

Corporate Finance, Module 19: Adjusted Present Value

*Practice Problems*

(The attached PDF file has better formatting.)

Exercise 19.1: Firm Value – Adjusted Present Value

Firms W and Y both have perpetual projects generating \$10 million of after-tax cash flows at the end of each year. At 100% equity financing, both firms have an opportunity cost of capital of 15%.

Both firms have 100% debt to equity ratios: debt is one half of total capital and equity is the other half. The yield to maturity on the debt is 8% per annum for Firm W and 12% for Firm Y. The corporate tax rate is 35%, and the personal tax rate is the same for interest income and equity income (that is, you need not consider personal tax rates).

What is the value of the project for Firms W and Y using the adjusted present values?

Solution 19.1:

The base case value of the firm is \$10 million / 0.15 = \$66.67 million.

*Firm W:* The present value of the tax shields is  $\frac{1}{2} \times \text{Value of Firm} \times 35\%$ . We write

$$\begin{aligned} \$66.67 \text{ million} + \frac{1}{2} \times Z \times 35\% &= Z \\ \Rightarrow Z &= \$66.67 \text{ million} / (1 - \frac{1}{2} \times 35\%) = \$80.81 \end{aligned}$$

*Firm Y:* Since the present value of the tax shields for perpetual debt does *not* depend on the debt yield, the value of Firm Y is the same as the value of Firm W.

## Exercise 19.2: Leveraged Refinancing

The corporate tax rate is 35%, and the personal tax rate is the same for equity income as for interest income. The firm has \$20 million of debt with an effective annual yield of 8%. The debt is fixed; it is *not* rebalanced as the firm's value changes. (These are the standard assumptions used for the adjusted present value method.)

If the firm were financed 100% with equity, the value of the firm would be \$100 million. (The value of the firm now is not \$100 million; you must derive this value.)

The firm refinances with \$50 million of debt at an effective annual yield of 10% and uses the additional cash to pay a one-time dividend to shareholders.

- A. What is the value of the firm with \$20 million of debt? (Use APV; add the present value of the tax shields to the all-equity value of the firm.)
- B. What is the value of the firm with \$50 million of debt? (Use APV; the present value of the tax shields is larger is more debt.)
- C. What is the dividend paid to stockholders? (This is the additional debt; the dividend does not depend on the tax shields.)
- D. What is the change in the value of the firm? (This is the additional present value of the tax shields from \$20 million of debt to \$50 million of debt.)
- E. What is the change in the equity of the firm? (This is the additional tax shield minus the dividend paid to stockholders. The change in the value of the firm is positive; the change in the value of equity is negative. The firm has more liabilities now, meaning that more of it is owned by bondholders.)

### Solution 19.2:

*Part A:* The present value of the tax shields with the \$20 million 8% debt is  $35\% \times \$20 \text{ million} = \$7 \text{ million}$ . The coupon rate does not affect the present value of the tax shield with perpetual debt.

*Part B:* The present value of the tax shields with the \$50 million 10% debt is  $35\% \times \$50 \text{ million} = \$17.5 \text{ million}$ .

*Part C:* The dividend paid to stockholders is  $\$50 \text{ million} - \$20 \text{ million} = \$30 \text{ million}$ .

*Part D:* The increase in the value of the firm is  $\$17.5 \text{ million} - \$7 \text{ million} = \$10.5 \text{ million}$ .

*Part E:* The change in the value of the firm belongs to shareholders. The bondholders get a higher yield either for the higher default probability or for the increased risk of the firm with higher debt; the shareholders get the present value of the tax shields. The one-time dividend was  $\$50 \text{ million} - \$20 \text{ million} = \$30 \text{ million}$ , so the change in the value of equity is  $-\$30 \text{ million} + \$10.5 \text{ million} = -\$19.5 \text{ million}$ .

*Question:* It seems like everyone is better off: the bondholders' yield increases from 8% to 10% and the shareholders get \$10.5 million of additional wealth. Have we created free wealth?

*Answer:* The bondholders are not better off, since the higher yield reflects either additional defaults or additional risk.

- If the higher yield reflects a higher probability of default, the expected return after defaults is the same as before the change.
- If the higher yield reflects higher systematic risk, the present value of the bondholders' return has not changed.

The additional wealth of the shareholders is a transfer from the government (taxpayers) to the firm's owners.

*Question:* You say the bondholders get a higher yield because of the increased systematic risk. It makes sense that if investors switch from security YY to security ZZ, they get a higher return in security ZZ is riskier.

But the bondholders are investing in the same firm; if they get a higher return now, where does the additional return come from?

*Answer:* If the higher return reflects higher systematic risk, the additional return is paid by the firm's shareholders.

*Question:* You imply that financial restructuring just shifts wealth among the claimants to the firm: bondholders, shareholders, and taxing authorities. Does society's wealth ever change?

*Answer:* Society's wealth often changes. When taxes decrease, society's wealth increases, since the dead weight loss from the tax is reduced. We cover this in the micro- and macro-economics courses, not in the corporate finance course.