) and CURRENT YIELD (CY)										
3	EXCEL FORMULAS										
4				YTM			YTC1	YTC2	YTC3	YTC4	YTC5
5	Issuance Date =			1/16/2017			1/16/2017	1/16/2017	1/16/2017	1/16/2017	1/16/2017
6	Trading Date =			Wednesday, July 11, 2018			7/11/2018	7/11/2018	7/11/2018	7/11/2018	7/11/2018
7											
8	Settlement Date (T+3) (SD)			Monday, July 16, 2018			7/16/2018	7/16/2018	7/16/2018	7/16/2018	7/16/2018
9	Maturity Date / Call Date (MD)			1/16/2027			1/16/2018	1/16/2019	1/16/2020	1/16/2021	1/16/2022
10	Coupon Rate (CR)			8.00%			8.00%	8.00%	8.00%	8.00%	8.00%
11	Market Price (MP)			98.50			98.50	98.50	98.50	98.50	98.50
12	Redemption (Final payment % of Par) (R)			100.00			105.00	104.00	103.00	102.00	101.00
13	Frequency (payments per year) (F)			2			2	2	2	2	2
14											
15	Call Provision						105.00	104.00	103.00	102.00	101.00
16											
17			YTM=	8.249%		YTC=	NA	19.289%	11.006%	9.415%	8.757%
18											
19			YTW=	8.249%		CY=	8.1218%				
20									=YIELD(J9,J9,J11,J12,J13)		
21	Face Value			$1,000					=YIELD(SD,MD,CR,MP,R,F)		
22	Coupon Payment $			$40	=+E10*E21/2						
23	Years (Term)			10	Years						
24											
25	INTERNAL RATE OR RETURN METHOD										
26											
27		# Pmts	Coupon Dates	YTM			YTC1	YTC2	YTC3	YTC4	YTC5
28				(985.00)				(985.00)	(985.00)	(985.00)	(985.00)
29		1	1/16/2019	40.00				1,080.00	40.00	40.00	40.00
30		2	7/16/2019	40.00					40.00	40.00	40.00
31		3	1/16/2020	40.00					1,070.00	40.00	40.00
32		4	7/16/2020	40.00						40.00	40.00
33		5	1/16/2021	40.00						40.00	40.00
34		6	7/16/2021	40.00						1,060.00	40.00
35		7	1/16/2022	40.00							40.00
36		8	7/16/2022	40.00			=+$E$10/$E$13*$E$21+K12*10				1,050.00
37		9	1/16/2023	40.00							
38		10	7/16/2023	40.00				Payment $40			
39		11	1/16/2024	40.00				Redemption $1020			
40		12	7/16/2024	40.00							
41		13	1/16/2025	40.00							
42		14	7/16/2025	40.00							
43		15	1/16/2026	40.00							
44		16	7/16/2026	40.00							
45		17	1/16/2027	1,040.00							
46	IRR =			8.249%			N/A	19.289%	11.006%	9.177%	8.666%
47				=IRR(E28:E45)*2				=IRR(I28:I45)*2			

Figure 11.6

Calculating Current Yield (Quick & Dirty)

Current yield (CY): This measures a quick annual rate of return for the investor who is planning to buy the bond in the secondary market.

$$\text{Current bond yield} = \frac{\text{Annual coupon or interest payment}}{\text{Market price}}$$

Example: A \$1,000 bond that is selling for \$985 and paying an 8% coupon rate. The current yield is calculated as follows:

$$\text{Current bond yield} = \frac{\$80.00}{\$985.00} = 0.08122 = 8.122\%$$

3. Maturities/Time

Bond Dates and General Timing Concepts

- Issuance date
- Maturity date
- Coupon dates
- Call dates
- Trading day
- Settlement day (T+3)
- Day-count basis

4. Bond Payments

Bond Payment Concepts

- **Coupon payments**
- **Frequency of payments**
- **Principal payments**
  - **Term bond**, the most popular, refers to the bond that pays all its principal amount at maturity. For example, for a 5-year bond the principal payments for years 1–5 are 0, 0, 0, 0, 1000.
  - **Serial bond** refers to the bond that pays all its principal amount equally across maturity. For example, for a 5-year bond the principal payments for years 1–5 are 200, 200, 200, 200, 200.
  - **Bullet bond** refers to the bond that pays a partial amount of the principal upfront and the balance at maturity. For example, for a 5-year bond the principal payments for years 1–5 are 50, 50, 50, 50, 800.

Bond Investment Valuation

Bond Investment Valuation Concepts

Bond analysis lives by the fundamental concept that the value of the bonds in the secondary market go up and down based on the return expectation for the investor looking to buy these bonds.

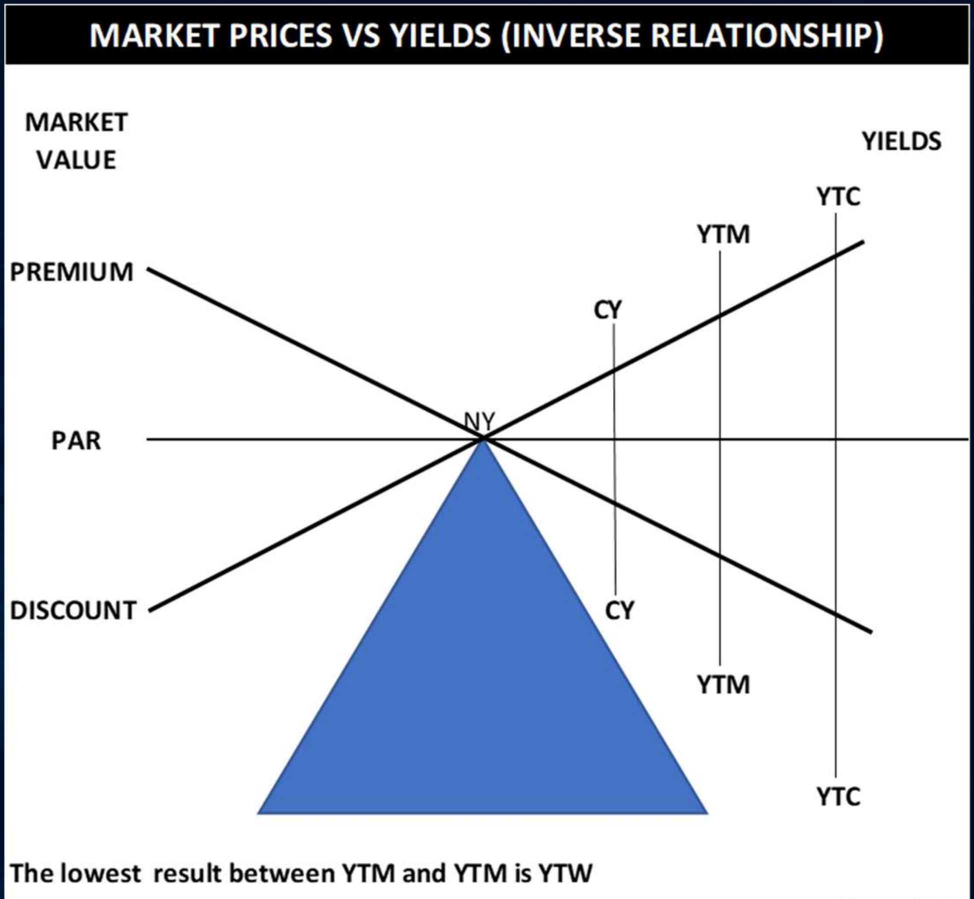

Figure 11.7

Bond Price

$$\mathrm{MV} = \sum_{1}^{\mathrm{n}} \frac{\mathrm{CP}}{(1+\mathrm{YTM})^{\mathrm{n}}} + \frac{\$1{,}000}{(1+\mathrm{YTM})^{\mathrm{n}}} \text{ and } \mathrm{MP} = \frac{\mathrm{MV}}{10}$$

Duration (D)

This is a measurement the price sensitivity of the bond and/or bond funds to changes with interest rates. They are two types of duration measurement

- ***Macaulay Duration*** (expressed in years): identifies how many years it will take to recover the initial investment (market value) by calculating the weighted average of each present value of future coupon payments using the yield as a discount rate times the payment year

$$\mathrm{Dm} = \frac{\sum_{1}^{n} \frac{\mathbf{CF}}{(\mathbf{1+y})^{\mathbf{t}}} . \mathbf{t}}{\mathbf{MV}}$$

- ***Modified Duration***: (expressed in percentages): Measures the average percentage of movement of the bond price for every 1% movement of the interest rate. For example, the price of a bond with a duration of 5 would be expected to move 5% for every 1% move in interest rates.

$$\text{Modified D} = \frac{\mathrm{Dm}}{1 + \frac{\mathrm{y}}{\mathrm{n}}}$$

Convexity (C)

Like the modified duration, convexity is a further measurement of the relationship between the value of the bond and a movement of interest rates. It also measures the sensitivity of the bond price to 1% movement of the interest rates, but it's calculated on non-linear relationships. Duration can be a good measure of how bond prices may be affected due to sudden fluctuations in interest rates. Nevertheless, the relationship between bond prices and yields has more of a sloped or convex relationship. It is represented as a derivative to the duration.

The formula for calculating the convexity is as follows:

$$\mathrm{Convexity} = \frac{\frac{1}{(1+y)^2}\sum_1^n \frac{CF}{(1+y)^t}\left(t^2 - t\right)}{MV\,.\,f^2}$$

- Where y is the periodic yield, t is the time period, CF is the cash flow payment or the coupon payment, n is the number is periods, and f is the frequency of payments per year.

Calculating Price, Duration and Convexity

1	B	C	D	E	F	G	H	I	J	K	L
2	**BOND PRICE, DURATION & CONVEXITY**										
3	**Sensitivity to interest rate movements**										
4											
5	Face Value	1,000									
6	Coupon Rate	8.00%									
7	Life in Years	5									
8	Yield	10.00%									
9	Frequency	2									
10	**Bond Price**	$922.78	=-PV(E9/E10,E8*E10,E7*E6/E10,E6)								
11											
12	**Macaulay Duration**	4.18									
13											
14	Modified Duration	4.1%	=+E13/(1+E9/E8)/100								
15											
16	**Convexity**	17.83	1.93%	=+E17/E11							
17											
18	**Period**	**Cash Flow**	**PV Cash Flow**			**Weighted**	**Duration Calc**		**Factor years**	**Convexity Calc**	
19	0	($922.78)									
20	1	40.00	38.10	=+C21/(1+($E$9/2))^B21		4.128%	0.04128	=+F21*B21	2.000	76.19	=+I21*D21
21	2	40.00	36.28			3.932%	0.07863		6.000	217.69	
22	3	40.00	34.55			3.744%	0.11233	=+B21+B21^2	12.000	414.64	
23	4	40.00	32.91			3.566%	0.14265		20.000	658.16	
24	5	40.00	31.34			3.396%	0.16982		30.000	940.23	
25	6	40.00	29.85			3.235%	0.19408		42.000	1,253.64	
26	7	40.00	28.43			3.081%	0.21564		56.000	1,591.93	
27	8	40.00	27.07			2.934%	0.23471		72.000	1,949.30	
28	9	40.00	25.78			2.794%	0.25148		90.000	2,320.59	
29	10	1,040.00	638.47			69.190%	6.91896		110.000	70,231.68	
30						100.000%	8.35959	=SUM(G21:G30)		79,654.05	=SUM(J20:J30)
31											
32		PRICE	922.78	=SUM(D20:D30)		DURATION	4.18	=+G31/2	CONVEXITY	17.83	=+((J31/((1+E9)^2))/(D33*E10^2))
33											

Figure 11.8