WEIGHTED AVERAGE COST OF CAPITAL

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Nature of WACC

• Weighted average cost of sources used by the regulated company
• Return on regulated asset base (Regulatory point of view)
• If Actual WACC < Regulated WACC → Company creates value.
• Investor takes risk, finds sources: WACC is the allowed return for investments.
Nature of WACC

• WACC as a regulatory tool (Incentivizing investments or some investments)
• Differentiated WACCs used by some regulators: pilot smart grid projects, pilot storage projects, renewal of network at historical/touristic/important sites, renewal of network to decrease losses are incentivized.
• Very high WACC → Goldplating
• Very low WACC → Inadequate investment, financial burden for the companies.
Sources of Funds

• Debt: Agreed/negotiated return, priority in liquidation of company, secured against default risk, principal payment protected.
• Equity: None of above.
• It is riskier to be a shareholder of a company than being a creditor. Therefore, for every leverage level, cost of equity is higher than cost of debt.
• Cost of equity is the required rate of return by investors.
Formula of Pre-tax WACC

\[ WACC = \left[ k_d \times w_d \times (1-t) + k_e \times w_e \right] / (1-t) \]

- \( k_d \): Cost of debt
- \( w_d \): Weight of debt
- \( t \): Tax rate
- \( k_e \): Cost of equity
- \( w_e \): Weight of equity
Parameters

• Some parameters are directly obtained from national markets.
• Some other parameters are indirectly obtained from international markets for national market.
• If there are publicly traded utilities/companies in the energy sector and there is a long history of capital markets, national data preferred. However, this is not the case for developing countries.
Risk-free Rate

• Government/treasury bonds are considered to be risk-free assets.

• Domestic data: not stable and not have long history for emerging economies

• Risk-free rate for a country: USA risk-free rate + Long term inflation difference between country and USA + Country risk premium.

• Additional research needed for long term inflation difference.
Combination of Debt and Equity

• Leverage: Debt to total assets ratio.
• Gearing: Debt to equity ratio.
• International benchmark can be useful for what leverage to consider in WACC calculation.
• Actual leverage may be not suitable for long term perspective. Target leverage can be assumed in calculation.
Cost of Equity

• Capital Assets Pricing Model is widely preferred.
• In CAPM, all the market risk is captured in the beta, measured relative to a market portfolio, which at least in theory should include all traded assets in the market place held in proportion to their market value.
• Beta: Observed Beta (Equity Beta-Levered Beta) unlevered using leverage and tax rates (Asset Beta-Unlevered Beta).
• Market Risk Premium-historical data, MRP of USA + country risk premium: Capital markets are not well-developed in developing countries. Adaptation from USA data is widely used.
• In finding cost of equity, ‘cost of company bond + risk premium’ is an alternative method
Levered Beta

Various Beta levering formulas exist in the literature:

\[ \beta_L = \beta_u \left( 1 + (1 - t) \frac{D}{E} \right) \]

where

\( \beta_L = \) Levered Beta for equity in the firm

\( \beta_u = \) Unlevered beta of the firm (i.e., the beta of the firm without any debt)

\( t = \) Corporate tax rate

\( D/E = \) Debt/Equity Ratio

After finding an average unlevered Beta from benchmarking, it is re-levered according to target leverage.
Cost of Debt

• Cost of debt: interest bearing debt, NOT commercial debt.
• Actual loans or ‘risk-free rate + debt risk premium’.
• Historical data on interest rate difference between energy sector loans and risk-free asset indicates debt risk premium (for the same period and term)
Country Risk Premium

• Eurobond-USA bond difference: If a country issues Euro-dollar government bonds, then interest difference between these bonds and that of USA treasury is an indicator of the country risk premium. Bear in mind, it is a historical data.

• Credit default swap (CDS): Shows insurance premium for default risk for a certain issuer.
Nominal vs. Real WACC

\[ RWACC = \frac{1 + NWACC}{1 + EI} - 1 \]

- RWACC: Real WACC
- NWACC: Nominal WACC
- EI: Expected inflation
- Since all calculations done in real terms, real WACC should be calculated and applied.
- Inflationary adjustment done by revenue adjustment every two years.
Pre-tax vs. After-tax WACC

• Company will pay tax over profit earned from distribution fee.
• Then, WACC can be applied pre-tax.
• Alternatively, after-tax WACC can be applied, and actual tax paid added back to revenue.
Mid-year Correction

\[
WACC_a = \frac{WACC}{1 + \frac{WACC}{2}}
\]

• Adjustment for time of inflows and outflows.
• Cash outflows are assumed to be done in the middle of the year. For that reason, WACC to be applied for mid-year average RAB is adjusted.
Flexibilities of Regulator

• Leverage: Target or actual leverage.
• Beta: International benchmark (scope up to regulator).
• Risk-free rate: Direct/indirect method.
• Country risk premium: CDS, calculated premium etc.
• Statistical methods (e.g. period for averages, elimination of outliers, means or medians, etc.).
• Market Risk Premium: 5-6% for USA + country risk premium.
• Different approaches give an opportunity of cross-check.
<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Risk-free rate (%)</td>
<td>10.54</td>
</tr>
<tr>
<td>Debt risk premium (%)</td>
<td>5.23</td>
</tr>
<tr>
<td>Pre-tax Nominal Cost of Debt (%)</td>
<td>15.77</td>
</tr>
<tr>
<td>Pre-tax Nominal Cost of Equity (%)</td>
<td>20.04</td>
</tr>
<tr>
<td>Leverage (%)</td>
<td>50.00</td>
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<tr>
<td>Market Risk Premium (%)</td>
<td>8.95</td>
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<td>Unlevered Beta (Asset Beta)</td>
<td>0.59</td>
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<tr>
<td>Levered Beta (Equity Beta)</td>
<td>1.06</td>
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<td>Pre-tax Nominal WACC (%)</td>
<td>20.41</td>
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<tr>
<td>Expected Inflation (%)</td>
<td>6.88</td>
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<tr>
<td>Pre-tax Real WACC (%)</td>
<td>12.66</td>
</tr>
<tr>
<td>Mid-year Corrected Pre-tax Real WACC (%)</td>
<td>11.91</td>
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</tbody>
</table>
Explanation of Numbers

- Risk-free rate: 10.54% is the interest rate of the most up-to-date government bonds.
- Debt risk premium: 5.23% is a historical data calculated from interest rate difference between energy sector bonds and government bonds at the same period and with the same term.
- Cost of debt: 15.77% is (10.54%)+(5.23%)
- Cost of equity: 20.04% is derived from CAPM equation.
Explanation of Numbers

• Leverage: 50% is target rate, accepted since 2010 by EPDK.
• MRP: 8.95% is 6% (average long term USA MRP) + 2.95% (Turkey risk premium-calculated from interest rate difference from Turkish Eurodollar government bonds and USA bonds at the same period).
• Beta: Derived from international benchmark.
• Expected Inflation: 6.88% is from Turkish Central Bank’s expectation survey.
Potential Risks and Problems for Turkey and Other Emerging Economies

• Beta: Not exact, approximations by other countries data
• Shareholdes Structure: Global-Local, Government-Private
• Country Risk: Adjustments in WACC, some claim that it can be diversified
• Time Component of Change: Everything can change
• Activity Based Risk:
  Distribution + Retail Sale Different Risks

• Debt: Different D/(E+D) ratios causes different costs/benefits
• Transparency: No methodology for WACC
Recommendations & Conclusions

- Use different methods, crosscheck
- Probabilistic approach is better
- Always set higher WACCs, less risky
- Determine real WACCs not nominal
- Short review periods
- Correction factors
- Analyse effects of shareholder structure
- Use other regulators’ experiences
- Transparency: Clear WACC methodology
THANK YOU!

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