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Beta

The Forgotten Middle Child of Valuation ABCs

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BETA – THE FORGOTTEN MIDDLE CHILD OF VALUATION'S ABCS

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The examples provided herein are simplified and may not be applicable in all contexts.

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Presentation Overview

1. **Overview of Betas**
2. **Application of Betas**
3. **Other Considerations**
4. **Case Study**

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PRESENTATION OVERVIEW

1. **Overview of Betas**
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1. Overview of Betas – What is a Beta?

- Beta measures a security's sensitivity to market movements.
- Demonstrates correlation between a security's returns relative to overall market returns.
  - $\beta = 1$: same volatility as the market.
  - $\beta > 1$: more volatile than market → higher risk & potential return.
  - $\beta < 1$: less volatile than market → lower risk & return.
- Beta measures only a stock's systematic risk and not its unsystematic risk.

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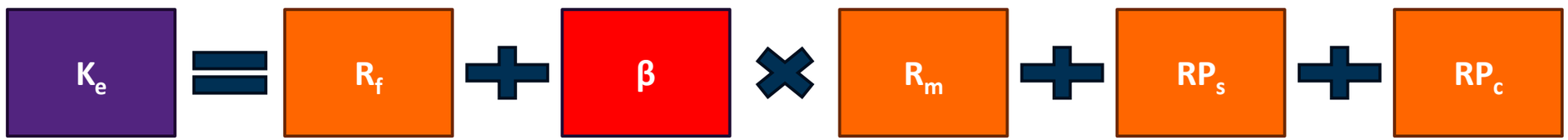
1. Overview of Betas – How is Beta Used?

- Used as part of a capital asset pricing model (CAPM) to calculate a company's cost of equity:



- Typically used as a proxy for the risk of an industry in which the subject company operates.
  - Betas used in a build-up approach if applying an industry risk premium.
- Smaller companies tend to have higher Betas.

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1. Overview of Betas – Beta Sources

Where do you source your Betas from?

a. S&P CapitalIQ
b. Bloomberg
c. Damodaran
d. Kroll Cost of Capital Navigator
e. Calculate Myself
f. Other

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2. Application of Betas – How to Calculate Beta?

- Commonly measured through an Ordinary Least Squares (OLS) regression as follows:

$$\beta_i = \frac{Cov(ri, rm)}{Var(rm)}$$

- It is more accurate to capture total returns or excess returns than price returns.
- OLS may underestimate betas for small companies and a Sum Beta may be more accurate.
- Betas should come from the same source to be comparable.
- The asset returns and market index should have consistent currencies.

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2. Application of Betas – Regression Statistics

T-Statistic

- Measures significance of Beta coefficient (how greatly it differs from zero at a given confidence level)
- Does NOT measure accuracy of the Beta itself
- Rule of thumb is t-stat > 2.0.

R-Squared

- Measures "goodness of fit" of the regression line
- Ranges from 0 (no relationship between variable) to 1 (perfect correlation – market explains stock return movements)
- Typically not close to 1 as there are other factors that impact a company's returns.

Standard Error

- Measures sampling error (i.e., standard deviation of a return)
- Shows how much individual observations differ from the predicted values, reflecting the reliability of the regression estimate
- Look at this in relation to estimate beta.

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2. Application of Betas – Key Inputs

Market Proxy

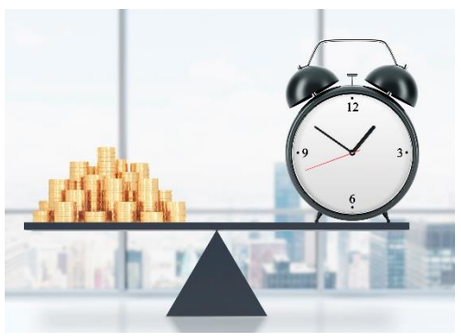
- Index against which the volatility of the individual security is measured. Should be a diversified market index (i.e., not too concentrated in a single industry).

Historical Time Period

- Time period over which Beta is measured, which is typically between 2 and 5 years.

Time Interval

- The frequency of return data ranges (e.g., annual, quarterly, monthly, or daily). Must strike a balance between a sufficient number of observations and avoiding "noisy" data.



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2. Application of Betas – Which Market Index to Use?

Index	Best For	Advantages	Disadvantages
S&P 500	US large-cap, global exposure	Diversified, widely used, reliable data	Less useful for non-US or small-cap firms
Russell 2000	US small-cap stocks	Captures small-cap volatility, domestic focus	High volatility, not global
NASDAQ Composite	Tech/growth-focused firms	Good for tech Beta, high growth correlation	Overconcentration in tech
MSCI World	Global multinationals	Broad developed market exposure, global relevance	Lacks emerging market representation
MSCI EM	Emerging markets	Reflects EM risk and volatility	Less diversified, higher volatility
FTSE 100	UK firms or UK investor perspective	Reflects UK blue chips, GBP-relevant	Multinational skew, less diversified
TSX Composite	Canadian companies	CAD-focused, local relevance	Sector-concentrated (e.g., energy, banks)
Local Index (e.g. Nikkei, DAX, Sensex)	Region-specific firms	Matches country-specific risk factors	Limited international comparability

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2. Application of Betas – Lookback Period

When calculating Betas, what lookback period do you typically use?

a. Less than 2 Years
b. 2 Years
c. 3 Years
d. 5 Years
e. Greater than 5 Years

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2. Application of Betas – Lookback & Time Period

Key Considerations Include:

1. **Liquidity of the Stock**
    - Illiquid/small-cap stocks: Weekly or monthly data reduces the effect of stale prices or bid-ask bounce.
    - Highly liquid/large-cap stocks: Daily data is more reliable and offers higher frequency.
2. **Environment Volatility**
    - In calm markets, monthly or weekly data provides stable estimates.
    - In volatile or rapidly changing markets, daily data may capture risk shifts more quickly (but be noisy).
3. **Purpose of the Beta**
    - Valuation (CAPM, DCF): Monthly or weekly Beta over a 3–5 year period is typically recommended for stability.
    - Portfolio risk management or VaR: Daily Beta over 1–2 years for precision and reactivity.

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2. Application of Betas – Time Interval

When calculating Betas, what time interval do you typically use?

a. Daily
b. Weekly
c. Monthly
d. Annual
e. Other

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2. Application of Betas – Normalization of Betas

Consider the following:

1. **Use a longer lookback period**
    - Simple and transparent, reduces distortion from short-term volatility, but may underreact to structural shifts post disruption
2. **Adjust the Beta using a Regression with dummy variables**
    - Statistically sound, uses a broader history, requires statistical knowledge
3. **Blended Betas – i.e., pre and post the significant event**
    - Allows isolation of structural shifts but is highly subjective

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3. Other Considerations – Equity vs Asset Betas

Levered

Equity Betas

- Measures total systematic risk (business + financial).
- Used to calculate cost of equity (reflects risk to equity shareholders).
- Sensitive to company's debt/leverage (higher leverage = greater risk).

Unlevered

Asset Betas

- Excludes effects of debt (purely business risk).
- Independent of capital structure and tax rates.
- Used as a step in re-levering beta.

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3. Other Considerations – Un-levering and Re-levering Betas

- Necessary when trying to make an apples-to-apples comparison of Equity Betas, because they are impacted by a firm's capital structure.

Hamada

- Fixed amount of debt
- Tax rate impacts Beta
- Assumes no risk in tax deduction

Harris-Pringle

- Fixed percentage of debt
- No impact of taxes
- Requires debt Beta

Miles-Ezzell

- Fixed percentage of debt
- Tax rate impacts beta
- Requires debt Beta

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3. Other Considerations – Full-Information vs Pure Play Beta

1. A **Pure Play** approach estimates Beta by examining publicly traded companies that are focused on a single line of business (i.e., a pure play)

2. A **Full Information** approach estimates Beta by using a combination of information, such as financial statements, business segment details, revenue by geography or business line and other qualitative and quantitative risk factors.

    - In some cases, it combines publicly traded companies' Betas weighted by the companies' revenue or EBITDA contribution.

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3. Other Considerations – Full-Information vs Pure Play Beta

Aspect	Full Information Approach	Pure Play Approach
Advantages	• Reflects diversified operations (good for conglomerates) • Customizable based on true economic exposure • More robust for private companies with mixed business lines	• Simple and intuitive • Ideal for single-industry projects or startups • Easier to explain and apply in discounted cash flow models
Disadvantages	• Requires extensive data and reliable segment info • Complex to implement; subjective weighting and assumptions • Time-consuming to build and justify in practice	• Hard to find truly "pure" comparables • Risk of mismatch if comps have different operating/geographic risk • Bias if the comparable firm has unusual leverage or market perception

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3. Other Considerations – Full-Information vs Pure Play Beta

1. A **Pure Play** approach is most suitable for:
    - Estimating the cost of capital for a project in a specific industry; or,
    - A new business venture or start-up in a niche market.

2. A **Full Information** approach is most suitable for:
    - Valuing a diversified private company, unless comparables are similar
    - Infrastructure project with multiple risk exposures
    - M&A involving multi-segment business unit

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3. Other Considerations – Adjusting Historical Betas to Forward Betas

1. **Re-Levering Industry or Peer Betas:** un-levering and then re-levering the comparable company Betas using the future expected capital structure.
2. **Blend Historical and Forward Looking Betas (Bayesian Adjustment):** weighting of a historical Beta and a future Beta, with the future Beta being an industry Beta as a proxy for future expectations.
3. **Implied Beta from the Market:** estimate the observed cost of equity from the market (i.e., from a stock price or DCF) and then back into the Beta.
4. **Machine Learning:** can improve the calculation of Betas.

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3. Other Considerations – Machine Learning

1. **Modelling time varying Beta:** can capture how a stock's Beta evolves over time in response to changing market conditions.
2. **Capturing Non-Linear Relationships:** Beta assumes a linear relationship between asset and market returns. ML models can detect non-linearities and asymmetric responses (e.g., downside risk bias).
3. **Feature-Enhanced Beta Estimation:** instead of solely relying on market returns, additional factors such as volatility, trading volume and interest rates, macroeconomic factors and sentimental factors can be included
4. **Predictive / Forward Betas:** ML can be used to forecast future Beta based on based on trends in firm fundamentals, market sentiment, or macro trends

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3. Other Considerations – Machine Learning

Advantages	Disadvantages
• Captures non-linear, dynamic, and asymmetric effects	• Requires large, clean datasets
• Can integrate diverse inputs beyond price returns	• Results can be less interpretable (black box models)
• Adapts better to changing regimes	• Risk of overfitting if not cross-validated properly
• Enables forward-looking and predictive Beta modeling	• Requires ML expertise and computing power

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4. Case Study – Background Facts

Consider the following background facts:

1. Preparing valuation for Cool Bean Vanilla ("**CBV**") Ice Cream Factory
2. Private ice cream manufacturer located in Ontario
3. Revenue of $800 million
4. Using a CAPM approach to estimate the cost of equity, which requires a Beta.

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4. Case Study – Comparable Companies

Company	Revenue ($mm)	% of Revenue in Ice Cream Manufacturing	Monthly Trading Volume (mm)
Scoops & Snacks	500	35%	4.3
Sprinkles+	1,100	90%	8.1
Colossal Cone	88,000	100%	100.3
La Meilleure Glace	700	95%	2.8
Mom & Pop Shoppe	550	100%	0.06
Nice Cream	980	85%	3.5

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4. Case Study – Comparable Betas

Company	OLS Beta	Sum Beta	Debt-to-Equity	Credit Rating
Sprinkles+	0.66	0.71	25%	B
La Meilleure Glace	0.58	0.62	38%	A
Nice Cream	0.86	0.88	14%	BB

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4. Case Study – Un-levering of Betas

Company	Sum Beta	Debt-to-Equity	Debt Beta	Unlevered Beta
Sprinkles+	0.71	25%	0.37	0.64
La Meilleure Glace	0.62	38%	0.32	0.54
Nice Cream	0.88	14%	0.36	0.82
Average	**0.74**	**26%**	**0.35**	**0.67**

Harris-Pringle Formula for Un-levering Beta:

$$\beta_U = \frac{\beta_L + \left(\frac{D}{E}\right) \times \beta_D}{1 + \left(\frac{D}{E}\right)}$$

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4. Case Study – Re-levering Beta

1. **Key Assumptions**
    - Un-levered Beta of 0.67
    - Debt-to-Equity of 26%
    - Credit Rating of BBB (Debt Beta of 0.35)
2. **Harris-Pringle Formula for Re-levering Beta:**

$$\beta_L = \beta_U + \left(\frac{D}{E}\right) \times (\beta_U - \beta_D)$$

3. **Re-levered Beta** = 0.75
4. **Consideration of Other Adjustments (e.g., Blume, Bayesian, Vasicek)**

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