Cost of Capital

Learning Problems

Answer Keys

**WACC at Winnipeg Electric**

1. WACC = 1(.555) 2(.079) + 1(.09) 3(.05) + 1(.355) 4(.0432) = .0637 or 6.37%

1

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Calculation** | **Market Value** | **% of Total** |
| Debt | (1,500) (1.0532) (1,000) | 1,579,800 | 35.5% |
| Preferred shares | (5,000) (80) | 400,000 | 9.0% |
| Common shares | (65,000) (38) | 2,470,000 | 55.5% |
| Total | 4,449,800 | 100.0% |

2 kc = .04 + (.78) (.05) = .079

3 kp = 4 / 80 = .05

4 1,579,800 = 551,000 ($\frac{1-(1+kd)^{-20}}{kd}$) + $\frac{1,500,000}{(1+kd)^{20}}$

kd = .0304

(1 + .0304)2 - 1 = .0617

(.0617) (1 - .30) = .0432

5 (1,500) (1,000) (.068/2)

**WACC at Balmer**

1. WACC = 1(.3451) 2(.095) + 1(.0785) 3(.0694) + 1(.5764) 4(.0456) = .0645 or 6.45%

1

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Calculation** | **Market Value** | **% of Total** |
| Common shares | (4,500,000) (38) | 171,000,000 | 34.51% |
| Preferred shares | (540,000) (72) | 38,880,000 | 7.85% |
| Debt | (300,000) (.952) (1,000) | 285,600,000 | 57.64% |
| Total | 495,480,000 | 100.00% |

2 kc = .03 + 1.3 (.05) = .095

3 kp = 5 / 72 = .0694

4 285,600,000 = 59,000,000 ($\frac{1-(1+kd)^{-40}}{kd}$) + $\frac{300,000,000}{(1+kd)^{40}}$

kd = .0321

(1 + .0321)2 - 1 = .0652

(.0652) (1 - .30) = .0456

5 (300,000) (1,000) (.06/2)

**WACC at Jackson**

1. WACC = (.3) 1(.1378) + (.2) 2(.0844) + (.5) 3(.0636) = .0900 or 9.00%

1 kc = (7 / 90) + .06 = .1378

2 kp = (95) (.08) / 90 = .0844

3 4970 = 540 ($\frac{1-(1+kd)^{-40}}{kd}$) + $\frac{1,000}{(1+kd)^{40}}$

kd = .04155

(1 + .04155)2 - 1 = .0848

(.0848) (1 - .25) = .0636

4 1,000 - 30

5 (1,000) (.08) (6 / 12)

**WACC at Anderson**

1. WACC = 1(.4134) 2(.0905) + 1(.0709) 3(.075) + 1(.5157) 4(.0728) = .0803 or 8.03

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|  |  |  |  |
| --- | --- | --- | --- |
|  | **Calculation** | **Market Value** | **% of Total** |
| Common shares | (35,000) (10) | 350,000 | 41.34% |
| Preferred shares | (15,000) (4) | 60,000 | 7.09% |
| Bonds | (450) (1,000) (.97) | 436,500 | 51.57% |
| Total | 846,500 | 100.00% |

2 kc = .03 + 1.21 (.05) = .0905

3 kp = .30 / 4.00 = .075

4 97 = 54.5 ($\frac{1-(1+kd)^{-20}}{kd}$) + $\frac{100}{(1+kd)^{20}}$

kd = .0474

(1 + .0474)2 -1 = .0970

(.0970) (1 - .25) = .0728

5 (100) (.09) (6 / 12)

**Issuance Costs at Wilson**

1. Issuance costs should be shown as a negative cash flow at the beginning of the project’s life. These costs are tax-deductible.

Issuance costs should not be included in the cost of capital which should only reflect the risk of the project. By including issuance costs in the cost of capital, the negative cash flows from the issuance costs are being spread over the project’s life instead of being recognized at the beginning of the project’s life when they are incurred.

Weighted average issuance costs = (.35) (.03) + (.20) (.05) + (.45) (.10) = .0655 or 6.55%

(Total capital to raise) (1 – Issuance costs) = (Total capital needed)

(Total capital to raise) (1 – .0655) = 5,000,000

Total capital to raise = 5,350,454.79

Issuance costs = (5,350,454.79 – 5,000,000) = 350,454.79

After-tax issuance costs = (350,454.79) (1 – .25) = 262,841.09

262,841.09 should be shown as a negative cash flow at T=0 in the capital budgeting analysis

1. The process would be the same except the cost of common equity would be 0% resulting in weighted average issuance costs of:

= (.35) (.03) + (.20) (.05) + (.45) (0) = .0205 or 2.05%

Most companies do not issue equity because of high issuance costs and control issues that may arise from selling new shares. Using this lower weighted average issuance costs would be common in practice.

**WMCC at Greyhound**

1. No. A new cost of capital or WMCC should be calculated since the airline and bus industries have very different risk levels.
2. WMCC = (.30) 1(.0848) + (.10) 2(.09) + (.60) 3(.139) = .1178 or 11.78%

1 kd = (.1130) (1 - .25) = .0848

2 kp = 9 / 100 = .09

3 kc = .04 + 1.65 (.06) = .139

Point-to-Point was selected as a comparable company because it had a very similar capital structure to Greyhound. A firm’s borrowing level affects its beta.

# WMCC at Predator

1. WMCC = (.5) 1(.125) + (.1) 2(.085) + (.4) 3(.0690) = .0986 or 9.9%

1 kc = .04 + 1.7 (.05) = .125

2 kp = .085

3 kd = ((1 + .09/2)2-1) (1 - .25) = .0690

# WMCC at Allison with Project Risk

1. Common share beta: (1.21 + 1.15 + 1.11 +1.32) / 4 = 1.20

Treasury spread: (4.10 + 3.85 + 3.50 + 3.95) / 4 = 3.85

WMCC = (.4) 1(.10) + (.6) 2(.0589) = .0753 or 7.53%

7.53% + 2.00% = 9.53%

1 kc = .04 + 1.2 (.05) = .10

2 kd = .04 + .0385 = .0785

(.0785) (1 - .25) = .0589

# WMCC at Harrison with Project Risk

1. Common share beta: (1.45 + 1.56 + 1.39 + 1.48) / 4 = 1.47

Preferred share yield: (.054 + .061 + .049 + .055) / 4 = .055

Treasury spread: (2.45 +2.58 + 2.10 + 2.49) / 4 = 2.41

WMCC = (.5) 1(.1035) + (.1) 2(.055) + (.4) 3(.0406) = .0735 or 7.35%

7.37% + 3.00% = 10.37%

1 kc = .03 + 1.47 (.05) = .1035

2 kp = .055

3 kd = .03 + .0241 = .0541

(.0541) (1 - .25) = .0406

# Adjusting Beta for Leverage

1. 1.23 = Bu (1 + (1 - .25) (.24)) Bu = 1.04

BL = 1.04 (1 + (1 - .25) (.43)) BL =1.38

Conversion of Dempsey’s debt ratio to debt-to-equity ratio

Debt ratio = $\frac{.3}{1}$ = .3

Debt-to-equity ratio = $\frac{.3}{1- .3}$ = .43

**WMCC at Baxter**

1. WACC = (.40) 1(4.64%) + (.60) 2(10.90%) = 8.40%

1

|  |  |  |
| --- | --- | --- |
| **Company** | **Beta** | **Debt-to-Equity** |
| Wilson | .97 | 40% |
| Jacobs and Sons | 1.34 | 50% |
| Mathew Jenkins | 1.53 | 65% |
| Average | 1.28 | 52% |

(X) (.5) + (1.45) (.5) = 1.21 X = .97

1.28 = Bu (1 + (1 -.25) (.52)) Bu = .92

BL = .92 (1 + (1 -.25) (.67)) BL = 1.38

$\frac{D}{E}$ = $\frac{.4}{.6}$ = .67

kc = .04 + 1.38 (.05) = .1090 or 10.90%

2 990 = 30 $(\frac{1-\left(1+i\right)^{-30}}{i})$ + $\frac{1,000}{(1+i)^{30}}$

i = .0305

(1 + .0305)2 – 1 = .0619

(.0619) (1 - .25) = .0464 or 4.64%

**Arithmetic and Geometric Mean**

1. Arithmetic Mean

|  |  |  |  |
| --- | --- | --- | --- |
| 2010 | (350,000 – 200,000) / 200,000 | .750 | 75.0% |
| 2011 | (200,000 – 350,000) / 350,000 | -.429 | -42.9% |
| 2012 | (400,000 – 200,000) / 200,000 | 1.000 | 100.0% |
| 2013 | (200,000 – 400,000) / 400,000 | -.500 | -50.0% |
| Total | 82.1% |

82.1% / 4 = 20.53%

Geometric Mean

(200,000) (1 + i) 4 = 200,000 i = .000 or 0.0%

Different experts prefer different methods.

Arithmetic Mean

* Used by most financial information services like Duff & Phelps.
* Results in higher rates of return compared to the geometric mean and the differences become more pronounced as the returns display more variability.
* Some feel this is a better way to measure risk because it captures the higher variability of returns which is the risk investors experience.

Geometric Mean

* Favoured by academics.
* Results in lower rates of return compared to the arithmetic mean.
* Some feel this is a better way to measure risk because it provides a more accurate return over the longer term. Investors know variability will cancel out in the long term leaving the geometric return.
1. Geometric mean return is calculated based on the first and last values. If these values are outliers then the rate of return will be distorted. This can be improved upon by smoothing the data using regression.

|  |  |
| --- | --- |
| 1 | 200,000 |
| 2 | 350,000 |
| 3 | 200,000 |
| 4 | 400,000 |
| 5 | 200,000 |

Regression lines

Year 1 255,000 + (5,000) (1) = 260,000

Year 2 255,000 + (5,000) (5) = 280,000

(260,000) (1 + i) 4 = 280,000 i = .019 or 1.9%

**Historical Market Risk Premium at Grayson**

1. Geometric Mean

Stocks

(100) (1 + i) 92 = 502417.21 i = .0971

Bonds

(100) (1 + i) 92 = 8012.89 i = .0488

.0971 - .0488 = .0483 or 4.83%

Arithmetic Mean

Stocks – .1157

Bonds – .0515

.1157 - .0515 = .0642 or 6.42%

Some feel the arithmetic mean is best because it captures the short-term variability of equity returns resulting in a higher market risk premium and cost of common equity (i.e. greater risk). Others feel the geometric mean is better as it takes a longer view of this variability recognizing that it will likely cancel itself out over time causing the market risk premium and cost of common equity to be lower (i.e. lower risk). Research shows that using the arithmetic mean and historical data overstates the market risk premium on average, so a geometric mean is preferred.

Results could be improved by removing periods that are unusual such as the Great Depression or WW II, times when interest rates are being controlled by the government (WW II up to the Korean War), or an interval of unusually low rates such as since 2008.

Geometric mean return is calculated based on the first and last values. If these values are outliers then the rate of return will be distorted. This can be improved upon by smoothing the data using regression.



1. Geometric Mean

Stocks

(156658.05) (1 + i) 20 = 502417.21 i = .0600

Bonds

(2912.88) (1 + i) 20 = 8012.89 i = .0519

.0600 - .0519 = .0081 or .81%

Arithmetic Mean

Stocks – 7.59%

Bonds – 5.49%

.0759 - .0549 = .0210 or 2.10%

The market risk premium varies considerably based on the measurement period selected.

**Forward-looking Market Risk Premium at Gagne**

1. The market risk premium can be calculated using either the dividend or earnings yield as follows:

km = $\frac{D\_{1}}{P\_{0}}$ + $g\_{d}$ = (.0381) (1 + .0350) + .0350 = .0744

.0744 – .0300 = .0444 or 4.44%

$k\_{m}$ = $\frac{E\_{1}}{P\_{0}}$ = .0793 (1 + .0350) = .0821

.0821 – .0300 = .0521 or 5.21%

1. A 3-stage DDM model could be used which allows for higher initial growth that falls to the long-term growth rate over time.

**Calculating Beta at Stead**

1. Raw beta = 1.25 (based on returns)

Overall the regression model has a R2 of 0.51 which is average. The S&P return coefficient or raw beta is statistically valid with a high t-stat and low p-value. The beta has a confidence interval (95%) of .92 to 1.57. If the risk-free rate was 3.0% and the market risk premium was 5.0%, the kc would vary from 7.60% to 10.85% at this confidence level. Estimating raw beta is imprecise at best, but different adjusted betas may help improve the estimate.

1. Raw beta = 1.23 (based on excess returns)

Excess return is the difference between the market portfolio return or company return and the 90-day treasury bill rate. This adjustment eliminates the effect of inflation over the measurement period resulting in a more accurate regression coefficient. The beta is slightly lower than in Part 1 but the statistical quality of the regression is unchanged. Adjusting for information is normally made by academics, but has little effect on the regression results, so it is often ignored by practitioners.

1. Blume adjusted beta = .371(1) + .635 (1.25) = 1.16

Research indicates that betas move towards their mean industry over time which is referred to as the shrinkage effect. To provide a more forward-looking beta, the Blume adjusted beta considers this by applying a 1/3, 2/3 adjustment to reduce the beta. Blume adjusted beta coefficients are based on historical rates of regression towards the mean.

1. Vasicek adjusted beta = (1.08) ($\frac{.0258}{.0129+ .0258}$) + (1.25) ($\frac{.0129}{.0129+ .0258}$) = 1.14

Vasicek adjusted beta also incorporates the shrinkage effect. It takes a weighted average of the company’s beta and a market or industry beta. The weights are based on variance, so more weight is placed on the betas with the greater variability. Research indicates that betas with greater variability will regress to the mean more quickly.

1. Sum beta = 1.22 + (-.12) = 1.10

Research indicates that small compared to large companies tend to lag the overall market in stock movement possibly because of less market liquidity resulting in a lower beta which is referred to as the lag effect. To adjust for this, sum beta regresses the company’s return against both the return on the market this period and last period and then add the two regression coefficients together. For Stead, using the sum beta reduces the beta estimate from 1.25 to 1.10. Stead is a large company and research indicates that the lag effect is not important for them as markets for large-company stocks are very efficient. The sum beta should not be used and should only be used for small and medium-sized companies.

1. Downside beta = 1.26

Risk can be measured as the overall variability of returns (up and down), or only the downside risk potential. Downside beta measures the downside risk potential of a security compared to the market’s or industry’s returns. In a downturn, Stead’s losses will be 1.25 times those of the industry.

**Industry and Peer Group Betas at Cascade**

1.



The betas for each operating segment or industry are the coefficients. The R square and t-stats for each coefficient are strong except for the “other” segment. This low t-stat is not surprising given that it is a miscellaneous category.

2.

Peer group beta = (.35) (.95) + (.52) (1.67) + (.11) (1.11) + (.02) (1.77) = 1.3584 or 1.36

**Accounting Beta at Excalibur**

1.

|  |  |  |
| --- | --- | --- |
| **Year** | **Net Income (Y)** | **Net Income S&P 500 (X)** |
| 2004 | .10 | .05 |
| 2005 | -.16 | .14 |
| 2006 | -.17 | -.08 |
| 2007 | -.74 | -.55 |
| 2008 | 3.00 | .52 |
| 2009 | .75 | .78 |
| 2010 | .14 | .04 |
| 2011 | -.31 | .00 |
| 2012 | .27 | -.07 |

B = 2.00

1. Both business and financial risk should be incorporated into the beta calculation. As a result, an income measure that includes both fixed operating costs and fixed interest should be used. Net income includes both these amounts while sales and operating income do not.
* The company’s operations may not be pure relative to the trucking industry which will distort the beta.
* The sample size includes only nine data points. For the beta, the normal sample size is 60 observations based on five years of monthly data.
* Companies normally smooth earnings to make their companies appear less risky to their investors, which results in lower accounting betas compared to market betas as net income is more stable.

**Accounting Beta at Allison**

1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Operating Income** | **Debt-to-Equity** | **Payout** | **Change in EPS** |
| 2008 | 220,000 | .39 | .10 | - |
| 2009 | 125,000 | .36 | .05 | -.43 |
| 2010 | 300,000 | .41 | .11 | 1.40 |
| 2011 | 350,000 | .39 | .13 | .17 |
| 2012 | 310,000 | .40 | .14 | -.11 |
| Average | 261,000 | .39 | .11 | .26 |
| SD | 89,471 |  |  |  |
| CV | .34 |  |  |  |

B = .9783 + .078 (.34) + .138 (.39) - .171 (.11) + .025 (.26) B = 1.05

2.

* Use the companies in Allison’s industry only instead of the S&P 500 as a whole to develop a more accurate regression model. The sample size is smaller but the companies included are more comparable.
* Allison’s performance relating to the four ratios should be measured over a full business cycle.
* Watch for other statistical problems with the regression model relating to:
* Low adjusted Rsquared
* Multicollinearity between variables
* Poor t-stats or p-values for the coefficients
* Signs of coefficients indicate a correct cause and effect relationship

**Unlevered and Levered Beta at Seymour**

1.

Remove the effect of industry financial leverage

* 1. = Bu (1 + (1 - .25) (.62))

Bu = .86

Remove the effect of industry operating leverage

.86 = Bop (1 + 1.25)

Bop = .38

Add the effect of the company’s operating leverage

Bu = .38 (1 + 1.45)

Bu = .93

Add the effect of company financial leverage

BL = .93 (1 + (1 - .25) (.40))

BL = 1.21

**Weighted Average Cost of Debt at Ryerson**

1. Cost of Debt

Bonds

(.993438) (6,500,000) =(.035) (6,500,000) ($\frac{1-(1+kd)^{-40}}{kd}$) + $\frac{6,500,000}{(1+kd)^{40}}$

kd = .0353

(1 + .0353)2 - 1 = .0718 or 7.18%

Term loan

(1+$\frac{.06}{12}$) 12 – 1 = .0617 or 6.17%

Lease

(1+$\frac{.05}{12}$) 12 – 1 = .0512 or 5.12%

Market Value of Debt

 Bonds

 (.993438) (6,500,000) = 6,457,347

 Term loan

 36,100 ($\frac{1-(1+\frac{.06}{12})^{-96}}{\frac{.06}{12}}$) = 2,747,037

 Lease

 16,450 + 16,450 ($\frac{1-(1+\frac{.05}{12})^{-59}}{\frac{.05}{12}}$) = 875,329

Weighted-Average Cost of Debt

|  |  |  |  |
| --- | --- | --- | --- |
| Bond | .0718 | 6,457,347 | 463,638 |
| Term loan | .0617 | 2,747,037 | 169,492 |
| Lease | .0512 | 875,329 | 44,817 |
| Total | 10,079,713 | 677,947 |

= 677,947 / 10,079,713 = .0673 or 6.73%

**Weighted Average Cost of Debt at Sanders**

1. Cost of debt

Bonds

(1 + $\frac{.0872}{2} $)2 - 1 = .0891 or 8.91%

Term loan

(1+$\frac{.07}{12}$) 12 – 1 = .0723 or 7.23%

Lease

(1+$\frac{.05}{12}$) 12 – 1 = .0512 or 5.12%

Market value of debt

 Bonds

 (1.023450) (5,900,000) = 6,038,355

Term loan

 32,950 ($\frac{1-(1+\frac{.07}{12})^{-84}}{\frac{.07}{12}}$) = 2,183,178

Lease

 14,450 + 14,450 ($\frac{1-(1+\frac{.05}{12})^{-23}}{\frac{.05}{12}}$) = 330,744

Weighted-average cost of debt

|  |  |  |  |
| --- | --- | --- | --- |
| Bond | .0891 | 6,038,355 | 538,017 |
| Term loan | .0723 | 2,183,178 | 157,844 |
| Lease | .0512 | 330,744 | 16,934 |
| Total | 8,552,277 | 712,795 |

= 712,795 / 8,565,355 = .0832 or 8.32%

2.

Separate groups should be established for bonds with similar maturities and features. An interest rate should be established for each group. A market-weighted average cost of debt should be calculated for these groups.

**Convertible Bonds at Grayson**

1.

(15,000,000) (1.12310) = 16,846,500.00

P0 = 1361,500 ($\frac{1-(1+(\frac{.052}{2}))^{-20}}{\left(\frac{.052}{2}\right)}$) + $\frac{15,000,000}{(1+(\frac{.052}{2}))^{20}}$ = 14,559,877.05

1(15,000,000) ($\frac{.0482}{2}$)

16,846,500.00 – 14,559,877.05 = 2,286,622.95

Debt component – CAD 14,559,877.05 at a current market rate of 5.20%, semi-annual

Equity component – CAD 2,286,622.95

Convertible bonds trade at a premium compared to straight bonds because investors are willing to pay more for the conversion feature. The additional premium is included in equity as it is part of the purchase price for the shares that will be issued when the bonds are converted.

**Callable Bonds at Wilkinson**

1. Use the yield-to-call as the bond is likely to be called given the decline in interest rates.

(10,000,000) (1.03521) = 1250,000 ($\frac{1-(1+(\frac{.i}{2}))^{-4}}{\left(\frac{i}{2}\right)}$) + $\frac{(10,000,000)(1.02)}{(1+(\frac{i}{2}))^{4}}$

1(10,000,000) ($\frac{.0500}{2}$)

i = .0412 (Solved using Goal Seek feature in Excel)

(1 + .0412)2 – 1 = .0841 or 8.41%

Current market rate = 8.41%

Fair market value = CAD 10,352,100

**Yield Curve Approach at Ranson**

1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Amount** | **Interest Rate** | **Interest** |
| Year 1 | 10,180 | .0487 | 495.77  |
| Year 2 | 9,166 | .0512 |  469.30  |
| Year 3 | 15,978 | .0559 |  893.17  |
| Year 4 | 14,108 | .0581 |  819.67  |
| Year 5 | 8,048 | .0617 |  496.56  |
| Year 6+ | 8,200 | .0701 |  574.82  |
| Total | 65,680 |  | 3,749.29  |

3,749.29 / 65,680 = .0571 or 5.71%

**WMCC at Wilcox**

1.

**Cost of Common Equity**

1.32 = Bu (1 + (1 - .25) (.31))

Bu = 1.07

BL = 1.07 (1 + (1 - .25) ($\frac{.3}{.7})$

BL = 1.41

.04 + 1.41 (.055) = .1176 or 11.76%

**Cost of Debt**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Life of Debt** | **Debt Maturities** |  **Weight** | **Interest Rate** | **Weighted Average Rate** |
| Year 1 | 12,380 | .1645 | .1112 | .0183 |
| Year 2 | 19,840 | .2636 | .1168 | .0308 |
| Year 3 | 17,450 | .2318 | .1223 | .0284 |
| Year 4 | 12,390 | .1646 | .1245 | .0205 |
| Year 5 | 7,890 | .1048 | .1263 | .0132 |
| Year 6+ | 5,320 | .0707 | .1351 | .0095 |
|  | 75,270 | 1.000 |  | .1207 |

(.1207) (1 - .25) = .0905 or 9.05%

WACC = (.7) (11.76%) + (.3) (9.05%) + 3.00% = 13.95%

2.

* Three comparable companies selected are not pure as they have considerable trucking and truck service operations as well as trailer manufacturing.
* The sample size of comparable companies is small.
* No adjustment for the size premium in the cost of common equity.
* No adjustments are made to the raw beta for the lag, shrinkage, or downside effects.
* Using the corporate yield curve does not consider varying interest rates due to different bond features.
* Calculating synthetic bond ratings using regression may be inaccurate if the regression has a low Rsquared.
* A 20 or 30-year government bond should be used to determine the risk-free rate to match the maturity of the acquisition.
* A government bond with a regular coupon should have been used instead of a zero-coupon bond to match the maturity of the cash flows of the acquisition.
* Using arithmetic mean overstates the market risk premium compared to the geometric mean.
* A shorter measurement period for calculating market risk premium leads to considerably higher standard error

**Build-up Method at Creative Impressions**

1.

kc = .03 + .05 + .035 + (0.95 \* .05 - .05) + .04 = .1525 or 15.25%

bL = (.8) (1 + (1 - .25) (.25)) = 0.95

D/E = $\frac{.20}{1- .20}$ = .25

**Note:** The company’s debt ratio of 35% is not used to calculate the industry risk premium. The fact that the company is overleveraged compared to the industry is reflected in the company risk premium.

**3-Stage Implied Cost of Common Equity at Rebecca**

1.

|  |  |  |
| --- | --- | --- |
| **Year** | **Earnings per Share** | **% Change** |
| 2004 | 1.69 |  |
| 2005 | 1.74 | 2.96% |
| 2006 | 1.83 | 5.17% |
| 2007 | 1.99 | 8.74% |
| 2008 | 1.93 | -3.02% |
| 2009 | 2.01 | 4.15% |
| 2010 | 2.11 | 4.98% |
| 2011 | 2.35 | 11.37% |
| 2012 | 2.40 | 2.13% |
| 2013 | 2.50 | 4.17% |
| **Total** | 40.65% |

**Geometric Mean**

(1.69) (1 + i) 9 = 2.50 i = .0445 or 4.45%

**Arithmetic Mean**

(40.65%) / 9 = 4.52%

**Geometric Mean**

kc = $\frac{\left(1.50\right) (1+ .0445)}{25}$ + .0445 = .1072 or 10.72%

**Arithmetic Mean**

kc = $\frac{\left(1.50\right)(1+ .0452)}{25}$ + .0452 = .1079 or 10.79%

2.

**Years 1 – 5**

25 = $\frac{\left(1.50\right)(1+ .10)^{1}}{(1+kc)^{1}}$+$\frac{\left(1.50\right)(1+ .10)^{2}}{(1+kc)^{2}}$+$\frac{\left(1.50\right)(1+ .10)^{3}}{(1+kc)^{3}}$+$\frac{\left(1.50\right)(1+ .10)^{4}}{(1+kc)^{4}}$+$\frac{\left(1.50\right)(1+ .10)^{5}}{(1+kc)^{5}}$ +

**Years 6 – 10**

$\frac{\left(2.42\right)(1+ .075)^{1}}{(1+kc)^{6}}$+$\frac{\left(2.42\right)(1+ .075)^{2}}{(1+kc)^{7}}$+$\frac{\left(2.42\right)(1+ .075)^{3}}{(1+kc)^{8}}$+$\frac{\left(2.42\right)(1+ .075)^{4}}{(1+kc)^{9}}$+$\frac{\left(2.42\right)(1+ .075)^{5}}{(1+kc)^{10}}$+

**Years 11+**

$\frac{\frac{\left(3.47\right)(1+ .043)^{1}}{(kc- .043)}}{(1+kc)^{10}}$

kc = .1273 or 12.73%

**Fama and French 3-factor Model at IBM**

1. Market risk premium = 8.55%, Size risk premium = 3.07%, Value risk premium = 4.49%
2. kc = .0300 + (1.2724) (.0855) + (.0917) (.0307) + (.1858) (.0449) = .1499 or 14.99%

The overall adjusted R2 is low, the t-stats for SMB and HML are low. The Mkt-RF factor does have a high t-stat. The SMB and HML factors should probably not be included, but Mkt-RF should be.

Mkt-RF provided by French is considerably above the market risk premium of 5.0% to 5.5% supplied by most information providers. This is because the Rf component is for the one-month treasury bill and not the 20 or 30-year treasury bond rate. This estimate is likely more precise, so it should be substituted for 8.55% lowering the cost of common equity.

**Fama and French 3-factor Model at Delaware**

1. kc = .04 + 1.22 (0.085) -.33 (.0307) - .18 (.0449) = .1335 or 13.35%

|  |  |
| --- | --- |
| Risk-free rate | 4.00% |
| Market risk | 10.37% |
| SMB | -1.01% |
| HML | -.01% |
| Premium over the risk-free rate | 9.35% |
| Cost of common equity | 13.35% |

1. Delaware is a large-cap company displaying high market risk and modest growth.

Large-cap companies should display a negative correlation with the size factor which Delaware does (sensitivity coefficient is -.33). High market risk companies should have a strong correlation with the market risk factor which Delaware does (sensitivity coefficient is 1.22). High growth companies should be negatively correlated with the value factor while companies displaying more modest growth should display a negative correlation that is closer to zero which Delaware does (sensitivity coefficient is -.18).