**Additional Problems on Risk, Betas, and WACC**

**Expected Value, Variance, Covariance, and Correlation**

1. Calculate the expected value, variance and standard deviation for Asset X and Asset Y along with the covariance and correlation.

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| --- | --- | --- |
| **Probability** | **Asset X** | **Asset Y** |
| 0.2 | 8% | 0% |
| 0.4 | 12% | -2% |
| 0.3 | 0% | 6% |
| 0.1 | -4% | 20% |

1. Here are some historical data on the risk characteristics of Southern Company and Abbott Labs:

Southern Company Abbott Labs

Expected rate of return 12% 16%

Standard deviation of return 16% 26%

What is the expected return and standard deviation of an equally weighted portfolio of Southern Company and Abbott Labs if:

1. The correlation coefficient between the returns on the two stocks is -1.0.
2. The correlation coefficient between the returns on the two stocks is -0.5.
3. The correlation coefficient between the returns on the two stocks is 0.0.
4. The correlation coefficient between the returns on the two stocks is 0.5.
5. The correlation coefficient between the returns on the two stocks is +1.0.

**Betas and WACC**

1. Comment on the following quotation from a leading investment analyst.

 "Stocks that move perfectly with the market have a beta of 1. Betas get higher as volatility goes up and lower as it goes down. Thus, Southern Co., a utility whose shares have traded close to $12 for most of the past three years has a low beta. At the other extreme, there is Texas Instruments, which has been as high $150 and as low as $75 and has a high beta."

1. The equity beta for Oracle is 1.53. The cost of debt capital for oracle is 9%. The risk-free rate of return is 7% and the average MRP has been 5%. Currently Oracle's debt-to-equity ratio is 3/2 and the marginal tax rate for the company is 26%.
2. What is the cost of equity for the company?
3. What is the WACC for the company?
4. Boise Cascade also had debt outstanding of $ 1.7 billion and a market value of equity of $ 1.5 billion; the corporate marginal tax rate was 36%.
	1. Assuming that the current beta of 0.95 for the stock is a reasonable one, estimate the unlevered beta for the company.
	2. How much of the risk in the company can be attributed to business risk and how much to financial leverage risk?
5. You have just done a regression of monthly stock returns of HeavyTech Inc., a manufacturer of heavy machinery, on monthly market returns over the last five years and come up with the following regression:

RHeavyTech = 0.5% + 1.2 RM

The variance of the stock is 50% and the variance of the market is 20%. The current T.Bill rate is 3% (Historically it’s been around 5%). The stock is currently selling for $50, down $4 over the last year, and has paid a dividend of $2 during the last year and expects to pay a dividend of $2.50 over the next year. The NYSE composite has gone down 8% over the last year, with a dividend yield of 3%. HeavyTech Inc. has a tax rate of 40%. Assume a MRP of 8.5%.

* 1. What is the expected return on HeavyTech over the next year?
	2. What would you expect HeavyTech's price to be one year from today?
	3. What would you have expected HeavyTech's stock returns to be over the last year?
	4. What were the actual returns on HeavyTech over the last year?
	5. HeavyTech has $100 million in equity and $ 50 million in debt. It plans to issue $50 million in new equity and retire $50 million in debt. Estimate the new beta.
1. Novell, which had a market value of equity of $2 billion and a beta of 1.50, announced that it was acquiring WordPerfect, which had a market value of equity of $ 1 billion, and a beta of 1.30. Neither firm had any debt in its financial structure at the time of the acquisition, and the corporate tax rate was 40%.
2. Estimate the beta for Novell after the acquisition, assuming that the entire acquisition was financed with equity.
3. Assume that Novell had to borrow the $ 1 billion to acquire WordPerfect. Estimate the beta after the acquisition.
4. You are analyzing the beta for Hewlett Packard and have broken down the company into four broad business groups, with market values and betas for each group.

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| --- | --- | --- |
| **Business Group** | **Market Value of Equity** | **Beta** |
| Mainframes | $ 2.0 billion | 1.10 |
| Personal Computers | $ 2.0 billion | 1.50 |
| Software | $ 1.0 billion | 2.00 |
| Printers | $ 3.0 billion | 1.00 |

1. Estimate the beta for Hewlett Packard as a company. Is this beta going to be equal to the beta estimated by regressing past returns on HP stock against a market index. Why or Why not?
2. If the treasury bond rate is 7.5%, estimate the cost of equity for Hewlett Packard. Estimate the cost of equity for each division. Which cost of equity would you use to value the printer division? Assume a MRP of 5.5%.
3. Assume that HP divests itself of the mainframe business and pays the cash out as a dividend. Estimate the beta for HP after the divestiture. (HP had $ 1 billion in debt outstanding.)
4. The following table summarizes the percentage changes in operating income, percentage changes in revenue and betas for four pharmaceutical firms.

|  |  |  |  |
| --- | --- | --- | --- |
| **Firm** | **% Change in Revenue** | **% Change in Operating Income** | **Beta** |
| PharmaCorp | 27% | 25% | 1.00 |
| SynerCorp | 25% | 32% | 1.15 |
| BioMed | 23% | 36% | 1.30 |
| Safemed | 21% | 40% | 1.40 |

1. Calculate the degree of operating leverage (DOL) for each of these firms. DOL is often defined as the (% change in operating income)/(% change in sales).
2. What is DOL measuring?
3. Use the operating leverage to explain why these firms have different betas.
4. You have run a regression of monthly returns on Amgen, a large biotechnology firm, against monthly returns on the S&P 500 index, and come up with the following output:

RAmgen Stock = 3.28% + 1.65 RS&P 500 ; R2= 0.20

The current one-year Treasury bill rate is 4.8% and the current thirty-year bond rate is 6.4%. The firm has 265 million shares outstanding, selling for $ 30 per share. Assume a MRP of 5.5%.

1. What is the expected return on this stock over the next year?
2. Would your expected return estimate change if the purpose was to get a discount rate to analyze a thirty-year capital budgeting project?
3. The firm has a debt/equity ratio of 3%, and faces a tax rate of 40%. It is planning to issue $2 billion in new debt and acquire a new business for that amount, with the same risk level as the firm's existing business. What will the beta be after the acquisition?
4. Southwestern Bell, a phone company, is considering expanding its operations into the media business. The beta for the company at the end of 1995 was 0.90, and the debt/equity ratio was 1. The media business is expected to be 30% of the overall firm value in 1999, and the average beta of comparable firms is 1.20; the average debt/equity ratio for these firms is 50%. The marginal corporate tax rate is 36%.
5. Estimate the beta for Southwestern Bell in 1999, assuming that it maintains its current debt/equity ratio.
6. Estimate the beta for Southwestern Bell in 1999, assuming that it decides to finance its media operations with a debt/equity ratio of 50%.
7. The chief financial officer of Adobe Systems, a growing software manufacturing firm, has approached you for some advice regarding the beta of his company. She subscribes to a service which estimates Adobe System's beta each year, and she has noticed that the beta estimates have gone down every year. She notices the firm’s beta has fallen from a value of 2.45 in 1991 to a value of 1.4 in 1995. She would like answers to the following questions.
8. Is this decline in beta unusual for a growing firm?
9. Why would the beta decline over time?
10. Is the beta likely to keep decreasing over time?