

**Homework Assignment 4: Answers**

1. The validity of this statement depends upon whether the firm's stock is correctly priced *and* what other investments are available to the firm. If the stock is correctly priced, then repurchasing the stock is a zero NPV investment. If the firm's alternative investments all have negative NPVs, then the firm should pay the money out to investors. Repurchasing stock is the best investment.
 

If instead the firm has positive NPV investments available, then repurchasing its own stock can only be the best investment (highest NPV) if the stock price is undervalued. Remember, in this case we are interested in whether the stock is correctly priced given the manager's inside information. It is not surprising that the firm's managers have better information about the value of the firm than outside investors. Consistent with this, the stock price of firms tends to jump when stock repurchases are announced.

If managers always maximized shareholder's wealth, this would be the end of the story. However, managers may have an incentive to push the stock price up. If managers' compensation is tied to stock price, they will prefer a higher stock price. In this case, the manager may have an incentive to repurchase stock, even if it is not the best investment.
  
2. Equity repurchases and earnings per share. Increasing EPS is an often heard goal of financial managers. This example should demonstrate that cosmetic changes in EPS, such as this one, have no effect on the value of the firm.
 

The firm must raise \$40 million to repurchase the 200,000 shares. If the firm doesn't issue any liabilities, then it must sell assets to raise the money -- for example cash in the bank. In this case, it is unlikely that the firm's earnings will still be \$10 million. Assume the assets which are sold are identical to the ones which are retained (i.e. the scale of the firm is shrunk by twenty percent). In this case earnings will shrink by twenty percent -- to \$8 million and EPS will be \$10/share (\$8M/800,000) not \$12.50. EPS has not changed. Since the asset type is the same, the P/E ratio should remain the same. The share price is thus  $\$10 * 20 = \$200$  -- no change.

The firm could also sell bonds to raise the \$40 million. In this case the shareholders would receive \$40 million for their shares. However, the remaining shares would be responsible for repaying the \$40 million bond issue plus interest. The total value of shareholders wealth would be the same. EPS may increase or decrease, depending upon how much the interest payments are and when they are made. If the interest payments were rolled over and repaid in a lump sum when the bond matures and the interest expense wasn't recognized each year, then EPS may jump initially and then fall in the year the bonds mature. The value of the firm can't be changed by changing the timing of payments, holding the net present value of the payments constant.
  
3. Capital Structure Quotes

(A) In a world without taxes, the cost of capital depends upon the asset beta which is unchanged by the financial structure of the firm. It is true that by lowering the debt ratio, the required return on both debt and equity decline. They are both less risky. The weighted average, which is the firm's cost of capital, does not change because the lower debt ratio changes the weights on the two returns. As the required rates of return on debt and equity fall, more of the firm is equity financed. Since equity has a higher required rate of return, this offsets the fall in the required rate of return on debt and equity. If taxes are accounted for, the asset mix changes by the amount of the change in the interest expense tax deduction. By reducing debt, this relatively safe asset would be reduced which would cause the overall asset beta to increase.

Are investors better off? In a world without taxes, the firm's cost of capital (and therefore firm value) doesn't change as long as investment is not altered. Both bond and equity holders receive lower expected returns but they also face less priced risk. If markets are complete, investors can offset this change if it is not to their liking. In this case investors are indifferent between the two situations. When taxes and bankruptcy costs are considered, there is an optimal level of leverage where the cost of capital is minimized and firm value is maximized. Whether or not investors are better off depends on whether the change in leverage moves the firm closer to or farther from the optimal leverage ratio.

(B) Take the case where the debt promises are so small that the debt is riskless. The firm never defaults. Even in this case, the equity holders are carrying financial risk. Remember the formula for the expected return on equity:

$$r_{\text{Equity}} = r_{\text{Asset}} + \frac{D}{E} (r_{\text{Asset}} - r_{\text{Debt}})$$

If the debt is riskless, the expected (and actual) return on the debt is the riskfree rate. The expected return on equity is still increasing in the debt ratio. All of the variation in the cash flow to the assets appears in the cash flow to the equity. Since all of the risk is concentrated in a smaller equity base, the equity risk has increased. Not surprisingly, the expected return on equity must also increase. Even issuing risk free debt will raise the risk borne by the equity holders.

- 4 (A) The first step in answering this question involves calculating the NPV of the investment project. Given this NPV, we can calculate existing shareholder=s wealth. Based on the asset beta of 1.0, we know that the appropriate discount rate for the project is 12.4% (= 4.0% + 1.0\*8.4%). The NPV is:

$$NPV = -110,000 + \frac{100,000}{.124} = \$696.45$$

After the new equity is issued, total equity value equals \$1.806 million (= \$1M + \$.696M +

\$.110M). This is the initial equity value plus the NPV of the project plus the \$110,000 contributed by new equityholders. We can now write two equations with two unknowns (share price and number of shares to be issued). The first equation states that the new share price must equal the new firm value divided by the new number of shares outstanding. The second equation states that new shareholders must get \$110,000 worth of equity in exchange for the \$110,000 cash they contribute:

$$P = \frac{\text{Firm Value}}{(10,000 + N)} = \frac{\$1.0M + \$.696M + \$.110M}{(10,000 + N)}$$

$$P * N = \$110,000$$

Solving these equations yields P=\$169.65 and N=648.4 shares.

(B) The effect of asymmetric information on the number of shares issued and issue price depends on whether the market over or under values existing assets. Suppose that new investors believe that the value of assets in place is less than \$1.696M. To find the effect of this belief on the issue price and number of shares issued, replace \$1.696 in the above equations with  $FV_{low}$  where  $FV_{low} < \$1.696M$ . Solving the above equations for the number of shares issued under asymmetric information,  $N_{Asymmetric}$ , yields:

$$N_{Asymmetric} = \frac{10,000 * 110,000}{FV_{low}}$$

Since  $FV_{low} < \$1.696M$  by assumption,  $N_{Asymmetric} > N$ . And since  $P = 110,000/N$ , it must be true that  $P_{Asymmetric} < P$ . Therefore, the number of shares increases and the price per share decreases. This makes sense intuitively--if new investors are wary of the value of assets-in-place, you must compensate them by giving them a larger portion of the equity at a lower price. The opposite will be true if new investors overvalue existing assets.

(C) The new stock price will equal the new equity value divided by the number of shares outstanding. In the case of the debt issue, the number of shares outstanding does not change. The new equity value will equal the old equity value plus the interest expense tax shield minus expected costs of financial distress. Since the debt is perpetual, the present value of the tax shield is equal to  $\tau D$  where  $\tau = .34$  and  $D = \$610k$ . Therefore the NPV of the tax shield is \$207k and the new equity value is:

$$\text{New Equity Value} = \$1.69645M + \$.207M - \$.05M = \$1.853M$$

$$\text{New Stock Price} = \frac{\$1.853M}{10,000} = \$185.35 \text{ per share}$$

(D) After the debt issuance, ZZ=s market value balance sheet will be:

**Market Value Balance Sheet**

Assets-in-place	\$1,000,000		Equity	\$1,853,450
+PV Project	\$806,450		Debt	\$610,000
Tax Shield	\$207,000			
Expected CFDs	-\$50,000			
Cash	\$500,000			
Total Assets	\$2,463,450		Total Liabilities	\$2,463,450

Using the equity and debt values above, we can calculate WACC as follows:

$$WACC = \frac{E}{E+D} r_E + (1-\tau) \frac{D}{E+D} r_D$$

To get  $r_D$ , use CAPM:  $r_D = 4\% + .20 * 8.4\% = 5.68\%$ .

Calculating  $r_E$  is more complicated. There are two effects that must be considered. First the asset mix has changed. Whereas ZZ used to be comprised only of carpet cleaning assets, it is now comprised of carpet cleaning assets and cash. Therefore, the new asset beta is:

$$\begin{aligned} \beta_{Asset} &= \frac{\$500,000}{\$1,806,450 + \$500,000} \beta_{Cash} + \frac{\$1,806,450}{\$1,806,450 + \$500,000} \beta_{Carpet Assets} \\ &= .22 * 0 + .78 * 1.0 = 0.78 \end{aligned}$$

From this asset beta, we can use CAPM to calculate the required return on assets:

$$r_{Assets} = 4\% + .78 * 8.4\% = 10.6\%$$

The second effect to consider is the effect of leverage. To calculate  $r_E$ , we must delever the asset beta:<sup>1</sup>

$$r_E = r_{Assets} + \frac{D(1-\tau)}{E} (r_{Assets} - r_{Debt})$$

$$r_E = 10.6\% + \frac{\$610,000(1-.34)}{\$1,853,450} (10.6\% - 5.7\%) = 11.7\%$$

Now we can plug into the WACC formula:

$$WACC = \frac{\$1,853,450}{\$2,463,450} 11.7\% + (1-.34) \frac{\$610,000}{\$2,463,450} 5.7\%$$

$$WACC = 9.73\%$$

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<sup>1</sup>Note that this equation is technically incorrect in that it does not account for costs of financial distress. The correct procedure would be to subtract CFDs from the NPV of the tax shield. The equation would then be:

$$r_E = r_{Assets} + \frac{D(1-\tau) + CFD}{E} (r_{Assets} - r_{Debt})$$

$$r_E = 11.8\%$$

If you are looking for a challenge, try deriving this equation.