Risk Adjusted Discount Rates

A Survey of Practitioner Methodologies

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Agenda

- International CAPM
- ICAPM with currency risk premium
- Don Lessard's Offshore Beta Model
- Godfrey-Espinoza or BoFA Adjusted Beta Model
- Goldman Sachs Model
- Salomon Smith Barney Model
- Damodaran's Country Risk Exposure Model

International CAPM

- Generic version ICAPM only prices global systematic risk.
- Other risks such a currency risk and country risk are not priced in this model
- The model assumes that these are diversifiable non-systematic risks.
- $$k = R_F + \beta_G \times (R_{GM} - R_F) = R_F + \beta_G \times GEMRP$$

R_F = US Risk Free Rate
β_G = Beta with respect to Global Market Index such as MSCI-World
GEMRP = Global Equity Market Risk Premium

ICAPM

- Strong assumptions needed
  - Perfect market integration
  - Mean-variance analysis implied by utility assumptions
- May give unreliable results in smaller, less liquid developed markets
- It is generally ok to use in developed markets
- Fails in emerging markets because of segmentation

Modified ICAPM

- Academics and analysts explored models that incorporate relevant risks in ICAPM.
- First such adjustment was introduced by Bruno Solnik.
- Solnik's ICAPM introduced risk adjustments for currency risk.

$$E(R_i) = R_F + \beta_{i,w} \times GMRP + \sum_{j=1}^{N} \gamma_{i,j} \times SRP_j$$

- SRP is the price of unit currency risk, and it is simply the average of changes in exchange rates from interest rate differentials. Gamma is the exposure coefficient.

$$SRP = s - (i_F^{DC} - i_F^{FOR})$$

Schramm-Wang Model

- A similar model was developed by Shramm-Wang.
- Like Solnik, Shramm-Wang argued that the currency risk is a systematic risk factor and it should be priced.
- Both models considered country risk as diversifiable risk.

Schramm-Wang-GCAPM

Risk Free Return in USD

Sensitivity of USD Returns to exchange Rate

Price of unit currency risk

$$R_{i,t} = R_F + \beta_{i,G} \times GEMRP_t + \varphi_i \times \left| \frac{F_T - S_T}{S_0} \right|$$

Global Beta calculated by using USD returns

Global Equity Risk Premium

Market Risk Premium

Currency Risk Premium

Segmented Markets

- International CAPM does not work for segmented markets.
- Under the segmentation assumption we consider several models:
  - Lessard's Offshore Model
  - Godfrey-Espinoza or BofA Adjusted Beta Model
  - Goldman Sachs Model
  - Salomon Smith Barney Model
  - Damodaran's Country Risk Exposure Model

Don Lessard's Offshore Beta

- Lessard suggests that foreign project/asset risk should be adjusted for the country risk.
- He suggests using a "country beta" which measures the sensitivity of foreign market equity index returns to US or global market index returns.
- If the asset/project is in a market with high beta, then the project risk would be adjusted to reflect this risk.

US Based vs Global View

- Lessard used US EMRP in his Journal of Applied Corporate Finance article, which reflects a US based approach.

$$k = R_f + \beta_{Country} \times \beta_{Project} \times EMRP$$

- Lessard also cautiously suggested a downside risk adjustment by adding a country risk premium such as sovereign yield spread.

$$k = R_f + CRP + \beta_{Country} \times \beta_{Project} \times EMRP$$

- While he cautioned the practitioners about the importance of accounting for the risks in the cash flows, he indicated that an adjusted discounted factor may be a good first cut in evaluating offshore projects.

CRP=Country Risk Premium; imperfect proxies for CRM are Sovereign Yield Spread or more recently Credit Default Swap Premiums

Example

- Special Chemical Company (SCC) is a US multinational firm with an estimated overall operating beta relative to the US market index of 1.45. Assume that the country beta of the Australian equity market index in US dollars is 0.862.
- Use the country beta method to estimate the operating beta of SCC's Australian division.
- Assume that the US dollar risk-free rate is 3% and the US EMRP is 6%.
- What is the Australian division's estimated cost of capital in US dollars?

Answer

- The estimated operating beta of the Australian division is
  - l.45x0.862= 1.25.
- SCC-Australia's cost of capital in US dollars is estimated to be
  - k=0.03 + 1.25(0.06) = 0.1050, or 10.50%.
- Assuming Australian CRP of 50 basis points, the cost of equity from US investor perspective is
  - k=0.03 + 0.005+1.25(0.06)=11%

Example: Discount factor in Valuation of Cemex by a US investor

Required return a US investors would use to value operating assets of Cemex:

1	US Risk Free Rate	6.00%
2	Sov.Spr for Indonesia	4.00%
3	Cemex Equity Beta	1.5
4	Mexico Country Beta	0.788
5	Cemex Offshore Beta (3x4)	1.182
6	Cost of Equity	17.09
7	Credit Spread	2%
8	Cost of Debt Adjusted (1+2+7)	12%
9	D/V	40%
10	Tax Rate	35%
11	WACC	11.93%

$$k=R_f+ CRP+ \beta_{off\text{-}shore} \times EMRP$$

A Practioner Model: Bank of America's Adjusted Cost of Equity

- A model suggested by Bank of America's Godfrey and Espinoza argues that using a project beta calculated with respect to investor's home market underestimates the risks in the foreign market.
- They suggest an adjusted beta that reflects the relative volatility of the foreign market with respect to home market.
- Godfrey and Espinoza define "adjusted beta" as the ratio of foreign market volatility to the home (US) market volatility adjusted for an overlap between equity market risk and sovereign yield spread.

- Based on their econometric analysis of the overlap between **equity risk** and **country risk**, they suggest a 40% downward adjustment in the relative volatilities.

$$\beta_{adj} = (1 - \rho) \times \frac{\sigma_F}{\sigma_W} = 0.6 \times \frac{\sigma_F}{\sigma_W}$$

- The required rate of return on equity investments then:

$$k = R_f + CRP + \{0.6 \times \frac{\sigma_F}{\sigma_W}\} \times EMRP$$

Goldman Sachs' Adjusted Cost of Equity

- A third model proposed by Goldman Sachs analysts propose a different adjustment for double counting than that included in the Godfrey-Espinosa model.
- More precisely, these analysts propose to substitute fixed adjustment factor of "0.60" by one minus the observed correlation between the stock market and the bond market of the country in which the project is based.
- The adjusted beta proposed by Goldman Sachs analysts is:

$$\beta_{adj} = (1 - \rho_{S/B}) \times \frac{\sigma_F}{\sigma_W}$$

- Where $\rho_{S/B}$ denotes the correlation between the stock and bond markets of the foreign country.
- As in the Godfrey-Espinosa model, the Goldman Sachs model includes the adjustment for country risk.

$$k = R_f + CRP + (1 - \rho_{S/B}) \times \frac{\sigma_F}{\sigma_{US}} \times EMRP$$

Example:Cost of equity for a standard project in Brazil

- Using Godfrey-Espinoza model we get the following:
  - US Risk free rate is → R_f =3%
  - Brazilian Sovereign Spread → 410bp
  - Brazilian Local Market Volatility → 0.5375
  - US Market Volatility → 0.0968
  - US Market Equity Risk Premium → 0.055

$$k = R_f + CRP + \{0.6 \times \frac{\sigma_F}{\sigma_W}\} \times EMRP$$

$$k = 0.03 + 0.041 + \left(0.6 \times \frac{0.5375}{0.0968}\right) \times 0.055 = 25.32\%$$

Salomon Smith Barney Approach

- This model accounts for project specific risks in a foreign country.

$$k_e = R_f + \beta_p \times EMRP + [(\gamma_1 + \gamma_2 + \gamma_3)/30] \times CRP$$

- The first adjustment is implemented by incorporating the project beta (βp) which is the beta of the relevant industry with respect to the US market.

- The second adjustment accounts for the political risk premium.
- Firm Specific Risk Adjustment A = [(γ1+γ2+γ3)/30]x CRP
  - γ_1 captures a company's access to capital markets, with 0 indicating best access 10 indicating no access;
  - γ_2 captures the susceptibility of the investment to political risk, with 0 indicating no susceptibility to political intervention and 10 indicating maximum susceptibility to political intervention
  - γ_3 captures the financial importance of the project for the company, with 0 indicating that the project involves a small proportion of the company's capital and 10 indicating that the project involves a large proportion of the company's capital.

Damodaran's Country Risk Exposure Model

- Damodaran suggests that we estimate the CRP by using relative equity market volatilities. He calls this "relative market risk factor" or RMRF
- RMRF is defined as:

$$RMRF_X = \frac{\sigma_X}{\sigma_{US}}$$

- After we estimate RMRF we can calculate the foreign market adjusted market risk premium (AMRP):

$$AMRP = ERP_{US} \times RMRF_X = ERP_{US} \times \frac{\sigma_X}{\sigma_{US}}$$

- The next step is to derive country risk premium (CRP). CRP is equal to the difference between foreign market AMRP and the US EMRP

$$CRP = AMRP - EMRP$$

- Once we estimate the CRP, we need to incorporate it into the CAPM model to make further risk adjustments.

Country Risk Exposure Model

- Damodaran argues that there are three possible ways to integrate the CRP in required rate of return:
  - 100% weighting

$$k_i = R_f + CRP + \beta_i \times EMPR$$

  - Scaling with Beta

$$k_i = R_f + \beta_i \times [CRP + EMPR] = R_f + \beta_i \times CRP + \beta_i \times EMRP$$

  - Estimating an country risk exposure coefficient lambda

$$k_i = R_f + \lambda \times CRP + \beta_i \times EMPR$$

CRP Based on Default Spread

- CRP can also be derived from Credit Default Spreads.

$$CRP = CDS \times \frac{\sigma_{Equity,X}}{\sigma_{Debt,X}}$$

- This method converts an essentially bond risk indicator to an equity risk indicator.

Required Rate of Return and CRP based on CDS Premium

- CRM based on CDS → 100% Exposure:

$$k_i = R_f + CRP + \beta \times EMPR$$

- CRM based on CDS/Scaled by Beta:

$$k_i = R_f + \beta_i \times [CRP + EMPR] = R_f + \beta_i \times CRP + \beta_i \times EMRP$$

- CRM based on CDS/Scaled by Lambda (Note that Lambda measures the exposure to country risk factor;

$$k_i = R_f + \lambda \times CRP + \beta_i \times EMPR$$