14.10: Solutions to CH 10 Exercises

Question 1

Debt holders are paid through interest payments whereas preferred and common stockholders are paid through dividends. Interest is paid out of pre-tax income. This means that each dollar we pay our bondholders results in fewer taxes. Thus, interest is providing a "tax-shield" which we must account for when estimating the cost. On the other hand, dividends are paid out of after-tax income. Since dividends offer no tax shield, we do not have to make a conversion to after-tax cost. The after-tax cost of common and preferred stock is the same as the before-tax cost.

Question 2

There are two reasons for this. The first relates to risk. Investors determine our cost of financing by the required return that they demand for investing in our stocks and bonds. The more risk the investor faces, the higher the required return that the investor will demand (which means a higher cost of financing to the firm.) From an investors perspective, it is the least risky to hold bonds (as bonds have the most stable and predictable cash flow streams and are first in line in the event of bankruptcy.) The most risky is common stock (as common stock has a very unstable/unpredictable cash flow stream and is last in line in the event of bankruptcy. Preferred stock falls somewhere between the risk levels of bonds and common stock. The second reason has to do with the tax-shield discussed in Question 1. Because interest provides a tax-shield that is not provided by dividends, the effective cost of debt is lowered. To summarize, debt is the lowest cost source because it is the least risky to investors and has a tax-shield. Common stock is the most risky because it is the most risky to investors.

Question 3

Each method is flawed. Specifically, the dividend valuation method assumes (A) dividends are being paid and (B) those dividends are growing at a constant rate. When we violate those assumptions, it introduces error into our calculations. The more unstable the dividend growth rate the greater the error. The SML approach is useful in that every stock has a beta and it is reasonably easy to get estimates for the expected market return and risk-free rate. However, there is evidence that beta may not be a reliable indicator of return. This makes us question the accuracy of the SML approach. Finally, the bond yield plus risk premium approach is also flawed. It is difficult to estimate exactly what the risk premium should be and is difficult to apply to firms that do not use debt financing (as we have no YTM for these firms.) Since each method is flawed, we hope that an average of the three will result in a lower error than applying any of the models in isolation. It should also be noted that the SML approach is the only approach that can be used with all firms.

Question 4

The first reason for this is that the coupon rate can be misleading because it doesn't take into account whether the bond was issued at a discount or premium. A zero-coupon bond is not free financing. The YTM corrects for this. The second reason is that the coupon rate is historical. It is set when the bond is issued and doesn't change. If our firm last issued bonds 10 years ago, that would tell us little about what return investors are requiring to hold our bonds today. YTM is current (or forward-looking) in that it incorporates today's bond price and remaining interest payments to estimate what investors are demanding as a rate of return to hold our bonds today. The cost of capital needs to be current in order to be useful.

Question 5

Always use market values. Market values are based on all available information about our firms risk and prospects TODAY. Book values are historical and may miss several areas of intangible assets. Thus, market values better capture the true "economic" value of our financing weights. If we issue new stocks and bonds, today's market values are a better indicator of what we can expect to receive.

Question 6

The MCC tells us our cost of financing. It is impossible for a firm to maximize value if it doesn't know how much it is paying to finance its operations. The MCC provides us a baseline required return to use in our capital budgeting analysis. If a project does not earn enough to pay for the financing it will not add value to the firm. On the other hand, a project that earns more than the cost of financing IS adding value to the firm. The lower the MCC, everything else being equal, the greater the value of the firm. This is

because at a lower required return (MCC), each project will have a higher NPV meaning that every project the firm undertakes is worth more to them.

Question 7

The first condition is that the financing weights for the project are similar to the financing weights for the firm. For instance, if our firm uses a 20%/20%/60% mix of debt/preferred/common and we decide to finance our next project with 100% common, the MCC is not capturing the true cost of financing the project. The actual cost will probably be more expensive than the MCC (since common stock is our most expensive form of financing). A correction for this problem is to adjust our weights in the MCC calculation to reflect the financing weights for the project.

The second condition is that the risk of the project is similar to the average risk level for our firm. If we undertake high risk projects, this makes our firm riskier and investors will want more compensation. Thus, we have to increase the cost of capital to reflect this. If we undertake low-risk projects, this makes our firm less risky and investors will settle for less compensation. Thus, we can lower the cost of capital to reflect this.

Question 8

TRUE. Think of a firm as a series of past and present capital budgeting projects. All the different projects that the firm has undertaken in the past, is currently working on, and will initiate in the future are what make the firm what it is right now. All the expected cash flows that are going to be generated are based off of these various projects. The cost of capital determines the required return for capital budgeting projects. We know that if we lower the required return for a cash flow stream, the PV of that cash flow stream will increase. The value of the firm is just the PV of the cash flows it will generate. Therefore, lowering the cost of capital, all else equal, will increase the value of the firm.

Question 9

FALSE. While at first glance, this appears to be a logical statement, it ignores a key factor about using more and more debt. Because debt generates a fixed cost (interest payments and the return of par value at maturity) that must be repaid (or the firm will be forced into bankruptcy), increasing the amount of debt financing used will also increase the risk associated with the firm. As we know, when risk increases, investors want higher returns. Thus, as the amount of debt increases, both stockholders and bondholders will start wanting higher returns to compensate them for the additional risk. This means the cost of equity financing and cost of debt financing will both increase. For most firms, there is an additional benefit to using some debt financing. Having some debt does not increase the risk much and therefore the cheaper source of financing (debt) offsets the impact of higher risk. However, as more and more debt gets added, the risk increases at an increasing rate. At some point the benefits of a cheaper source of financing are more than offset by the increased risk.

This optimal point varies from firm to firm. Firms with more predictable cash flows are not as sensitive to higher levels of debt (in terms of risk) and can carry more debt. Also, one of the things that makes debt cheaper is the tax benefits. Firms in high tax brackets will have a more significant tax benefit and thus can carry more debt. Thus, we typically see firms with high tax rates and/or predictable cash flow streams use more debt financing while firms with volatile cash flow streams and/or low tax rates will use less debt financing. The issue of how much debt financing should be used is referred to as “CAPITAL STRUCTURE”. The following diagram illustrates the capital structure decision.


Target Cost of Capital

Problem 1

First we must find the YTM and then plug it into the formula:

$k_i = YTM(1 – T)$

Remember that bonds pay interest semi-annually so that we must set our calculators to 2 Periods per Year and adjust the N and PMT to reflect the semi-annual framework.

Part 1a

40 N
-1135 PV

37.50 PMT
1000 FV
I/Y ⇒ 6.30%

$k_i = 6.30\%(1 - 0.35) = 4.10\%$

Part 1b

40 N
-875 PV
37.50 PMT
1000 FV
I/Y ⇒ 8.84%

$k_i = 8.86\%(1 - 0.35) = 5.75\%$

Problem 2

$k_p = D/P = (0.05)(30)/16.50 = 1.50/16.50 = 9.09\%$

Problem 3

Dividend Valuation Approach
$k_s = (D_1/P) + g = [(0.75)\times(1.08)/25] + 0.08 = 11.24\%$

Security Market Line Approach
$k_s = k_{rf} + \beta(k_m - k_{rf}) = 5\% + 0.8(12\% - 5\%) = 5\% + 5.6\% = 10.60\%$

Bond Yield plus Risk Premium Approach
$k_s = YTM + RP = 9\% + 5\% = 14.00\%$

Average $k_s = (11.24\% + 10.60\% + 14.00\%)/3 = 11.95\%$

Problem 4

Part 4a

Step 1 ⇒ Solve for Market Value Weights

$MV_{debt} = 24{,}000{,}000$
$MV_{pref} = 5{,}000{,}000$
$MV_{com} = 35{,}000{,}000$
$MV_{total} = 64{,}000{,}000$

$W_{debt} = 24{,}000{,}000/64{,}000{,}000 = 0.38$
$W_{pref} = 5{,}000{,}000/64{,}000{,}000 = 0.08$
$W_{com} = 35{,}000{,}000/64{,}000{,}000 = 0.55$

Step 2 ⇒ Solve for After-tax Cost of Debt

$k_i = YTM(1 - T) = 11\%(1 - 0.40) = 6.60\%$

Step 3 ⇒ Solve for Cost of Preferred Stock

$k_p = D/P = 6.50/50 = 13\%$

Note that the price per share for preferred stock is found by taking the total market value of preferred stock divided by the number of shares ⇒ $5,000,000/100,000 = $50

Step 4 ⇒ Solve for Cost of Common Stock

Dividend Valuation Approach
$k_s = (D_1/P) + g = (2.75/34) + 0.065 = 14.59\%$

Security Market Line Approach
$k_s = k_{rf} + \beta(k_m - k_{rf}) = 5\% + 1.35(12\% - 5\%) = 14.45\%$

Bond Yield Plus Risk Premium Approach
k_s = YTM + RP = 11% + 5% = 16.00%

Cost of Common Stock Financing
(14.59% + 14.45% + 16.00%)/3 = 15.01%

Step 5 ⇒ Solve for Marginal Cost of Capital (MCC)

$MCC = W_{debt}(k_i) + W_{pref}(k_p) + W_{com}(k_s)$
= (0.38)(6.60%) + (0.08)(13.00%) + (0.55)(15.01%)
= 11.80%

Part 4b

Solve for IRR ⇒ IRR = 12.59% > 11.80% ⇒ Accept Project
Solve for NPV@11.80% ⇒ $1254.70 > $0 ⇒ Accept Project

Note – Since there is no crossover problem and it is a single project instead of mutually exclusive, we can use either IRR or NPV to make our decision.

Problem 5

Part 5a

MV_{debt} = 10,000*1060 = $10,600,000
MV_{pref} = 40,000*53 = $ 2,120,000
MV_{com} = 1,000,000*41.25 = $41,250,000
MV_{total} = $53,970,000

W_{debt} = 0.20
W_{pref} = 0.04
W_{com} = 0.76

Part 5b

$k_i = YTM(1 - T) = 9.07\%(1 - 0.40) = 5.44\%$

Find YTM
20 N
-1060 PV
50 PMT
1000 FV
I/Y ⇒ 9.07%

$k_p = D/P = \$5/\$53 = 9.43\%$

Div Val Approach ⇒ $k_s = (D_1/P) + g = [(2.25)(1.10)/41.25] + 0.10 = 16.00\%$
SML Approach ⇒ $k_s = k_{rf} + \beta(k_m - k_{rf}) = 6\% + 1.3(13\% - 6\%) = 15.10\%$
BY + RP Approach ⇒ k_s = YTM + RP = 9.06% + 5% = 14.06%
Average of Three Approaches ⇒ (16.00% + 15.10% + 14.06%)/3 = 15.05%

Part 5c

$MCC = W_{debt}(k_i) + W_{pref}(k_p) + W_{com}(k_s)$
= (0.20)(5.44%) + (0.04)(9.43%) + 0.76(15.05%)
= 12.90%