Chapter 13: Taxes

Organizations can create value on the right-hand side of their balance sheet. For example, because debt interest payments are tax-deductible. Two valuation methods can be used to account for the additional cash flows that arise from the project's debt financing.

The *adjusted present value (APV) method*, computes present values that account for the debt interest tax shield and other loan subsidies by:

- Predicting a project's unlevered cash flows
- Valuing the cash flows in step 1, assuming that the project is financed completely with equity. Any method of computing PVs can be used for this step.
- Adding to the value acquired in step 2 the value generated as a result of the tax shield and other subsidies from the project's debt financing.

The second method is the *weighted average cost of capital (WACC) method*. This method accounts for the cost of debt and equity financing from the organization's viewpoint.

It produces present values by:

- Estimating a project's expected unlevered cash flows.
- Valuing the expected cash flows in step 1 by discounting them at a single risk-adjusted discount rate that varies with the degree of debt financing that can be attributed to the project.

We will suppose that the unlevered cash flows are not influenced by the amount of debt financing the organization uses. Unlevered cash flows are the after-tax cash flows produced straight by the real assets of the project or organization,

Because of this assumption, we can calculate the unlevered cash flow as the after-tax cash flows of the project or organization under the assumption the project or organization is financed only with equity. For an levered organization, the appropriate risk-adjusted discount rate for a project's future cash flow when the cash flows has the same risk as the overall organization is the organization's cost of capital.

The *unlevered cost of capital*, $\bar{r}_{UA}$, is the expected return on the equity of the organization, when we suppose that the organization is completely financed with equity. This is also the required rate of return on the organization's unlevered assets.

The WACC is a weighted average of the after-tax expected return paid by the organization on its debt and equity. The expected return paid by the organization to its shareholders is not the same as the expected return received by the shareholders, when there is a debt tax shield. Because of this, the WACC varies from the unlevered cost of capital.

The assets of the organization contain two components, one associated directly with the organization's operations (the *unlevered assets (UA)*), and the other an indirect asset associated with a financing subsidy (the *debt tax shield (TX)*), both present values. The more debt the organization has, the bigger the tax shield.

The value of the unlevered assets is the sum of the debt and equity minus the value of the debt tax shield. Viewing the assets of the organization with value A as a portfolio of unlevered assets with value UA and debt tax shields with value TX entails that the beta of the assets is the portfolio-weighted average of the betas of the unlevered assets and debt tax shields;

$$\beta_A = \left(\frac{UA}{D+E}\right)\beta_{UA} + \left(\frac{TX}{D+E}\right)\beta_{TX}$$

This also holds for the expected rate of return.

$$TX = T_c D$$

T_c is the effective corporate tax rate.

$$UA = D + E - T_c D$$

Each interest payment of Dr_f (default free perpetual debt) saves $T_c D r_f$ in taxes.

The PV of the tax savings is: $T_c D = \frac{T_c D r_f}{r_f}$ (The Hamada model)

The beta of the debt tax shield is zero, so:

$$\beta_A = \left[\frac{D + E - T_c D}{D+E}\right]\beta_{UA}$$

This states, that if β_{UA} more than 0, the beta of the combination of the unlevered assets and the debt tax shield assets, β_A, must decrease with an raise in leverage to reflect the addition of the risk-free tax savings.

The equation $\beta_E = \left[1 + (1 - T_c)\frac{D}{E}\right]\beta_{UA}$, states that, for a given debt raise, the beta of the

Equity of the organization raises minus the larger is the corporate tax rate, and raises the most when there are no taxes.

The formula for unleveraging the equity betas of comparison organizations in the presence of corporate taxes is embedded in the equation higher than, but reversed:

$$\beta_{UA} = \frac{\beta_E}{1 + (1 - T_c)\frac{D}{E}}$$

The Hamada formulas for leveraging and unleveraging equity betas are not correct if the organization uses debt in a flexible way.

Assessing investment projects with the APV method, with corporate tax deductions for interest payments:

- The unlevered assets are valued by discounting the expected unlevered cash flows at $\bar{r}_{UA}$, the required rate of return for equity financing with risk equal to β_{UA}.
- Assess the debt tax shield, with a different discount rate
- Add up the two present values to produce the project's present value

There are three sources of value to the shareholders of an organization that adopts an investment project:

- The PV of the project's unlevered cash flows
- The PV of subsidies due to the financing of the project, such as the debt tax shield
- Transfers wealth to shareholders from existing debt holders due to the financing of the project

Each organization has a explicit debt capacity. Management decides which amount of debt is in the best interest for the whole organization. A project's debt capacity is the marginal account by which an organization's debt capacity becomes higher as a result of taking on the project.

One would anticipate debt capacity to change over time, depending on the profitability of the organization or the project. This must be taking into account in determining the corporate tax subsidy

Organizations can use the APV method with a diversity of valuation methods, including those that make use of risk-adjusted discount rates, certainty equivalents, ratio comparisons and real options approaches.

The WACC method calculates unlevered cash flows and accounts for the debt tax subsidy by adjusting the discount rate that is applied to the unlevered cash flows. The adjusted discount rate is the weighted average cost of capital of the project:

$$WACC = w_E \bar{r}_E + w_D (1 - T_c) \bar{r}_D$$

$w_E = \dfrac{E}{D+E}$ = market value of equity over market value of all financing

$w_D = \dfrac{D}{D+E}$ = market value of debt over market value of all financing

T_c = marginal corporate tax rate if interest is fully tax deductible

The costs of the financing components are:

$\bar{r}_E$ = the expected return on equity to shareholders (use CAPM or APT to compute this)

$\bar{r}_D$ = the expected return on debt to shareholders

When there is default free debt, one can use CAPM to calculate this. When there is risky debt, one can use two different methods.

The first method takes the promised yield to produce the pre-tax cost of debt financing and subtracts the expected losses. The second method uses the CAPM or the APT to calculate $\bar{r}_D$.

When there are no taxes or other market frictions, the WACC does not depend on the way it is financed. When debt interest is tax deductible, the WACC will decline as the organization's leverage ratio, D/E, raises.

Modigliani and Miller's (1963) *adjusted cost of capital formula* gives the organization's WACC as a function of its debt to value ratio:

$$WACC = \bar{r}_{UA} \left[1 - T_c \frac{D}{D+E} \right]$$

In the Miles and Ezzell (1980, 1985) model, D is perfectly correlated with the value of the unlevered assets of the organization and thus the tax savings from debt issuance are perfectly correlated with the prior period's value of the unlevered assets.

This entails that, at least approximately: $\beta_{TX} = \beta_{UA}$,

entailing that the expected returns of assets, unlevered assets, and the debt tax shield are about the same. As periods become arbitrarily short, this equality between the expected returns of the assets and the unlevered assets holds exactly, in which case the equation

higher than reduces to $WACC = \bar{r}_{UA} - \left(\frac{D}{D+E}\right) T_c \bar{r}_D$

The relevant measure for the cost of capital of a project is the organization's marginal cost of capital, or the amount by which the organization's total cost of financing will raise if it raises an additional amount of capital to finance the project. The marginal cost of capital for the project reflects the risk of the project and not the risk of the organization as a whole.

The WACC of an organization is the relevant discount rate for the incremental cash flows of one of its projects only when:

- the projects have the same beta
- contribute the same proportion as the whole organization to the organization's debt capacity.

When we cannot suppose these condition, organizations can still use the WACC method by seeking another organization with the same risk profile as the project being valued and using the WACC of the comparison organization to discount the expected real asset cash flows of the project.

In the absence of default, the present value of a project's future unlevered cash flows, discounted at the WACC, is the same as the present value of cash flows to shareholders discounted at the cost of equity. Thus when there is no risk of default, the NPVs generated with both present value computations select and reject the same projects.

When there is a risk of debt default, projects that higher organization value may not raise the values of the shares held by shareholders and vice versa. On the other hand it is more suitable to analyze the values of cash flows with the real options approach in these cases.