Chapter 11: Risky Projects

In this chapter, there are two ways to forecast cash flows. The first one is the forecast of expected cash flows and the second one is the forecast of the cash flows that are adjusted for risks.

The risk-adjusted discount rate method estimates the expected cash flows of a project and then the expected cash flows are discounted by the risk-adjusted discount rate.

When a tracking portfolio of a future cash flow of a project has a tracking error without any systematic risk and when it has an expected value of zero, than the market value of the tracking portfolio is equal to the present value of the future cash flows of the project.

Sometimes, managers account for the riskiness of a cash flow by reporting a conservative 'expected cashflow', this means that they place too much weight on the bad outcomes and too little on the good state. This can be seen as a *certainty equivalent*.

Valuing a stream of certainty equivalents with the *certainty equivalent method* involves discounting at the risk-free rate. Thus, for valuation purposes, certainty equivalent cash flows can be treated as if they are certain.

When applied correctly, discounting expected cash flows at a risk-adjusted discount rate and certainty equivalent cash flows at a risk-free discount rate supply a similar value for the project's future cash flows.

With the risk-adjusted discount rate method, the expected future cash flows are discounted with the cost of capital. This is the return that shareholders expect to gain when holding an investment with the same level of risk. This method is usually used when there are comparable projects of companies.

The present value of a cash flow can be calculated with the risk-adjusted discount rate method, with the following steps:

1. calculate the expected future cash flow next period, $E(C)$;
2. calculate the beta of the return of the project, β ;
3. calculate the expected return of the project by filling in the tangency portfolio risk-expected return equation.
4. divide the expected future cash flow by one plus the expected return.

Formula:

$$PV = \frac{E(C)}{1 + r_f + \beta(\bar{R}_T + r_f)}$$

An important feature of this approach is the use of the *comparison approach,* with which an estimate of Beta is made by analyse comparison securities.

When a organization is all equity financed, the assets must have the same amount as equity. Also the risk of the assets and equity must be the same.

So, BetaA=BetaE.

The T-form balance sheet entails that A=D+E

Raising the organization's debt raises the risk per dollar of equity investment. It will raise linearly in the D/E ratio if the debt is risk free.

$$r_A = \left(\frac{D}{D+E}\right) r_D + \left(\frac{E}{D+E}\right) r_E$$

There are two sources of risk related to debt:

1. Interest rate risk. This is the risk related to changes in the long term interest rates.
2. Credit risk. This is the risk of default.

The *leverage ratio* is computed by dividing Debt by Equity. The *capital structure* is the mix of debt and equity financing.

The *cost of equity* for a organization is the expected return that shareholders want for holding equity in the organization. The cost of equity is computed with the following formula:

$$\bar{r}_E = \bar{r}_A + (D/E)(\bar{r}_A - \bar{r}_D)$$

The cost of equity raises as the organization's leverage ratio is increasing. It will raise linearly in the ratio D/E if the debt is default free and if $\bar{r}_A$,does not change as the leverage ratio raises. $\bar{r}_A$ is the expected return of the assets of an organization.

The expected return of a organization's debt $\bar{r}_D$, is equal to r_f for modest leverage ratios.

If an acquisition and its comparison organization are financed differently, it may be possible to adjust the comparison organization's beta for the difference in leverage ratios. However, this can be risky, particularly when taking corporate taxes into account.

APT is the right method to use when a combination of factor portfolios, instead of the market portfolio, is the tangency portfolio. When calculating the cost of capital using the expected returns generated by the APT, the present value of the project's future cash flow is:

$$PV = \frac{E(C)}{1 + r_f + \lambda_1\beta_1 + \lambda_2\beta_2 + \ldots + \lambda_K\beta_K}$$

Both the APT and the CAPM models are applied in practice, their applications have been criticized because of the hardies associated with estimating their essential inputs.

The CAPM requires knowledge of the covariance (or beta) and an estimate of the expected return of the market portfolio. The APT needs multiple factor sensitivities and the corresponding expected returns on multiple factor portfolios.

The *Gordon Growth Model* is a dividend discount model where dividends grow at one specific rate.

$$S_0 = \frac{div_1}{(\bar{r}_E - g)}$$

In this formula S_0 is the current stock price per share, div_1 is the expected dividend per share one year from now, $\bar{r}_E$ is the market required rate of return of the organization's stock and *g* is the expected growth rate of dividends.

The growth rate can be assessed with the following formula:

$g = b$ X ROE

In this formula, *b* is the *plowback ratio*, which is the fraction of earnings retained in the organization and *ROE* is *book return on equity*, which is the earnings divided by last year's book equity.

In the situation where there is no suitable comparison organization, a financial manager may still be able to find an suitable comparison by forming portfolios of organizations. This process is based on the thought that portfolio betas are portfolio-weighted averages of the betas of individual securities. When valuing a potential acquisition, it may be promising to recognize an suitable comparison portfolio using accounting numbers.

The following steps must be implemented, when valuing a project with multiple cash flow streams:

- Approximate the equity beta from a comparison organization using historical data. Regularly, the comparison organization is the organization doing the project
- Calculate the expected return using the risk-expected return formula of choice with parameters estimated from historical data
- Adjust for leverage and taxes to acquire cost of capital
- Make use of the cost of capital as a single discount rate for each period in the way that we used the risk-free rate to discount multiperiod cash flows

Pitfall: Analysts should discount the cash flows in different years at different discount rates, which is not possible in this model.

The use of the long-term and the short-term risk-free rate in the CAPM or APT risk-expected return relation depends on practical contemplations and not on the scope of the cash flow. For a long scope, the beta of the cash flow is zero, and the risk-free rate is the long-term riskless rate. Over short intervals of time, the values of both the certain cash flow and the market portfolio tend to decrease when expected inflation raises, and vice versa, the cash flow is probable to have a positive beta when measured against the short-term return of the market portfolio.

Whether it is improved to include a long-term risk-free bond or a short-term risk-free bond in the tracking portfolio depends on which bond generates a improved tracking portfolio. The decision about using a long-term or a short-term risk-free rate in a risky cash flow that cannot be perfectly tracked is more unambiguous.

When there is no comparison possible, beta risk can be calculated by estimating the cash flows of a project in different scenarios.

The betas of the actual returns of projects equal the project's profitability index times the appropriate beta needed to compute the true present value of the project. Since the profitability index exceeds 1 for positive NPV projects and is below 1 for negative NPV projects, this error in beta computation does not affect project selection in the absence of project selection constraints.

The certainty equivalent method looks like the risk-adjusted discount rate method, but instead of discounting with the risk-adjusted discount rates, the certainty equivalent method discounts with risk-free interest rates. To explain this method an example is used. Project A pays off either €200, €300 or €400. The payout depends on the state of the economy. When the probability of the three states are the same, then the expected cash flow is €300. When entailing risk aversion, one would rather have €300 for certain than adopting project A. So, the certainty equivalent cash flow is less than €300. On the other hand, project A has more value than a certain payout of €200. So, the certainty equivalent cash flow must be between €200 and €300. Between these amounts a manager would be indifferent in choosing the project or the cash for certain.

The main difference between the certainty equivalent method and the risk-adjusted discount rate method is whether there is adjusted for risk in the numerator of the denominator. In the certainty equivalent method there is adjusted for risk in the numerator and in the risk-adjusted discount rate method there is adjusted for risk in the denominator.

The certainty equivalent is computed as follows:

$$CE(C) = E(C) - b(\overline{R}_T + r_f) \text{ where } b = \frac{\operatorname{cov}(C, R_T)}{\sigma_T^2}$$

CE(C)= the certainty equivalent of uncertain future cashflow *C* and *E(C)* as the cash flow mean. *b* is the *cash flow beta*, that is the covariance of the future cash flow with the return of the tangency portfolio, divided by the variance of the return of the tangency portfolio.

The certainty equivalent PV formula:

$$PV = \frac{E(C) - b(\overline{R}_T - r_f)}{1 + r_f}$$

To compute the net present value, subtract the initial cost of the project, $-C_0$, from this PV.

$$PV = \frac{b}{\beta} \text{ if } PV \leq 0$$

To acquire the certainty equivalent in the one-factor APT, subtract from the expected future cash flow the product of:

- the factor loading of the future cash flow and
- the risk premium of the factor

If there is more than one factor, sum these products over all factors and then subtract.

Then discount this certainty equivalent at the risk-free rate to acquire the PV:

$$PV = \frac{E(C) - (\lambda_1 b_1 + \lambda_2 b_2 + \ldots + \lambda_K b_K)}{1 + r_f}$$

where $b_j\ (j = 1, \ldots, K)$ is the factor loading of the future cashflow on the *j*th factor.

Another computational approach to the certainty equivalent is the risk-free scenario method. This method produces the certainty equivalent with a characteristically conservative cash flow forecast under a scenario where all assets are expected to appreciate at the risk-free rate. It works when the returns of the tangency portfolio and the future cash flows of the project have specific distributions. It must be a distribution where the expectation of the future cash flow, given the return of a mean-variance efficient portfolio, is a linear function of the return of the tangency portfolio: algebraically: $E(C|$ *given the return* $R_T) = a + bR_T$

If it is a possibility to estimate the expected future cash flow of an investment or project under a scenario where all securities are expected to appreciate at the risk-free return, then the present value of the cash flow is calculated by discounting the expected cash flow for the risk-free scenario at the risk-free rate.

The organization’s stock price can be used for a risk-free scenario, but other traded securities or portfolios of securities can also be used.

Normally, using more securities and portfolios makes it more likely that the cash flow forecast error will be smaller.

The simplicity with which the risk-free scenario method is applied in a multiperiod setting gives it an advantage over the risk-adjusted discount rate method or the traditional certainty equivalent method.