

Why bottom-up betas?

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- Less Noisy: The standard error in a bottom-up beta will be significantly lower than the standard error in a single regression beta. Roughly speaking, the standard error of a bottom-up beta estimate can be written as follows:

$$\text{Std error of bottom-up beta} = \frac{\text{Average Std Error across Betas}}{\sqrt{\text{Number of firms in sample}}}$$

- Updated: The bottom-up beta can be adjusted to reflect changes in the firm's business mix and financial leverage. Regression betas reflect the past.
- Don't need prices: You can estimate bottom-up betas even when you do not have historical stock prices. This is the case with initial public offerings, private businesses or divisions of companies.

Estimating Bottom Up Betas & Costs of Equity: Vale

<i>Business</i>	<i>Sample</i>	<i>Sample size</i>	<i>Unlevered beta of business</i>	<i>Revenues</i>	<i>Peer Group EV/Sales</i>	<i>Value of Business</i>	<i>Proportion of Vale</i>
Metals & Mining	Global firms in metals & mining, Market cap>\$1 billion	48	0.86	\$9,013	1.97	\$17,739	16.65%
Iron Ore	Global firms in iron ore	78	0.83	\$32,717	2.48	\$81,188	76.20%
Fertilizers	Global specialty chemical firms	693	0.99	\$3,777	1.52	\$5,741	5.39%
Logistics	Global transportation firms	223	0.75	\$1,644	1.14	\$1,874	1.76%
<i>Vale Operations</i>			<i>0.8440</i>	<i>\$47,151</i>		<i>\$106,543</i>	<i>100.00%</i>

Business	Unlevered beta	D/E ratio	Levered beta	Risk free rate	ERP	Cost of Equity
Metals & Mining	0.86	54.99%	1.1657	2.75%	7.38%	11.35%
Iron Ore	0.83	54.99%	1.1358	2.75%	7.38%	11.13%
Fertilizers	0.99	54.99%	1.3493	2.75%	7.38%	12.70%
Logistics	0.75	54.99%	1.0222	2.75%	7.38%	10.29%
Vale Operations	0.84	54.99%	1.1503	2.75%	7.38%	11.23%

Embraer's Bottom-up Beta

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Business	Unlevered Beta	D/E Ratio	Levered beta
Aerospace	0.95	18.95%	1.07

- Levered Beta = Unlevered Beta (1 + (1- tax rate) (D/E Ratio))
= 0.95 (1 + (1-.34) (.1895)) = 1.07

- Can an unlevered beta estimated using U.S. and European aerospace companies be used to estimate the beta for a Brazilian aerospace company?
 - a. Yes
 - b. No

What concerns would you have in making this assumption?

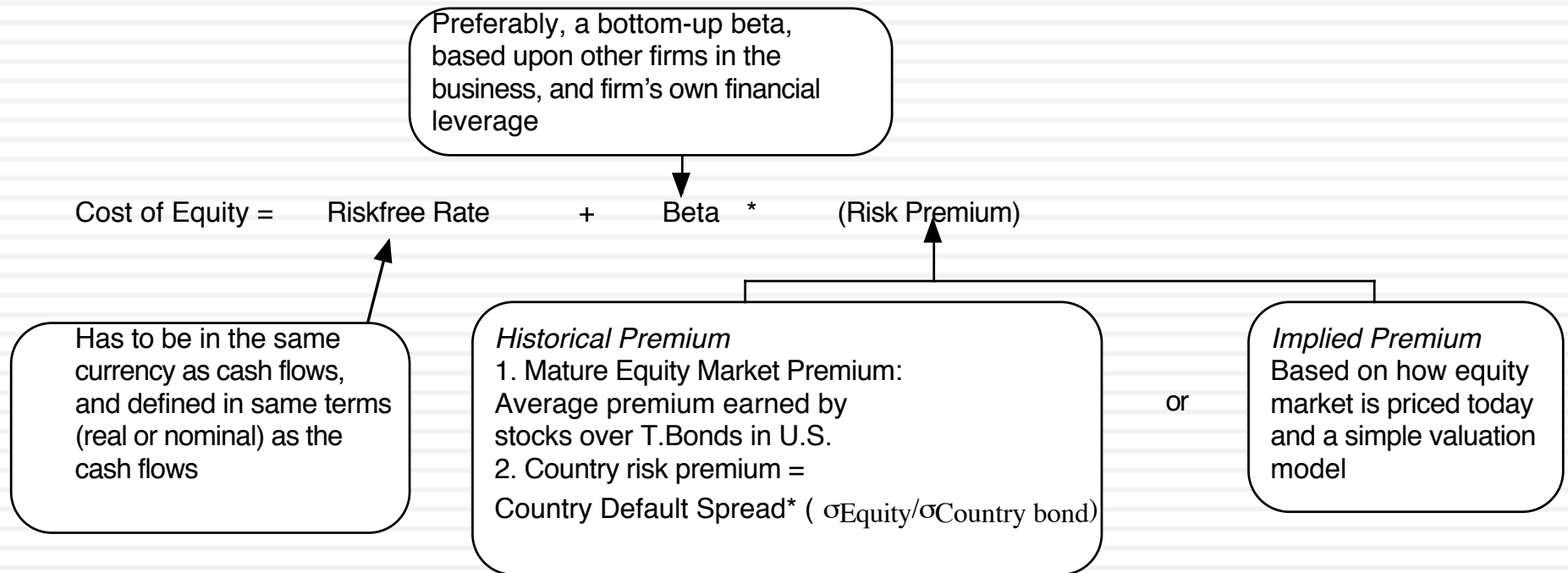
Gross Debt versus Net Debt Approaches

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- Analysts in Europe and Latin America often take the difference between debt and cash (net debt) when computing debt ratios and arrive at very different values.
- For Embraer, using the gross debt ratio
 - ▣ Gross D/E Ratio for Embraer = $1953/11,042 = 18.95\%$
 - ▣ Levered Beta using Gross Debt ratio = 1.07
- Using the net debt ratio, we get
 - ▣ Net Debt Ratio for Embraer = $(\text{Debt} - \text{Cash}) / \text{Market value of Equity}$
 $= (1953 - 2320) / 11,042 = -3.32\%$
 - ▣ Levered Beta using Net Debt Ratio = $0.95 (1 + (1 - .34) (-.0332)) = 0.93$
- The cost of Equity using net debt levered beta for Embraer will be much lower than with the gross debt approach. The cost of capital for Embraer will even out since the debt ratio used in the cost of capital equation will now be a net debt ratio rather than a gross debt ratio.

The Cost of Equity: A Recap

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Discount Rates: IV

Mopping up

Estimating the Cost of Debt

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- The cost of debt is the rate at which you can borrow at currently, It will reflect not only your default risk but also the level of interest rates in the market.
- The two most widely used approaches to estimating cost of debt are:
 - Looking up the yield to maturity on a straight bond outstanding from the firm. The limitation of this approach is that very few firms have long term straight bonds that are liquid and widely traded
 - Looking up the rating for the firm and estimating a default spread based upon the rating. While this approach is more robust, different bonds from the same firm can have different ratings. You have to use a median rating for the firm
- When in trouble (either because you have no ratings or multiple ratings for a firm), estimate a synthetic rating for your firm and the cost of debt based upon that rating.

Estimating Synthetic Ratings

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- The rating for a firm can be estimated using the financial characteristics of the firm. In its simplest form, the rating can be estimated from the interest coverage ratio

$$\text{Interest Coverage Ratio} = \text{EBIT} / \text{Interest Expenses}$$

- For Embraer's interest coverage ratio, we used the interest expenses from 2003 and the average EBIT from 2001 to 2003. (The aircraft business was badly affected by 9/11 and its aftermath. In 2002 and 2003, Embraer reported significant drops in operating income)

$$\text{Interest Coverage Ratio} = 462.1 / 129.70 = 3.56$$

Interest Coverage Ratios, Ratings and Default Spreads: 2004

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If Interest Coverage Ratio is	Estimated Bond Rating	Default Spread(2004)
> 8.50 (>12.50)	AAA	0.35%
6.50 - 8.50 (9.5-12.5)	AA	0.50%
5.50 - 6.50 (7.5-9.5)	A+	0.70%
4.25 - 5.50 (6-7.5)	A	0.85%
3.00 - 4.25 (4.5-6)	A-	1.00%
2.50 - 3.00 (4-4.5)	BBB	1.50%
2.25- 2.50 (3.5-4)	BB+	2.00%
2.00 - 2.25 ((3-3.5)	BB	2.50%
1.75 - 2.00 (2.5-3)	B+	3.25%
1.50 - 1.75 (2-2.5)	B	4.00%
1.25 - 1.50 (1.5-2)	B -	6.00%
0.80 - 1.25 (1.25-1.5)	CCC	8.00%
0.65 - 0.80 (0.8-1.25)	CC	10.00%
0.20 - 0.65 (0.5-0.8)	C	12.00%
< 0.20 (<0.5)	D	20.00%

Cost of Debt computations

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- Based on the interest coverage ratio of 3.56, the synthetic rating for Embraer is A-, giving it a default spread of 1.00%
- Companies in countries with low bond ratings and high default risk might bear the burden of country default risk, especially if they are smaller or have all of their revenues within the country.
 - If I assume that Embraer bears all of the country risk burden, I would add on the country default spread for Brazil in 2004 of 6.01%.
 - Larger companies that derive a significant portion of their revenues in global markets may be less exposed to country default risk. I am going to add only two thirds of the Brazilian country risk (based upon traded bond spreads of other large Brazilian companies in 2004)

Cost of debt

= Riskfree rate + 2/3(Brazil country default spread) + Company default spread = 4.29% + 2/3 (6.01%) + 1.00% = 9.29%

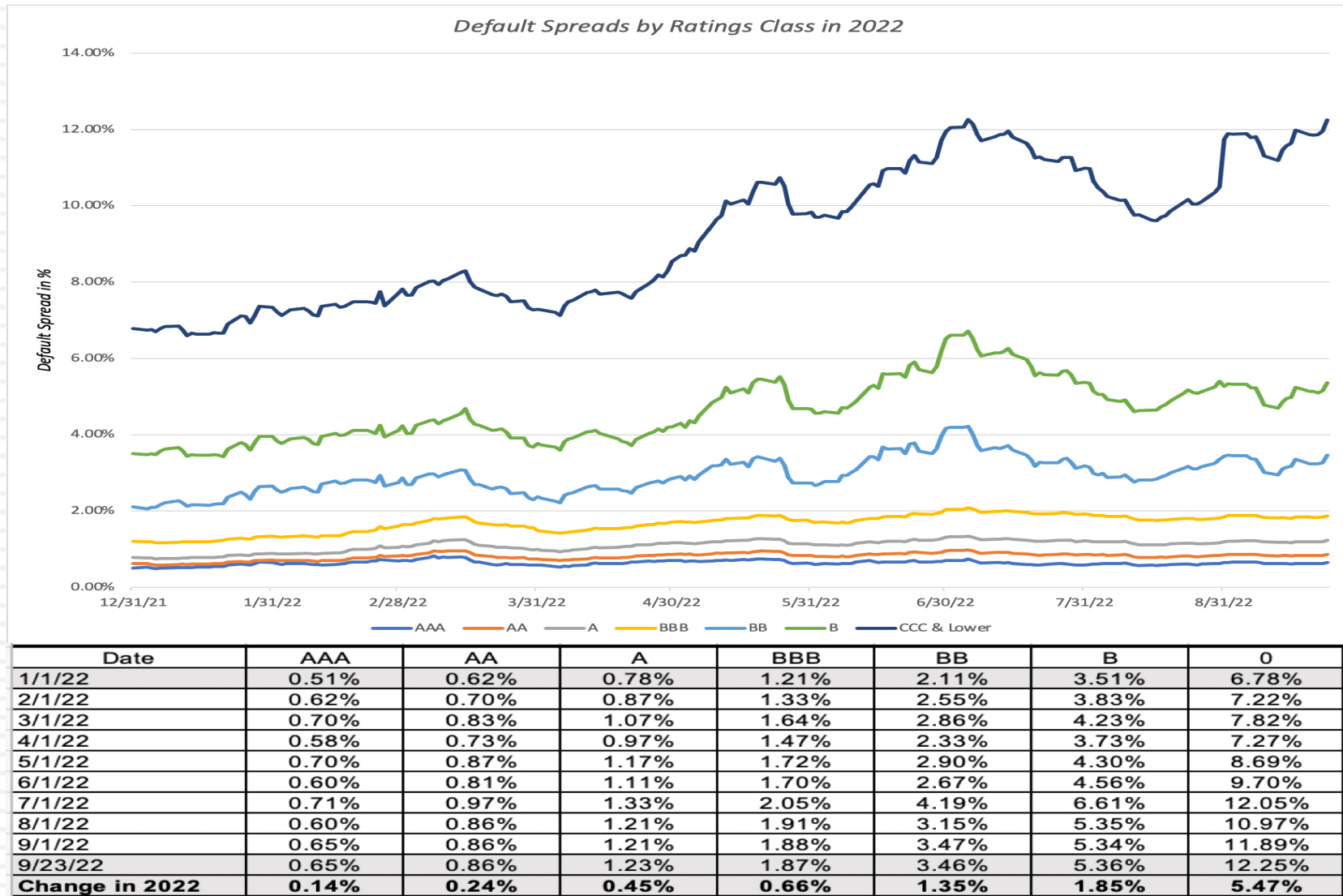
Synthetic Ratings: Some Caveats

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- The relationship between interest coverage ratios and ratings, developed using US companies, tends to travel well, as long as we are analyzing large manufacturing firms in markets with interest rates close to the US interest rate
- They are more problematic when looking at smaller companies in markets with higher interest rates than the US. One way to adjust for this difference is modify the interest coverage ratio table to reflect interest rate differences (For instances, if interest rates in an emerging market are twice as high as rates in the US, halve the interest coverage ratio).

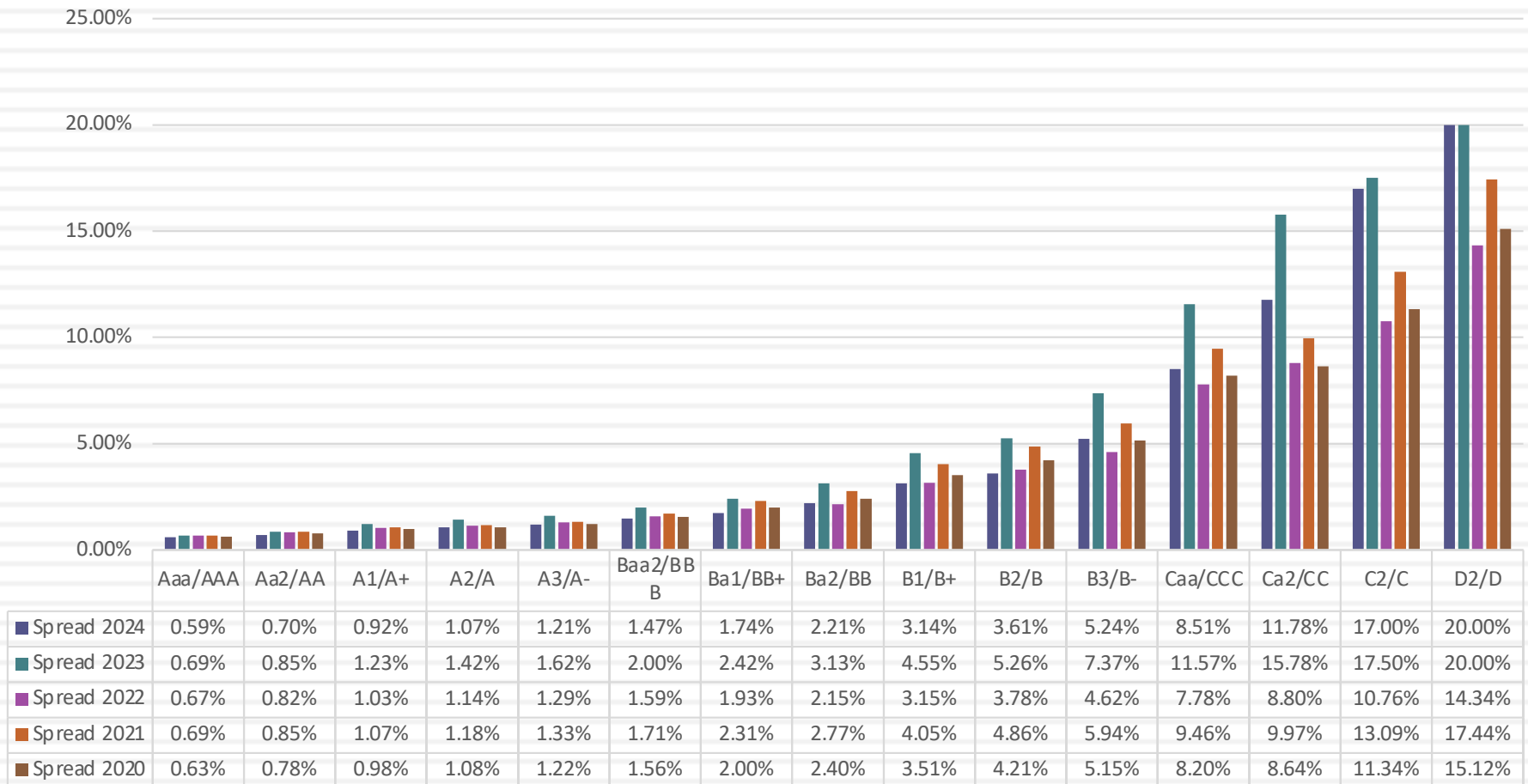
Default Spreads: Change is a constant

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Default Spreads – January 2024

Corporate Bond Default Spreads



Subsidized Debt: What should we do?

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- Assume that the Brazilian government lends money to Embraer at a subsidized interest rate (say 6% in dollar terms). In computing the cost of capital to value Embraer, should we use the cost of debt based upon default risk or the subsidized cost of debt?
 - a. The subsidized cost of debt (6%). That is what the company is paying.
 - b. The fair cost of debt (9.25%). That is what the company should require its projects to cover.
 - c. A number in the middle.

Weights for the Cost of Capital Computation

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- In computing the cost of capital for a publicly traded firm, the general rule for computing weights for debt and equity is that you use market value weights (and not book value weights). Why?
 - a. Because the market is usually right
 - b. Because market values are easy to obtain
 - c. Because book values of debt and equity are meaningless
 - d. None of the above

Estimating Cost of Capital: Embraer in 2004

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□ Equity

- Cost of Equity = $4.29\% + 1.07 (4\%) + 0.27 (7.89\%) = 10.70\%$
- Market Value of Equity = 11,042 million BR (\$ 3,781 million)

□ Debt

- Cost of debt = $4.29\% + 4.00\% + 1.00\% = 9.29\%$
- Market Value of Debt = 2,083 million BR (\$713 million)

□ Cost of Capital = $10.70\% (.84) + 9.29\% (1 - .34) (0.16) = 9.97\%$

- The book value of equity at Embraer is 3,350 million BR.
- The book value of debt at Embraer is 1,953 million BR; Interest expense is 222 mil BR; Average maturity of debt = 4 years
- Estimated market value of debt = $222 \text{ million (PV of annuity, 4 years, 9.29\%)} + \$1,953 \text{ million} / 1.0929^4 = 2,083 \text{ million BR}$

If you had to do it....Converting a Dollar Cost of Capital to a Nominal Real Cost of Capital

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- Approach 1: Use a BR riskfree rate in all of the calculations above. For instance, if the BR riskfree rate was 12%, the cost of capital would be computed as follows:
 - Cost of Equity = 12% + 1.07(4%) + 0.27 (7.89%) = 18.41%
 - Cost of Debt = 12% + 1% = 13%
 - (This assumes the riskfree rate has no country risk premium embedded in it.)
- Approach 2: Use the differential inflation rate to estimate the cost of capital. For instance, if the inflation rate in BR is 8% and the inflation rate in the U.S. is 2%

$$\text{Cost of capital} = (1 + \text{Cost of Capital}_{\$}) \left[\frac{1 + \text{Inflation}_{\text{BR}}}{1 + \text{Inflation}_{\$}} \right]$$

$$= 1.0997 (1.08/1.02) - 1 = 0.1644 \text{ or } 16.44\%$$

Dealing with Hybrids and Preferred Stock

- When dealing with hybrids (convertible bonds, for instance), break the security down into debt and equity and allocate the amounts accordingly. Thus, if a firm has \$ 125 million in convertible debt outstanding, break the \$125 million into straight debt and conversion option components. The conversion option is equity.
- When dealing with preferred stock, it is better to keep it as a separate component. The cost of preferred stock is the preferred dividend yield. (As a rule of thumb, if the preferred stock is less than 5% of the outstanding market value of the firm, lumping it in with debt will make no significant impact on your valuation).

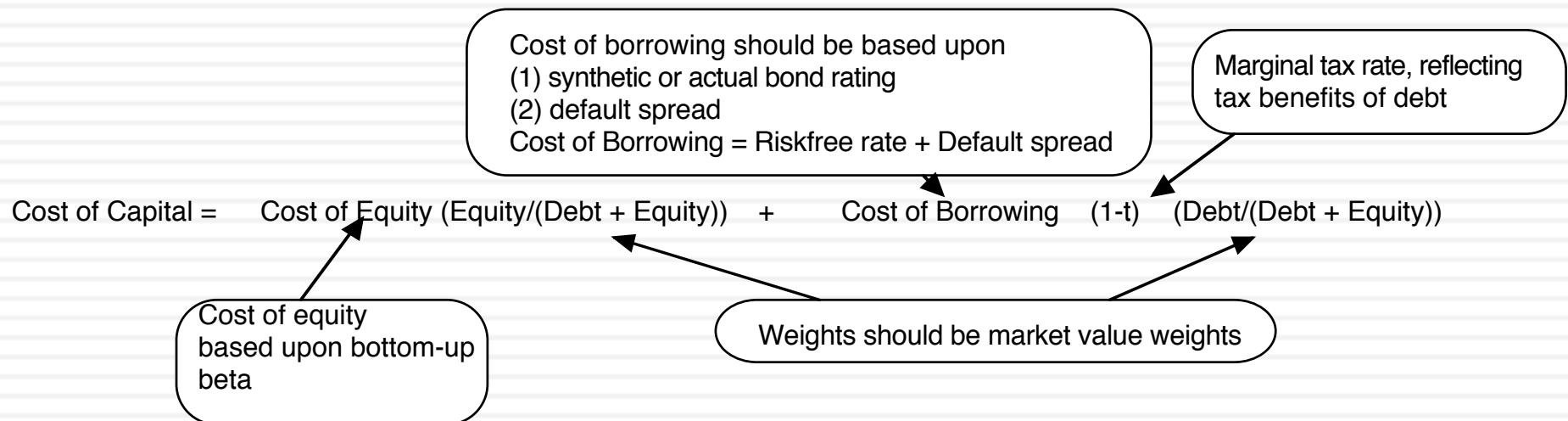
Decomposing a convertible bond...

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- Assume that the firm that you are analyzing has \$125 million in face value of convertible debt with a stated interest rate of 4%, a 10 year maturity and a market value of \$140 million. If the firm has a bond rating of A and the interest rate on A-rated straight bond is 8%, you can break down the value of the convertible bond into straight debt and equity portions.
 - Straight debt = (4% of \$125 million) (PV of annuity, 10 years, 8%) + 125 million/ 1.08^{10} = \$91.45 million
 - Equity portion = \$140 million - \$91.45 million = \$48.55 million
- The debt portion (\$91.45 million) gets added to debt and the option portion (\$48.55 million) gets added to the market capitalization to get to the debt and equity weights in the cost of capital.

Recapping the Cost of Capital

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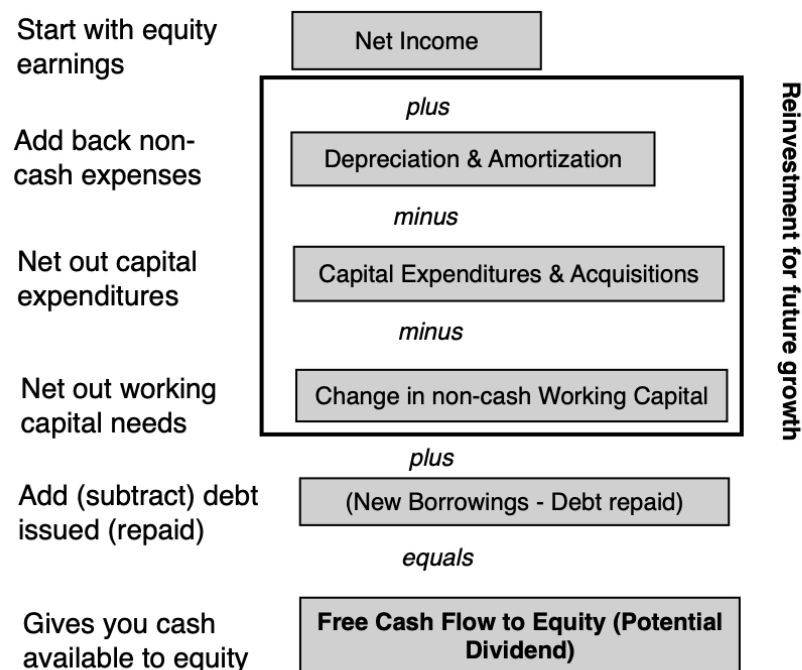
Estimating Cash Flows

Cash is king...

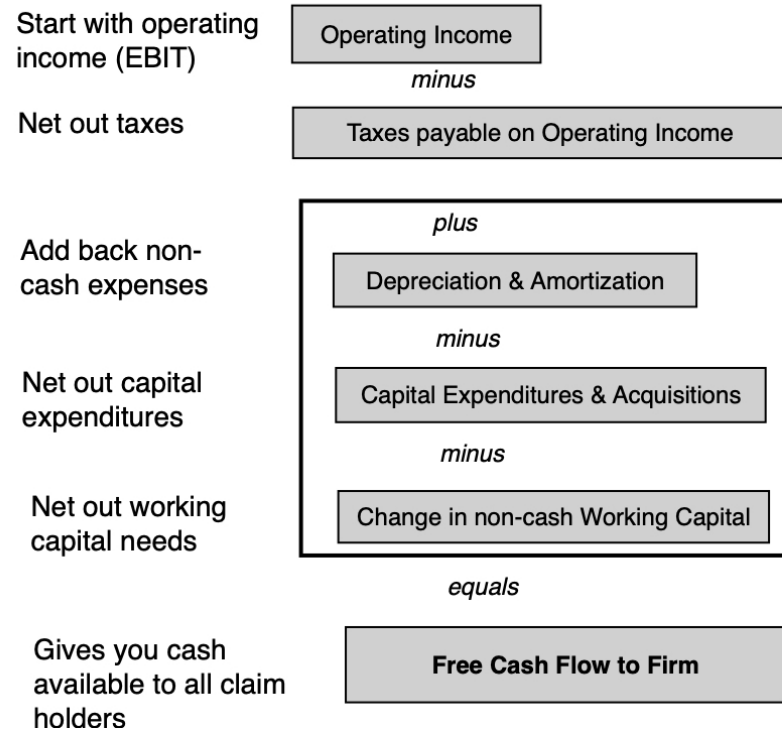
Free Cash Flow: FCFE and FCFF

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Free Cash Flow to Equity



Free Cash Flow to Firm



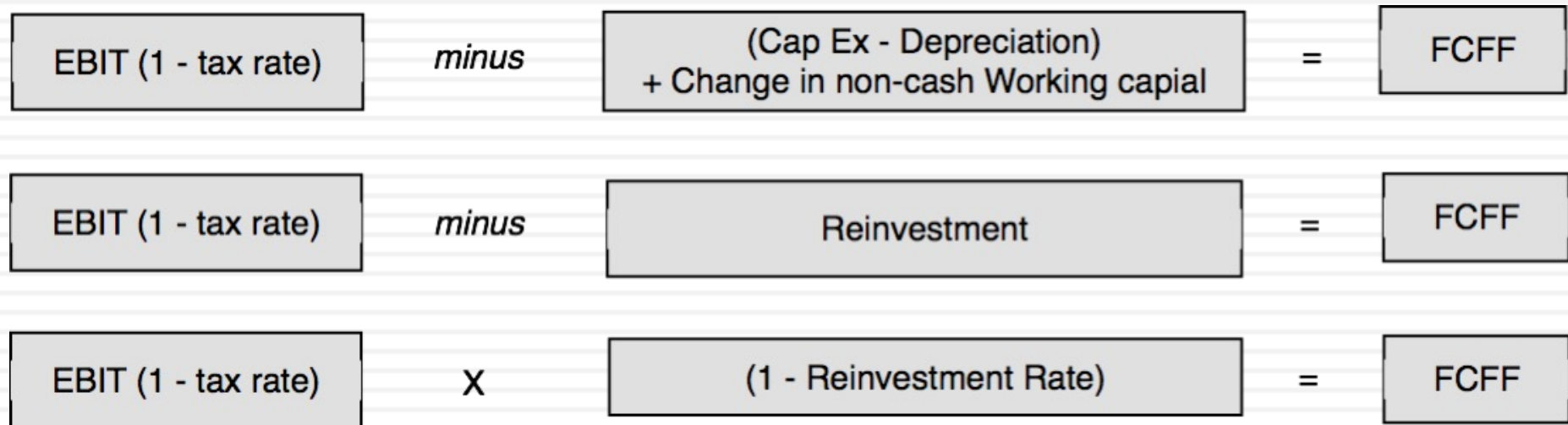
Steps in Cash Flow Estimation

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- Estimate the current earnings of the firm
 - If looking at cash flows to equity, look at earnings after interest expenses - i.e. net income
 - If looking at cash flows to the firm, look at operating earnings after taxes
- Consider how much the firm invested to create future growth
 - If the investment is not expensed, it will be categorized as capital expenditures. To the extent that depreciation provides a cash flow, it will cover some of these expenditures.
 - Increasing working capital needs are also investments for future growth
- If looking at cash flows to equity, consider the cash flows from net debt issues (debt issued - debt repaid)

Measuring Free Cash Flow to the Firm: Three pathways to the same end game

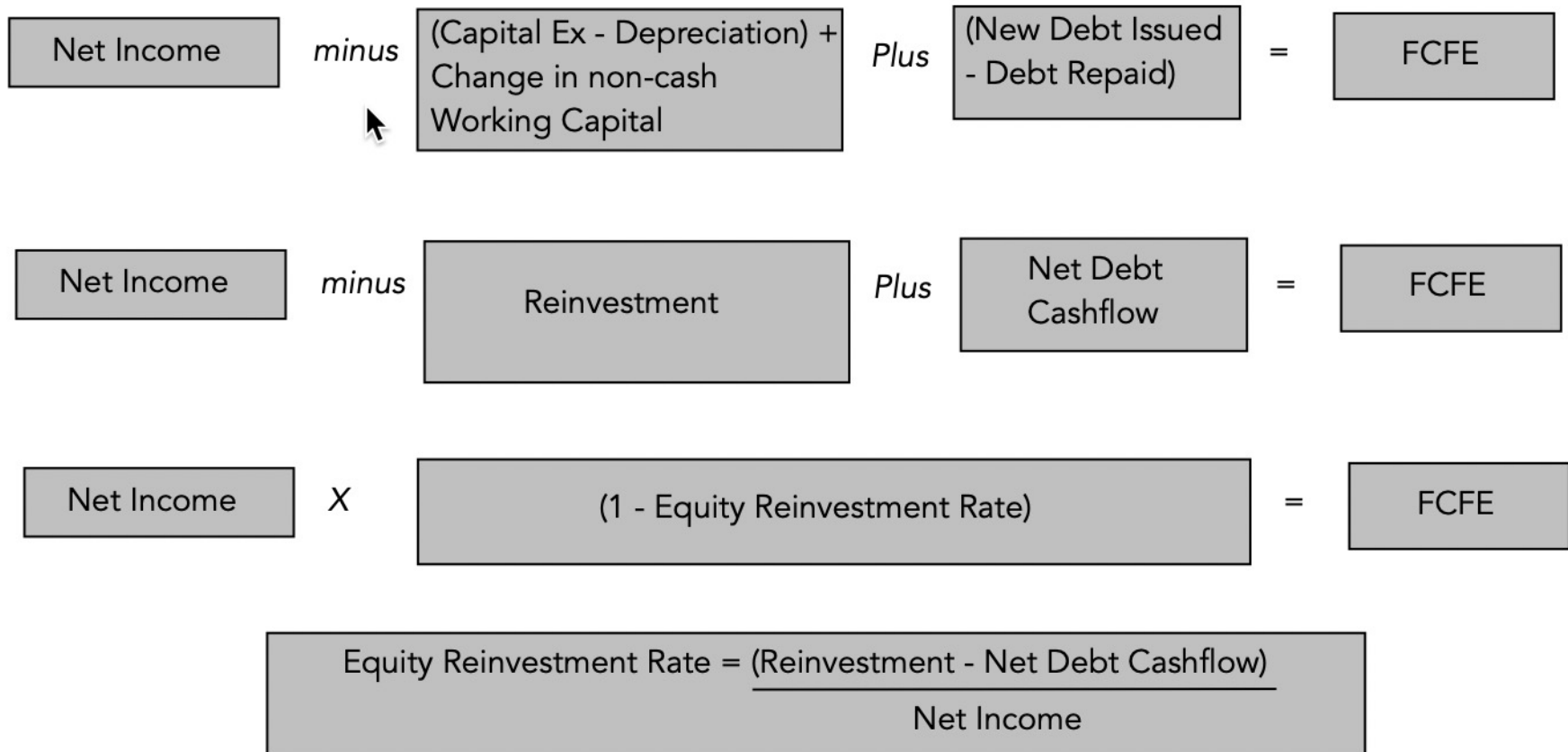
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Where are the tax savings from interest expenses?

Measuring Free Cash Flow to Equity: Alternative Pathways

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Microsoft in 2021: FCFE and FCFF

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