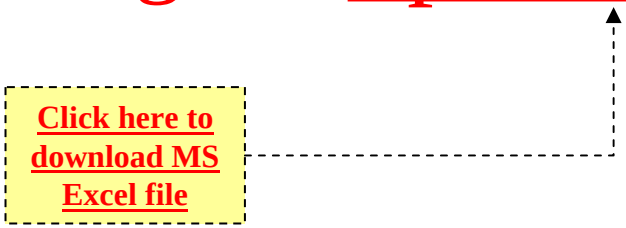
Generating the Capital Structure Curve of a Corporate Firm

Instructions for Using the Spreadsheet



Contents

Objectives

- To demonstrate the use of an effective, interactive and user-friendly Excel-based spreadsheet, with
  - the firm's financial statement as input and
  - the firm's capital structure as output
- To determine and locate the optimal capital structure of a corporate firm subject to various scenarios.

Background Information

- This is an extended version of the *MS Excel*-based spreadsheet that was used to generate the graphs in the original paper. The difference between this and the former lies in the underlying credit-rating model. While the earlier version employed only one S&P-type ratio, this incorporates 3. Refer to Page 11 of this document for more detail.

- We shall avoid any thorough description of the process here, as it is identical to the one described in the paper. It is, therefore, recommended that the user refer to the paper for details on how the process works. Never the less, an Appendix has been added to the end of this document, which briefly discusses the contents of the different pages.

Important Note Before You Begin…

(if you're using the *Microsoft* platform*)

Prior to inserting any numbers into the spreadsheet, go to

Tools>Options>Calculation

and set it up on

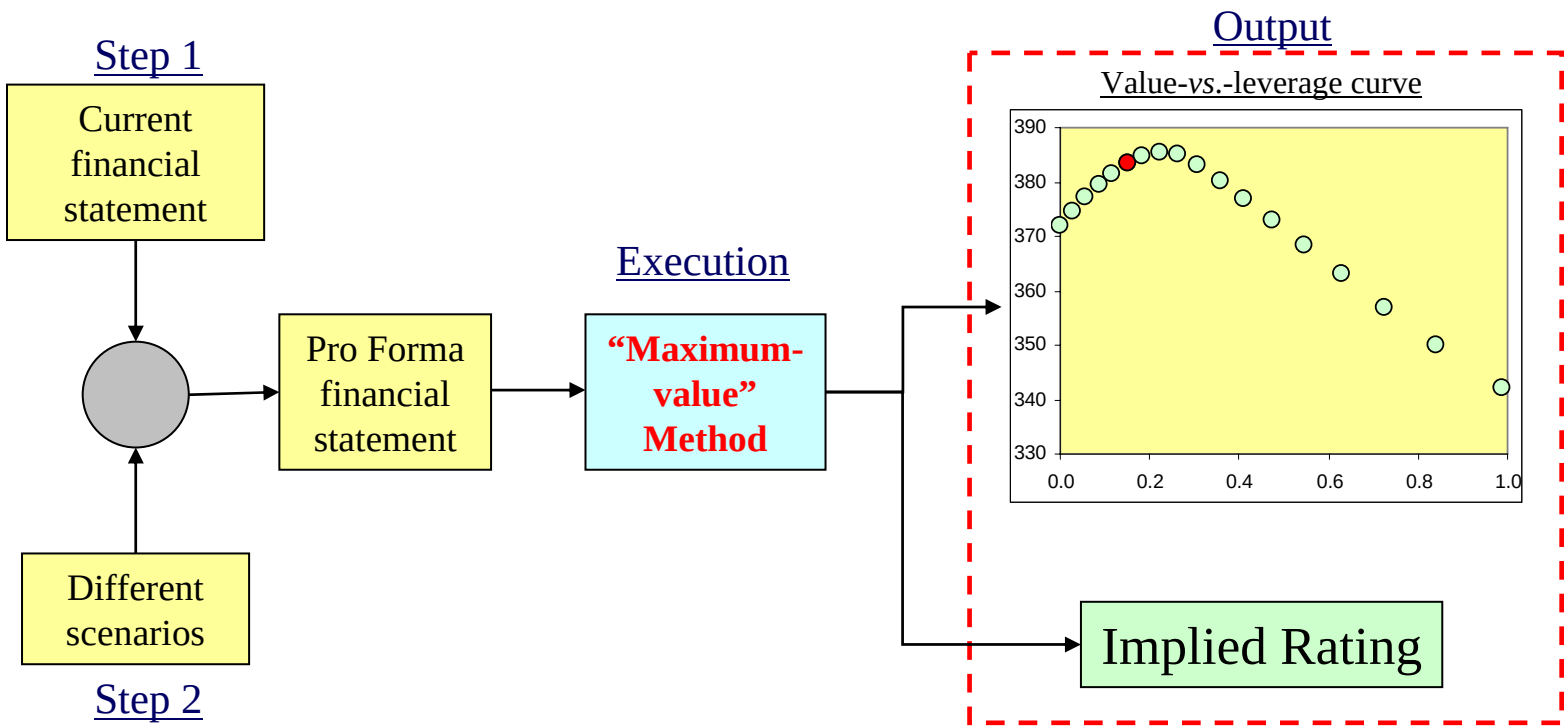
"manual" and "iteration"

(See Appendix 3 for details)

* ***NOTE***: Apple Mac computers will require a different procedure for manual calculations.

General Procedure in 2 Steps

- Step 1 - Input the current/available financial statement.
- Step 2 - Select scenarios leading to the pro forma statement
- The “Maximum Value” method is then automatically executed to generate the firm’s capital structure curve, as well as its implied rating.



General Procedure – Step 1

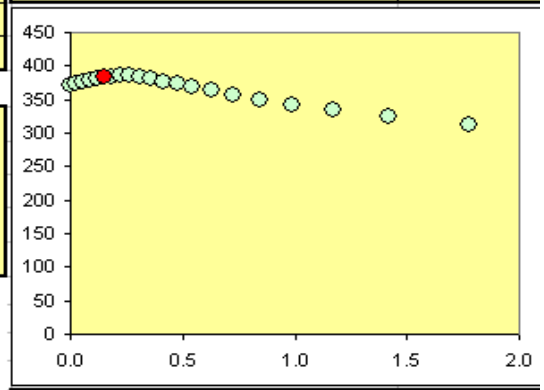
Go to *Page 1* of this file for additional information and to download instructions.

Company name	ABC
TABLE I	
Income Statement	
EBITDA	35.0
D&A	-5.0
EBIT	***30.0***
Other income	2.0
Gross interest expense	-3.0
EBT	***29.0***
Tax	***-8.7***
Net profits	***20.3***
Balance Sheet	
Assets	***383.3***
IB debt	50.0
Book equity	150.0
Market equity	***333.3***
Total liab. & market equity	***383.3***

TABLE II	
Input/Output Parameters	
Effective tax rate	30%
Book-to-Market Equity	0.45
Pre-tax cost of debt	***6.00%***
Implied spread	***0.56%***
Implied risk-free rate	***5.44%***
Implied rating	***A+***
V = D+E	***383.3***
V* = D*+E	***388.5***
Vu*=(1-T)D*+E	***371.9***

Insert relevant data in unprotected (white) cells and then press <F9> to calculate. *NOTE: Apple Mac computers require different procedure for manual calculations.*

TABLE III	
Ratios	
EBIT Interest cover (R1)	***10.67***
D/EBITDA (R5)	***1.43***
D/(D+Ebook) (R8)	***0.25***
D/Emarket	***0.15***
EV/EBITDA	***11.0***
ROE	***6.09%***
WACC	***5.48%***



The scales in the above graph could be adjusted for better resolution

Step 1 - Input the current/available financial statement on tab titled "**current PL, BS and VL**" in the spreadsheet. Values are to be inserted in unprotected cells only.

When all relevant data have been inserted in the appropriate cells, press **<F9>** to perform the calculation. ***NOTE***: Apple Mac computers require a different procedure for manual calculations.

General Procedure – Step 2

Company name	ABC
TABLE I	
Income Statement	
Operating EBITDA	*35.0*
D&A	*-5.0*
EBIT	*30.0*
Other income	*2.0*
Gross interest expense	*-3.0*
EBT	*29.0*
Tax	*-8.7*
Net profits	*20.3*
Balance Sheet	
Assets	*383.3*
Market equity	*333.3*
IB debt	*50.0*
Total liab. & equity	*383.3*

TABLE II	
Input/Output Parameters	
Effective tax rate	*30%*
Pre-tax cost of debt	*6.00%*
Implied spread	*0.56%*
Implied risk-free rate	*5.44%*
Implied rating	*A+*
V = D+E	*383.3*
V* = D*+E	*388.5*
Vu*=(1-T)D*+E	*371.9*

Table III	
Additional equity	0
Additonal debt	0
Total additional assets	***0***
% Impact on EBIT	***0%***

In accordance with *M&M*, the impact on *EBIT* and Other Income is assumed to be proportional to the % change in operating capital, *Vu**

Step 2 - Input scenarios in tab titled "**pro forma PL, BS and VL**" in the spreadsheet. Values must be inserted in unprotected cells only.

Note that any change in additional debt or equity will automatically adjust the interest expense, which is connected to the credit rating and spread.

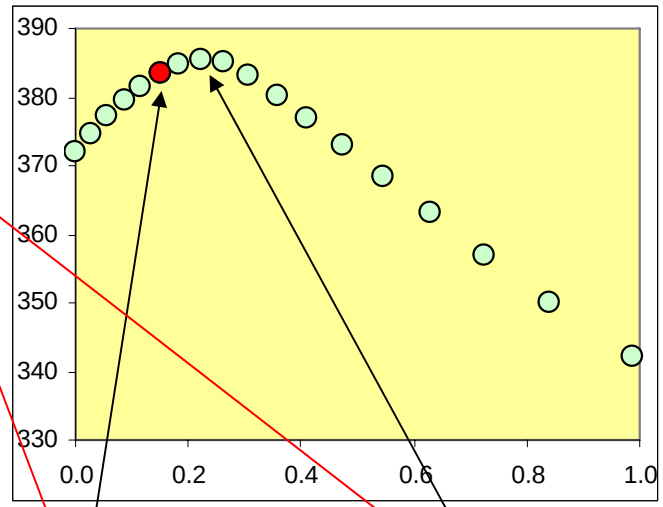
When all relevant data have been inserted in the appropriate cells, press **<F9>** to perform the calculation.

NOTE: Apple Macs require a different procedure for manual calculations.

General Procedure – Output

D	D/E	V	Implied Rating
0.0	0.00	371.9	AAA
10.0	0.03	374.6	AAA
20.0	0.06	377.3	AAA-
30.0	0.09	379.5	AA
40.0	0.12	381.5	AA-
50.0	0.15	383.3	A+
60.0	0.18	384.7	A
70.0	0.22	385.4	A-
80.0	0.26	385.0	BBB+
90.0	0.31	383.2	BBB
100.0	0.36	380.2	BBB-
110.0	0.41	376.9	BB+
120.0	0.47	373.0	BB
130.0	0.55	368.3	BB
140.0	0.63	363.0	BB-
150.0	0.72	356.9	BB-
160.0	0.84	350.0	B+
170.0	0.99	342.3	B+
180.0	1.17	333.5	B
190.0	1.42	323.6	B
200.0	1.78	312.7	B
210.0	2.32	300.5	B-
220.0	3.28	287.1	B-
230.0	5.40	272.6	B-

The "Maximum Value" method is then automatically executed, leading to the firm's capital structure and portraying the optimal as a maximum in the value-*vs*-leverage curve.



Current point

Optimal point in the value-*vs*-leverage curve

The "Maximum Value" Method

- The "Maximum Value" (*MV*) method is based on the Modigliani-Miller capital structuring theorems.
- It is derived in "An Analytical Process for Generating the *WACC* Curve and Locating the Optimal Capital Structure".
- The notion is that with rising leverage, the combined impacts of the interest tax shield and rising cost of debt leads to a maximum in the firm's value or minimum in the *WACC*.

Click on title to download paper

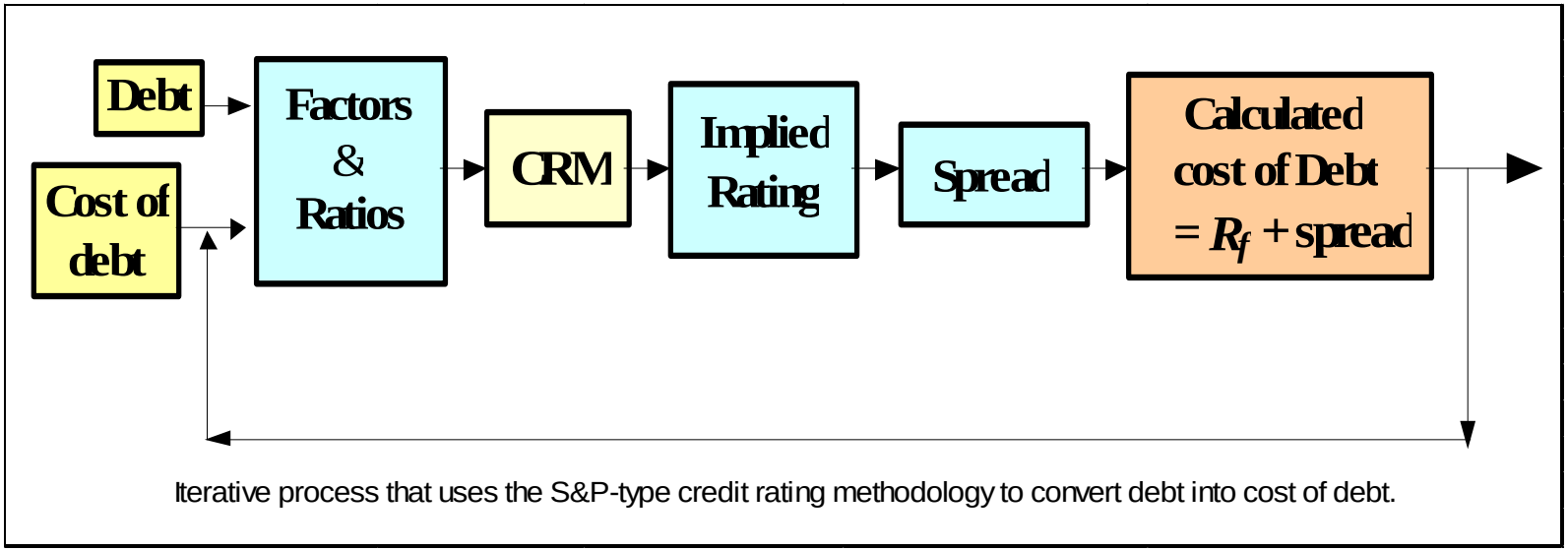
The Credit Rating Model*

- To work, the *MV* method requires a credit rating model (*CRM*).
- The underlying *CRM* is, in this case, a *simplified* version of the S&P methodology.
- The general S&P process incorporates 8 or 9 ratios, which may be grouped into three categories, namely:
  - *Profitability* (interest-coverage) ratios,
  - *Liquidity* (cash-flow) ratios and
  - *Leverage* ratios
- Each ratio is first calculated and the rating "specific" to it is then obtained. Finally, all "specific" ratings are weighted averaged to get an overall "implied credit rating"
- The *simplified* version of the S&P method is based on selecting one principle ratio from each category and following the process above.

* This spreadsheet is based on a *CRM* that runs on 3 ratios. The original version of the spreadsheet, in contrast, employed only one S&P ratio, namely the interest cover.

Procedure for Obtaining the Implied Rating, Spread & Cost of Debt

Incorporation of the *CRM* within the *MV* approach involves an iterative procedure. The procedure, upon convergence, leads to the "implied credit rating", as well as the effective cost of debt.



Iterative process that uses the S&P-type credit rating methodology to convert debt into cost of debt.

Sample Case Studies

Click on the link below to download a couple of example case studies:

http://rdcohen.50megs.com/Case_Studies.htm

Appendix

1. Description of the Different Tabs Contained in the *MS* Excel File
2. Updating Links
3. Troubleshooting: Regarding Error Message on "Circular Reference"
4. Troubleshooting: Debt Input Being Too High
    a. Regarding Error Message on Page 2 of the Excel file
    b. Regarding Error Message on Page 3 of the Excel file

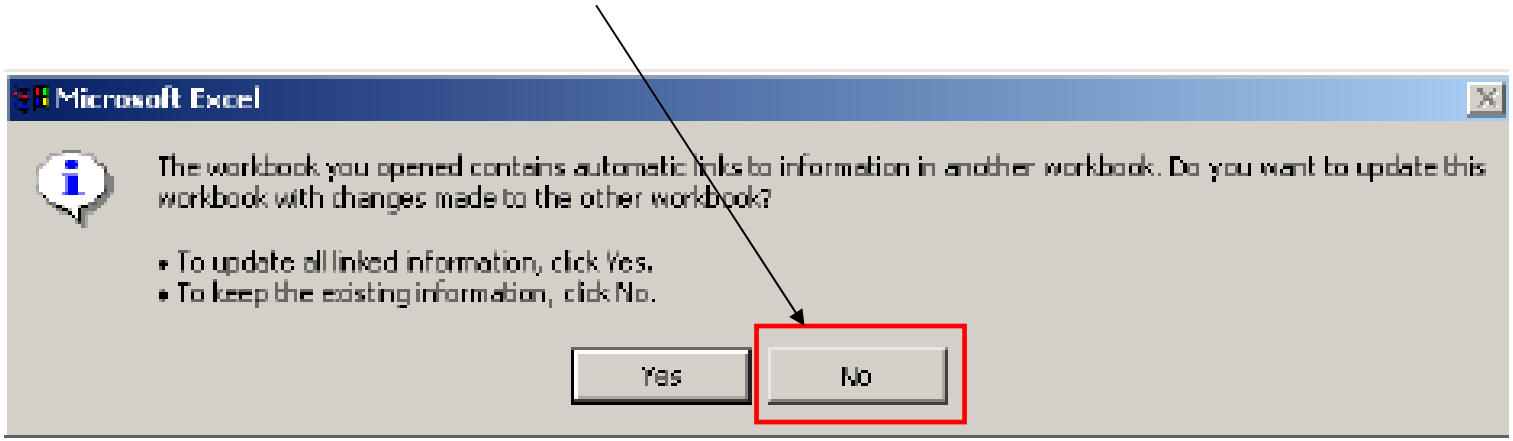
1. Description of the Different Tabs Contained in the *MS* Excel File

The file contains 10 tabs in total, which are described below:

- Tabs 1&2, titled "Instructions and info", "current PL, BS and VL", respectively, contain some instructions and cells for data input.
- Tabs 3&4, titled "pro forma PL, BS and VL" and "Value curve", respectively, contain some more cells for data input, as well as the output, in the forms of table & graph, displaying the firm's value *vs* leverage.
- Tab 5, titled "S&P cutoffs", contains the three S&P-type ratios used here for calculation purposes, as discussed on Page 9 of this document. These are Ratios 1, 5 and 8, belonging to the categories of **interest cover**, **cash flow [i.e. Debt/EBITDA]** and **leverage [i.e. D/(D+E)]**, respectively. Note that the leverage ratio is in book value of equity.
- Tab 5 also contains numerical ratings, which are integer numbers matching the S&P ratings – i.e. AAA = 19, AAA- = 18, etc., down to CCC = 1. This page also contains the credit spreads assigned to each of the ratings.
- Tabs 6a-c of the spreadsheet contain the curve fits for the Ratings vs Ratios 1, 5 and 8, all obtained from the "S&P cutoffs" table in Tab 5. The curve-fit equations are subsequently used in Tab 7 of this spreadsheet to determine the firm's value at every level of debt.
- Tab 6d, which is titled "Spread-rating Chart", displays the curve fit for the credit spread *vs* rating. The numbers are pulled out of the "S&P cutoffs" page of the spreadsheet.
- Finally, Tab 7 of the spreadsheet, titled "Calculations Table", is where all the calculations take place. It must be emphasised again that the approach is identical to the one explained in the paper (see Table 3 in "Analytical Process..."), as well as in the original spreadsheet, except that 3 ratios are implemented instead of one.

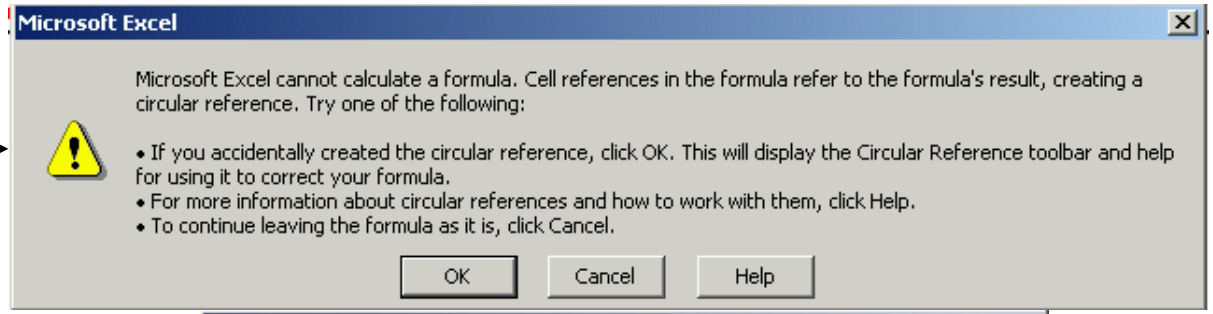
2. Updating Links

If upon opening the Excel file you get the following message to update links, click on **No**.



3. Regarding Error Message on “Circular Reference”

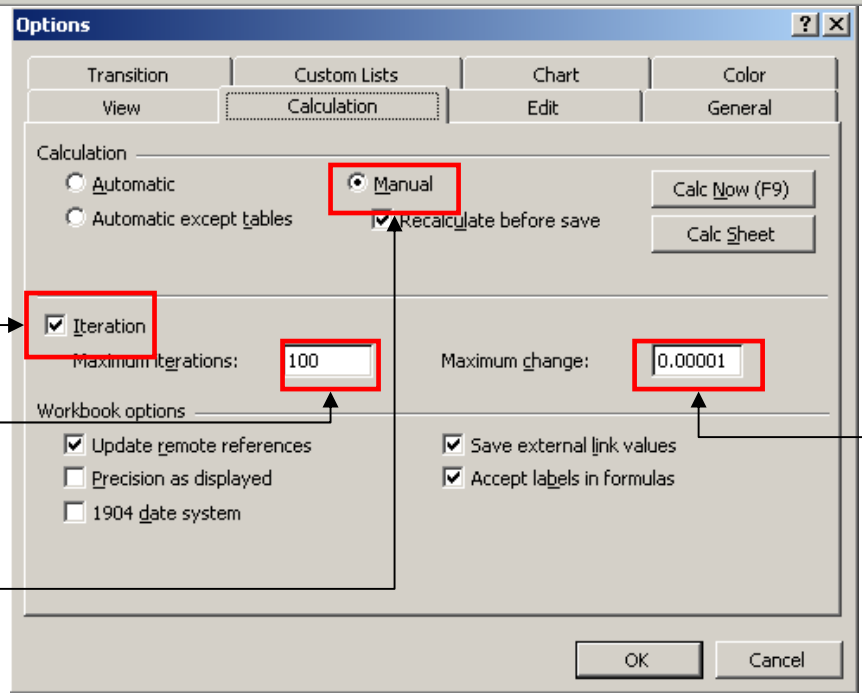
If, upon opening the Excel spreadsheet, the following error message on “circular reference” pops up:



1. Click on **OK.**
2. Go to **Menu>Tools>Options.**
3. In the “**Calculation**” bar click on the “**Iteration**” box, making sure it is checked.
4. Click on **OK**.

Insert “**100**” here.

Make sure also that you set this on “**Manual**”.



Set “**Maximum change**” at 0.00001.

4a. Regarding Error Message in Tab 2 Related to Debt Input Being Too High

In instances where the IB debt level input in either Cell B17 in tab 2 or Cell J4 in tab 3 is too high, the feedback procedure outlined on Page 11 of this document may not converge or it may converge to a different solution due to non-uniqueness. In this case, the following error message will pop up:

If this happens, simply exit the spreadsheet and do **NOT** save. Then start again with more reasonable numbers.

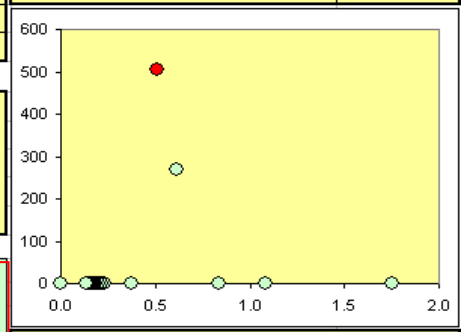
Go to *Page 1* of this file for additional information and to download instructions.

Company name	ABC
TABLE I	
Income Statement	
EBITDA	35.0
D&A	-5.0
EBIT	***30.0***
Other income	2.0
Gross interest expense	-3.0
EBT	***29.0***
Tax	***-8.7***
Net profits	***20.3***
Balance Sheet	
Assets	***503.3***
IB debt	170.0
Book equity	150.0
Market equity	***333.3***
Total liab. & market equity	***503.3***

TABLE II	
Input/Output Parameters	
Effective tax rate	30%
Book-to-Market Equity	0.45
Pre-tax cost of debt	***1.76%***
Implied spread	***1.92%***
Implied risk-free rate	***-0.15%***
Implied rating	***#VALUE!***
V = D+E	***503.3***
V* = D*+E	***-1,616.6***
Vu*=(1-T)D*+E	***-1,031.6***

Insert relevant data in unprotected (white) cells and then press <F9> to calculate. *NOTE: Apple Mac computers require different procedure for manual calculations.*

TABLE III	
Ratios	
EBIT Interest cover (R1)	***10.67***
D/EBITDA (R5)	***4.86***
D/(D+Ebook) (R8)	***0.53***
D/Emarket	***0.51***
EV/EBITDA	***14.4***
ROE	***6.09%***
WACC	***4.17%***



ERROR: The IB Debt inserted in either Cells B17 on this page or J4 on Page 3 is too high! You must reduce to a lower level.

The scales in the above graph could be adjusted for better resolution

4b. Regarding Error Message in Tab 3 Related to Debt Input Being Too High

In instances where the IB debt level input in either Cell B17 in tab 2 or Cell J4 in tab 3 is too high, the feedback procedure outlined on Page 11 of this document may crash In this case, the following error message will pop up:

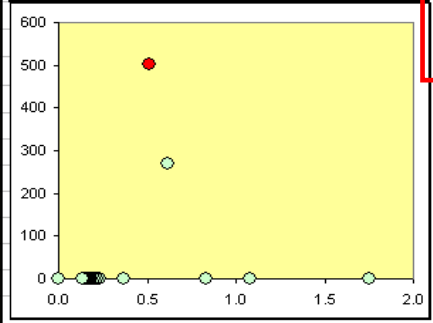
If this happens, simply exit the spreadsheet and do **NOT** save. Then start again with more reasonable numbers.

Company name	ABC
TABLE I	
Income Statement	
Operating EBITDA	56.9
D&A	-8.1
EBIT	48.7
Other income	2.0
Gross interest expense	-1.6
EBT	49.2
Tax	-14.7
Net profits	34.4
Balance Sheet	
Assets	503.3
Market equity	333.3
IB debt	170.0
Total liab. & equity	503.3

TABLE II	
Input/Output Parameters	
Effective tax rate	30%
Pre-tax cost of debt	0.93%
Implied spread	1.09%
Implied risk-free rate	-0.15%
Implied rating	#VALUE!
V = D+E	503.3
V* = D*+E	-695.9
Vu*=(1-T)D*+E	-387.2

D	D/E	V	Implied Rating
0.0	#VALUE!	#VALUE!	#VALUE!
34.0		#VALUE!	#VALUE!
68.0			
102.0	0.61	267.9	A-
136.0			
170.0			
204.0	7.73	230.4	BB
238.0			
272.0			
306.0			
340.0			
374.0			
408.0			
442.0			
476.0			
510.0			
544.0			
578.0			
612.0			
646.0			
680.0			
714.0			
748.0			
782.0			
816.0			
850.0			

Table III	
Additional equity	0
Additonal debt	0
Total additional assets	0
% Impact on EBIT	-62%
TABLE IV	
Ratios	
EBIT Interest cover (R1)	32.04
D/EBITDA (R5)	2.99
D/(D+Ebook) (R8)	0.53
D/Emarket	0.51
EV/EBITDA	8.9
ROE	10.32%
WACC	6.78%



Insert relevant data in unprotected cells and then press <F9> to calculate. *NOTE: Apple Mac computers require different procedure for manual*

ERROR: The IB Debt inserted in Cell B17 on Page 2 or the Additional Debt inserted in Cell J4 on this page is too high. Reduce either one.

The Scales in this graph could be adjusted for better resolution