Universität zu Köln
Markets for Risk Management

Problem Set #3
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Professor Garven

Problem #1

Suppose a corporation has issued zero coupon debt that matures 1 year from now. Management has promised to pay creditors €10 million at that date, provided that the firm is solvent. Corporate assets are currently worth €15 million, and the (annual) standard deviation of the return on these assets is 40%. Assume that the firm will be liquidated 1 year from today, that there is no corporate income taxation, and that the (annual) rate of interest is 4%.

A. What is the risk neutral probability that the firm will be bankrupt 1 year from today?

B. Suppose that after 6 months, the value of the firm's assets has risen from €15 million to €16 million. If this were to occur, what is the risk neutral probability 6 months from today that the firm will default on its debt 1 year from today? Explain the economic logic concerning why the risk neutral bankruptcy probability has changed.

C. Suppose the firm can reduce the volatility of its assets from 40% to 10% by purchasing an actuarially fair hedge on the value of its assets. Should management authorize such a hedge? Why or why not?

D. Now suppose that the government institutes a 50% tax rate on corporate income, which is defined as terminal asset value minus the sum of debt repayment plus depreciation allowances. Depreciation of €15,000,000 will be claimed by the firm. Under these circumstances, should management authorize such a hedge? Why or why not?

Problem #2

Suppose that a firm owns assets worth €20,000,000. These assets are financed with publicly traded equity and zero coupon bonds that have a face value of €8,000,000. The standard deviation of the return on the firm's assets is 30%. Assume that this firm will be liquidated one year from today and that the annual rate of interest is 2%.

The firm is considering an investment that costs €3,000,000 and has a (pre-tax) net present value of €1,500,000. If this investment is made, the firm plans to issue additional zero coupon bonds with a face value of €1,500,000. The project will be financed with the proceeds from the bond issue plus cash. However, since the new investment is very risky, if adopted it will increase the overall risk of the firm's assets from a standard deviation of 30% to 50%. Corporate taxes are assessed at a 35 percent rate whenever taxable income is positive.

However, if the firm loses money, then its tax liability is zero dollars; i.e., the government

does not provide tax rebates. Taxable income is defined as the difference between the time 1 value of the firm's assets less the sum of the face value of debt plus depreciation allowances. Currently, depreciation allowances total €12,000,000. If this investment is undertaken, then depreciation allowances will total €15,000,000.

A. Should this firm undertake this project? Why or why not?

B. Now suppose the tax authorities amend the corporate tax code so that the investment described above would provide a 5% investment tax credit of €150,000. Would such a change in the tax code affect the firm's decision to invest in this project? Why or why not?

C. Now suppose that instead of introducing an investment tax credit, the tax authorities lower the corporate income tax rate from 35 percent to 15 percent. If this happens, should this firm undertake this project? Why or why not?

D. At what tax rate is the firm indifferent about making the investment? Justify your answer.

Problem #3

Suppose that shareholders are contemplating making an investment today (at t=0) and are considering different financing alternatives. The payoffs on this investment occur one period from today (at t=1). At t=1, only two states of the world (loss and no loss) may occur with equal probabilities. If the loss occurs, the investment will be worth €2,000, and if there is no loss, then the firm will be worth €4,000. However, the firm has an option to rebuild the asset at a cost of €1,600 should a loss occur. Assume that shareholders are risk neutral, the interest rate is zero and bankruptcy is costless.

A. What is the net present value of rebuilding the asset?

B. Suppose the firm is all equity financed. Will shareholders rebuild the asset in the event of a loss? Why or why not?

C. Suppose that as an alternative to equity financing, shareholders can issue zero coupon bonds. If the promised payment on the bonds equals €2,000, will shareholders rebuild the asset in the event of a loss? Why or why not?

D. Suppose shareholders issue zero coupon bonds and promise to repay €3,000. With this type of financing arrangement, will shareholders rebuild the asset in the event of a loss? Why or why not?

E. Suppose that instead of issuing zero coupon bonds with a promised repayment of €3,000, shareholders decide to issue zero coupon bonds with a promised repayment of €2,600 and purchase an actuarially fair insurance policy with a deductible of €1,400. With this type of financing arrangement, will shareholders rebuild the asset in the event of a loss? Why or why not?

F. Now suppose that the insurance is not actuarially fair; specifically, all policies have 50% premium loadings. If shareholders issue zero coupon bonds with a promised repayment of €2,800 and purchase an actuarially unfair insurance policy with a deductible of €1,200, will they rebuild the asset in the event of a loss? Why or why not?

G. Why do the net present values computed in parts E and F differ from each other?