

Hurdle rates in practice

110 common errors in company valuations

- Betas of listed real estate firms in Spain

Beta	Vallehermoso	Colonial	Metrovacesa	Bani	Urbir	Average
Levered	0.49	0.12	0.38	0.67	0.42	0.42
Unlevered	0.29	0.11	0.27	0.39	0.28	0.47

“The resulting unlevered beta (0.27) is so small that it makes no sense to use it to value any company, let alone an unlisted one. By changing estimation period Average unlevered beta can range anywhere between 0.22 to 0.85...” Fenandez and Bilan (2007) IESE Working Paper.

Las Vegas Sands: Background

- Las Vegas Sands owns and operates the Venetian Casino and Sands Convention Center in Las Vegas and the Sands Macau Casino in Macau, China. While the firm does not fit the classic profile of a declining company – its revenues increased from \$1.75 billion in 2005 to \$4.39 billion in 2008 and it had two other casinos in development – it ran into significant financial trouble in the last quarter of 2008. Fears about whether the firm would be able to meet its debt obligations pushed down both stock prices (almost 90%) and bond prices (about 40%) in 2008.
- By January 2009, the firm was operating under the threat of defaulting on its debt and both its debt and equity prices reflected that fear.
- Source: Dark side of valuation: Damodaran

Las Vegas Sands: Background

- The debt was rated B2 by Moody's (and B+ by S&P) and a bond issued by Las Vegas Sands, expiring in 2015, was trading at a yield to maturity of 19.82%.
- Debt to total capital ratio = 74%
- The regression beta, estimated using two years of weekly returns from January 2007 to January 2009 was 2.78. Using a riskfree rate of 3% (the ten-year bond rate at the time of the analysis) and an equity risk premium of 6%, we derive a cost of equity of
- 19.68% for the firm.
- Cost of equity = $3\% + 2.78(6\%) = 19.68\%$
- Discussion: $k_d > k_s$, what does this mean?

Topics

- WACC: Practical issues with estimation
 - Choosing risk free rate
 - Length of estimation period
 - Estimating risk premia
 - Estimating beta of when stock price non-observable
 - Measurement error in beta estimation
- The impact of restructuring and divestiture on WACC
 - WACC for firms with multiple divisions
 - WACC after divesting a unit
 - WACC after acquisition in new business

Choosing the risk-free rate

- Characteristics of a risk-free asset
 - No default risk
 - No reinvestment risk
 - Thus, the key is to use government security with maturity that matches life of project.
- Picking the right risk free means you already have an adjustment for macro (sovereign risk).
- What to use when Rf asset not available (Sovereign bankruptcy)
 - Look at rate of largest and safest firm and use their rate of borrowing adjusted by default spread
 - Use forward contracts

Using forward contracts to estimate risk-free rate

$$F_t = S_t(1 + r_{FC}) / (1 + r_{\$})$$

- Suppose current spot rate is 35 THB/US\$ and ten year forward rate is 50 THB/US\$, the current US 10-year t-bond rate is 5%, the Thai risk free rate is 8.8%

$$50 = 35(1 + r_{FC})^{10} / (1.05)^{10}$$

Using forward contracts to estimate risk-free rate

Usually, only a one-year forward rate exist, so an approximation can be made from one-year forward,

Suppose current spot rate is 38.1 THB/US\$ and **one** year forward rate is 39.95 THB/US\$, the current US 1-year t-bond rate is 4%, the Thai risk free rate is 9.04%. Now assume the spread between 10 year and 1 year treasury is 1%. The Thai rate becomes 10.4%

$$39.95 = 38(1 + r_{FC})^1 / (1.04)^1$$

How long or short the estimation period

- Researchers prefer 60 months estimation window.
- In emerging markets, structural breaks occur so often that using shorter and more recent data is likely to be a better basis.

What if market risk premium is negative?

- Pick a longer history such that risk premium reflects long run market expectation.

	Rm-Rf
Last year avg	-5%
Last 3 year average	8%

- Pick a period in history that matches your expectation of near future. Ex. If you expect a bullish year next year, then pick period in history that resembles your expectations for next year.
- Needs risk free instrument that is liquid.

The Bloomberg adjustment

- Adjusted beta = Regression beta * 0.67 + 1.0 * 0.33
- Why adjust betas towards one? The rationale can be traced to studies that indicate that, over time, there is a tendency on the part of betas of all companies to move towards one. Intuitively, this should not be surprising. Firms that survive in the market tend to increase in size over time, become more diversified and have more assets in place

Estimating discount rates when market prices unobservable

1. Use sector averages

$$\text{Unlevered Beta for sector} = \frac{\text{Average Regression Beta for publicly traded firms}}{(1 + (1 - \text{Tax Rate}) \text{ Average Market D/E Ratio for sector})}$$

2. Use industry ROA

$$- \text{WACC} = R_A = (E/V)R_E + (D/V)(1-t)R_D$$

- Rearranging the above gives

$$R_E = R_A + (R_A - R_D)(D/E)(1-t)$$

MM: No tax no bankruptcy - Equations

- $WACC = R_A = (E/V)R_E + (D/V)R_D$
- Rearranging the above gives

$$R_E = R_A + (R_A - R_D)(D/E)$$
 - R_A is the “cost” of the firm’s business risk, i.e., the risk of the firm’s assets
 - $(R_A - R_D)(D/E)$ is the “cost” of the firm’s financial risk, i.e., the additional return required by stockholders to compensate for the risk of leverage

The cost of equity and WACC in a world with no taxes and no bankruptcy

- A firm has WACC = 12%. It can borrow at 8%. Assuming the firm’s targets equity = 80% and debt = 20%. What is the cost of equity. Now suppose, the firm changes target equity = 50%. Recompute the firm’s WACC.
- $R_E = R_A + (R_A - R_D)(D/E)$
 $= 12\% + (12\% - 8\%)0.25 = 13\%$
- $WACC = E/V \times R_E + D/V \times R_D = 0.8 \times 13\% + 0.2 \times 8\% = 12\%$
- When D/E changes to 1.0, then, cost of equity becomes 16%.
- New WACC = $0.5 \times 16\% + 0.5 \times 8\% = 12\%$

The CAPM, the SML and MM Proposition

- How does financial leverage affect systematic risk?
- CAPM: $R_A = R_f + \beta_A(R_M - R_f)$
 - Where β_A is the firm’s asset beta and measures the systematic risk of the firm’s assets
- From MM proposition
 - $R_E = R_A + (R_A - R_D)(D/E)$
 Replace R_A with the CAPM above and assume that the debt is riskless ($R_D = R_f$) gives
 $R_E = R_f + \beta_A(1 + D/E)(R_M - R_f)$

Business Risk and Financial Risk

- $R_E = R_f + \beta_A(1 + D/E)(R_M - R_f)$
- CAPM: $R_E = R_f + \beta_E(R_M - R_f)$
 - $\beta_E = \beta_A(1 + D/E)$
 - If there is taxes, then $\beta_E = \beta_A(1 + D/E(1-T))^*$
- Therefore, the systematic risk of the stock depends on:
 - Systematic risk of the assets, β_A (business risk)
 - Level of leverage, D/E (financial risk)
- * Does this look familiar?

Beta of a non-listed firm

- Step1: Pick firm in similar industry that is listed.
- Step2: Compute unleveraged industry beta of listed firm chosen.
- Step3: Compute levered beta, using the client's firm debt/equity ratio.
- Here's the formula:

$$\beta_L = \beta_U (1 + (1 - t)(D / E))$$

Example: Computing beta of non-listed firm

- Company A and B are in the same business. The first is listed, the second is not. Com A has a beta of 1.40 and market value of average debt to equity of 14%. Com B has debt to equity ratio of 25%. Compute the appropriate beta for Com B. Assume tax = 36%.

Step1: Compute unlevered beta of A from,
Unlevered beta = Current beta/[1+(1-tax rate)(debt/equity)]
= 1.4/[1+(1-0.36)(0.14)] = 1.289

Step 2: Compute levered beta of B from,
Levered beta = 1.289*[1+(1-0.36)(0.25)] = 1.49

Other issues with WACC

- Rolling or static WACC
- Rolling is preferred when debt/equity structure from year-to-year is volatile and that it is difficult to derive a target D/E
- Young firms
- Firms going through restructuring
- Otherwise, a target capital structure should reflect the firm's credit rating objective.
- It is quite alright to assume that current structure is optimal
- Adjustments can be made if there is expected change in capital structure over the estimation period.

The impact of restructuring and divestiture on WACC

Example 1: Cost of equity for firms with multiple division

- 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.

Business Group	Market Value of Firm	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

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Example 1: Q1

- 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?

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Example 1: A1

- The firm beta can be estimated from the market value weighted beta of its business groups. Thus, the beta for Hewlett Packard is,
- $1.1(2/8) + 1.5(2/8) + 2(1/8) + 1(3/8) = 1.275$
- This beta is unlikely to equal to the beta estimated by regressing past excess returns against past market risk premium because of estimation error.

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Example 1: Q2

- If the treasury bond rate is 7.5% and the market risk premium is 5.5%, 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?

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Example 1: A2

- Cost of equity for HP = $7.5\% + 1.275(5.5\%) = 14.51\%$
- Cost of equity (Main frames) = $7.5\% + 1.1(5.5\%) = 13.55\%$
- Cost of equity (PC) = $7.5\% + (1.5(5.5\%)) = 15.75\%$
- Cost of equity (Software) = 18.50%
- Cost of equity (Printer) = 13.00%

Example 1: Q3

- 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. Each division has debt allocated proportionately to its market value weight, ie. Mainframe debt = $(2/8)*1$ bn = 0.25 bn and so on.) Let tax rate = 36%.

Example 1: A3

Division	Beta	Unlevered beta	Value of division (D+E)	Debt
Mainframes	1.1	1.01	2	0.25
PCs	1.5	1.37	2	0.25
Software	2	1.83	1	0.125
Printers	1	0.92	3	0.375
Total	-	-	8	1

Value of firm without mainframes = $8 - 2 = 6.0$

Unlevered beta without mainframes

= $1.37(2/6.0) + 1.83(1.0/6.0) + 0.92(3.0/6.0) = 1.22$

New debt to equity ratio =

Old debt – Mainframe debt/Value of firm without mainframe

= $(1 - 0.25)/6.0 = 0.125$

New levered beta = $1.22(1+(1-0.36)(0.125)) = 1.32$

Example 2: Beta of firms after divesting

- You have collected returns on AnaDone Corporation (AD Corp.), a large diversified manufacturing firm, and the NYSE index for five years:

Year	AD Corp Excess return (R _i -R _f)	NYSE Market Risk Premium
2001	10% - 6% = 4%	5% - 6% = -1%
2002	5% - 6% = -1%	15% - 6% = 9%
2003	-5% - 6% = -11%	8% - 6% = 2%
2004	20% - 6% = 14%	12% - 6% = 6%
2005	-5% - 6% = -11%	-5% - 6% = -11%

Example 2: Q1

- Estimate the slope (beta) of the regression. Assume now that you are an undiversified investor and that you have all of your money invested in AD Corporation. What would be a good measure of the risk that you are taking on?

	$r(i)$	$r(m)$
2001	0.04	-0.01
2002	-0.01	0.09
2003	-0.11	0.02
2004	0.14	0.06
2005	-0.11	-0.11

cov(r_i, r_m)	0.0035
var(r_m)	0.0060
beta	0.5882
std (r_i)	0.1061

- The firm beta is approx 0.59 The risk of an undiversified investor is best captured by the standard deviation.

Example 2: Q2

- AD is planning to sell off one of its divisions. The division under consideration has assets which comprise half of the book value of AD Corporation, and 20% of the market value. Its beta is twice the average beta for AD Corp (before divestment). What will the beta of AD Corporation be after divesting this division?

Example 2: A2

- Beta for divested division is $2(0.59) = 1.18$
- Let new beta after divestiture = X, then it must be that,
- $1.18(0.2) + X(0.8) = 0.59$
- $X = 0.45$

Example 3: Cost of equity after divesting and acquisition

- You run a regression of monthly excess returns of Mapco Inc, an oil and gas producing firm, on the S&P 500 index market premium and come up with the following output for the period 1991 to 1995.
- Intercept of the regression = 0.06%
- X-coefficient of the regression = 0.46
- Standard error of X-coefficient = 0.20
- R squared = 5%
- There are 20 million shares outstanding, and the current market price is \$ 2. The firm has \$ 20 million in debt outstanding. (The firm has a tax rate of 36%)

Example 3: Q1

- What would an investor in Mapco's stock require as a return, if the T.Bond rate is 6% and market premium is 5.5%? What proportion of this firm's risk is diversifiable?
- Expected return = $6\% + 0.46(5.5\%) = 8.53\%$
- Proportion of risk that is diversifiable is
- $1 - R_{sq} = 1 - 0.05 = 95\%$

Example 3: Q2

- Assume now that Mapco has three divisions, of equal size (in market value terms). It plans to divest itself of one of the divisions for \$ 20 million in cash and acquire another for \$ 50 million (It will borrow \$ 30 million to complete this acquisition). The division it is divesting is in a business line where the average unlevered beta is 0.20, and the division it is acquiring is in a business line where the average unlevered beta is 0.80. What will the beta of Mapco be after this acquisition?

Example 3: A2

- Existing debt/equity = $20/(20 \times 2) = 0.50$
- Unlevered firm beta = $0.46/(1 + (1 - 0.36)(0.5)) = 0.35$
- Let X = beta of remaining non-divested divisions
- Unlevered beta without divested division
- $= 0.2(20/60) + X(40/60) = 0.35$
- $X = 0.42$
- Unlevered beta with NEW division
- $= 0.42(40/90) + 0.8(50/90) = 0.63$
- New debt/equity = $(20 + 30)/40 = 1.25$
- New levered beta = $0.63 + (1 + (1 - 0.36)(1.25)) = 1.13$

Computer exercise

Use **euronxt100.xls** data file to compute security beta for the following stocks:

Compute individual stock beta of Lafarge, BNP Paribas, Michelin, and Carrefour using monthly data between 2007-2012.

Use the historical data 2007-2012 as an estimate of expected market premium for 2012.

Obtain the cost of equity for 2012 based on your beta estimates

Homework

- Use **property.xls** data file to compute security beta for the following stocks:
- Compute individual stock beta of LH, MBK, NOBLE, QH, SIRI, and SPALI using **weekly** data between 2002-2004.
- Use the historical data 2002-2004 as an estimate of expected market premium for 2005.
- Obtain the cost of equity for 2005 based on your beta estimates
- Analyze your results. Do you see anything interesting?