Equity Securities

TOPIC 3:   ESTIMATING RISK PARAMETERS

(LECTURE EXAMPLES & SOLUTIONS
COVERED ON TUESDAY 13 MARCH)

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Outcome 3.1

Expected return – CAPM ✅

- The risk-free rate is 5%
- The beta for an asset is 1.20
- The market risk premium is 4.5%

- **What is the required return for the asset according to the CAPM?**

$$\text{Required return} = 0.05 + 1.20(0.045) = 10.4\%$$

3.2

Outcome 3.2

Historical market betas ❓

- Boeing Company (BA) is one of the largest aerospace and defense companies in the world and has been listed on the NYSE for decades
- You are interested in calculating a value for BA's common stock, as at the end of 2000, for which you require a discount rate
- Assume the risk-free rate is 5% and the equity premium is 5.5%
- The stock price as at the end of 2000 is US$66.00 and the current annual dividend is US$0.56

- **Calculate the required rate of return for BA.**

3.3

Outcome 3.2

Historical market betas ✅

To solve this problem we need to:
- Download BA monthly prices and dividends (There are 100+ data items to 2000)
- Download S&P 500 adjusted monthly values

- Calculate monthly total returns for BA and the S&P

$$R_{BA,m} = \left(P_{BA,m} - P_{BA,m-1}\right) / P_{BA,m-1}$$

$$R_{S\&P,m} = \left(I_{S\&P,m} - I_{S\&P,m-1}\right) / I_{S\&P,m-1}$$

- Run a regression in Excel (Tools – Data Analysis – Regression)

3.4

Outcome 3.2

Historical market betas ✅

Boeing v S&P 500 (1992 - 2000)

Each point represents a monthly observation

This is the "line of best fit" and beta is the slope of the line

3.5

Outcome 3.2

Historical market betas ✅

SUMMARY OUTPUT

Regression Statistics	
Multiple R	29.92%
R Square	8.95%
Adjusted R Square	8.08%
Standard Error	0.07
Observations	106

ANOVA

	df	SS
Regression	1	0.052710131
Residual	104	0.535914942
Total	105	0.588625073

	Coefficients	Standard Error
Intercept	0.68%	0.01
Beta	0.59	0.18

The beta given by the output of the regression analysis is BA's beta

Based on the time period and interval chosen, it represents Boeing's exposure to market risk

3.6

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Slide 3.7

Outcome 3.2

Historical market betas ✅

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The alpha can be compared to $R_f(1-\beta)$

The monthly riskless rate in the period was 0.4%.

Hence, Boeing's excess return is equal to
$\alpha - R_f(1-\beta) =$
$0.68\% - 0.4\%(1-0.59)$
$= 0.52\%$ pm
$= (1 + 0.0052)^{12} - 1$
$= 6.42\%$ pa

3.7

Slide 3.8

Outcome 3.2

Historical market betas ✅

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The R^2 suggests that 8.95% of Boeing's risk comes from market risk factors, Hence 91.05% of the risk comes from firm-specific risk factors

3.8

Slide 3.9

Outcome 3.2

Historical market betas ✅

SUMMARY OUTPUT

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Adjusted R Square	8.08%
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ANOVA

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Regression	1	0.052710131
Residual	104	0.535914942
Total	105	0.588625073

	Coefficients	Standard Error
Intercept	0.68%	0.01
Beta	0.59	0.18

The standard error of this estimate implies that the true beta for Boeing could range from 0.59 ± 0.36, or from 0.23 to 0.85, with 95% confidence.

This suggests we should consider estimates of beta from regressions with caution

3.9

Slide 3.10

Outcome 3.2

Historical market betas ✅

- Betas calculated by an information provider, such as Bloomberg may differ slightly due to:
  - Exclusion of dividends
  - Sample period
  - Return interval
  - Benchmark

3.10

Slide 3.11

Outcome 3.2

Historical market betas ✅

Bloomberg's raw beta will be similar to the one derived from the previous calculation, although in this case it is calculated based on weekly data over two years

3.11

Slide 3.12

Outcome 3.2

Historical market betas ✅

The adjusted beta is designed to better estimate forward-looking betas.

The standard adjustment is 0.67 × Raw Beta + 0.33 × 1

3.12

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Outcome 3.2
Fundamental betas ✅

- Bloomberg calculates the beta of BA as at the end of 2000 as being 0.57, based on monthly returns for the period 1996 – 2000
- You have calculate the average debt-to-equity ratio for Boeing over that period as being equal to 15.56%
- Assume an effective tax rate of 35%

If debt-to-capital is 50%, debt-to-equity must be 100%

$$\beta_U = \frac{\beta_L}{\left[1+\left(D/E\right)\right]} = \frac{0.57}{1+0.1556} = 0.4932$$

$$\beta_L = \beta_U\left[1+\left(D/E\right)\right] = 0.4932\left[1+1.0\right] = 0.9865$$

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Outcome 3.2
Fundamental betas – bottom-up ❓

- Boeing change both its business mix and financial gearing in the 1990s, debt-funding the acquisition of Rockwell and McDonnell Douglass
- As at 2000 its business was divided into two segments: Commercial aircraft and Information, space, defence systems (ISDS)
  - The market value of equity and debt are $55.2 bn & $7.85 bn
  - The corporate tax rate is 35%

Segment	Revenue	Multiple	Unlevered beta
Aircraft	$26,929m	1.12	0.91
ISDS	$18,125m	0.70	0.80

- **Calculate a bottom-up beta for Boeing as at 2000**

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Outcome 3.2
Fundamental betas – bottom-up ✅

Segment	Revenue	x	β	Value	Wgt	β_{wgt}
Aircraft	$26,929m	1.12	0.91	$30,160m	70.39%	0.6405
ISDS	$18,125m	0.70	0.80	$12,688m	29.61%	0.2369

$$\text{Value}_{\text{Aircraft}} = \text{Revenue} \times \text{Multiple} = 26,929 \times 1.12 = \$30,160m$$

$$\text{Weight}_{\text{Aircraft}} = \$30,160 / \left(\$30,160 + \$12,688\right) = 70.39\%$$

$$\beta_{U,\text{Aircraft}} = \text{Weight} \times \text{Segment Beta} = 0.7039 \times 0.91 = 0.6405$$

$$\beta_{U,\text{Firm}} = 0.6405 + 0.2369 = 0.8774$$

$$\beta_{L,\text{Firm}} = \beta_{U,\text{Firm}}\left[1+\left(D/E\right)\right] = 0.8774\left[1+\left(7.85/55/2\right)\right] = 1.0022$$

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Outcome 3.2
Fundamental betas – bottom-up ❓

- Boeing change both its business mix and financial gearing in the 1990s, debt-funding the acquisition of Rockwell and McDonnell Douglass
- At the time of its acquisition of MDD, the business values were as follows:

Company	β	Debt	Equity	Value
Boeing	0.95	$3,980m	$32,438m	$36,418m
MDD	0.90	$2,143m	$12,555m	$14,698m

- **Calculate a bottom-up beta for Boeing after its acquisition of MDD**

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Outcome 3.2
Fundamental betas – bottom-up ✅

Company	β	Debt	Equity	Value
Boeing	0.95	$3,980m	$32,438m	$36,418m
MDD	0.90	$2,143m	$12,555m	$14,698m

$$\beta_{U,\text{Boeing}} = 0.95 / \left[1+\left(3,980/32,438\right)\right] = 0.85$$

$$\beta_{U,\text{MDD}} = 0.90 / \left[1+\left(2,143/12,555\right)\right] = 0.77$$

$$\beta_{U,\text{Firm}} = 0.85\left(36,418/51,116\right) + 0.77\left(14,698/51,116\right) = 0.83$$

$$D/E_{\text{Firm}} = \left(3,980+2,143\right) / \left(32,438+12,555\right) = 13.61\%$$

$$\beta_{L,\text{Firm}} = 0.83\left[1+0.1361\right] = 0.94$$

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