UST Inc. – Case Questions

The purpose of this case is to apply your knowledge of optimal capital structure to the following question: How much debt should UST Inc. have in its capital structure? Based on the information in the case, your notes from class, and your experience, answer the following questions. You may want to start by thinking about the business UST is in and the competitive environment in which it operates.

To guide your analysis, examine the three scenarios described in this handout. An electronic version of Exhibit 4 is available on the course webpage. When preparing this case, you should use the revised Exhibit 4, included in this handout and on the webpage. Do NOT use the one which comes as part of the case.

1) What rating do you expect UST's debt to receive? You can use the note "Estimating Default Probabilities from Promised Yields" (attached) and "S&P's Creditstats" (in case packet) to estimate the debt rating and the implied probability of default for the debt.

2) What are the benefits of debt for UST? How do you calculate the value of these benefits?

3) What are the costs of debt for UST? When describing the costs of financial distress, be specific. Think about what kind of company UST is. Is this the kind of company that has high costs of financial distress and thus should have little debt in its capital structure? Numerically estimating the costs of financial distress is quite difficult. I am more interested in your description of the type and size of financial distress costs than your actual numerical estimate.

4) What capital structure would you recommend as appropriate for UST Inc.? To answer this question you will first need to determine your objective function. What should you be maximizing or minimizing when choosing an optimal capital structure?

You do not need to answer each question explicitly. The questions are designed to guide your thinking. You should, however, discuss all the relevant issues.

Exhibit 4

UST Inc. -- Pro Forma 1993 Results for Alternative Capital Structures[1]
($ in millions except per share data)

	1992	1993 Existing Cap. Structure	1993 Scenario I	1993 Scenario I	1993 Scenario I
Net Sales	1007.6	1173.9			
EBIT	480.5	576.0			
Interest	0.7	0.0			
Profits before taxes	479.8	576.0			
Taxes	182.3	218.9			
Profits after taxes	297.5	357.1			
Cashflow[2]	276.2	331.1			
Total dividends	168.7	200.0			
Shares outstanding	211.0	210.0			
Earnings / share (EPS)	1.41	1.70			
Dividends / share (DPS)	0.80	0.95			
Total debt	0.0	0.0	350	700	1050
Total book equity[3]	516.6	495.0			
Total market equity	6753.3	6300.0			
Stock price	32.0	30.0			
Equity β	0.8	0.8			

[1] The flow numbers (i.e. earnings) are for calendar year 1992 and calendar year 1993. The stock numbers (i.e. stock price) are for year end 1992 (December 31, 1992).

[2] The difference between operating profits after tax and free operating cashflow is net capital expenditure. To calculate cashflow I used capital expenditure of 34.0, depreciation of 50.7 and an increase in net working capital (accounts receivable plus inventory minus accounts payable) of 38. The 1993 numbers are capital expenditure of 38.4, depreciation of 55.0, and an increase in net working capital of 42.6.

[3] This number does not match the asset number from Exhibit 2 (674.0). The difference between my number and the number in Exhibit 1 is UST's accounts payable (179.0). I treat them as a negative asset rather than a liability (debt). Remember, net working capital is accounts receivable plus inventory minus accounts payable. Exhibit 1 treats accounts payables as a liability (debt) and thus doesn't subtract them off when it calculates total assets.

Mechanics of a Leverage Increasing Transaction

This note describes the mechanics of a leverage increasing transaction. UST will issue debt and use it to buy back its own equity. It also describes how to write the stock price after a transaction as a weighted average of the stock price prior to the transaction and another term. This is a technique we will use again in Lecture 13.

UST Inc. will increase its debt ratio without changing its underlying assets. Thus the proceeds from the debt issue will be used to repurchase stock. We need to calculate the number of shares which are repurchased ($N_{repurchased}$) and the new stock price (P_{new}). The stock price before the repurchase is announced is $30 per share.

1. Assume a straight exchange of debt for equity. This method is logically equivalent to making a large dividend payment. However, unlike a share repurchase, the number of shares would not change if a large dividend payment were made. Instead, the ex-dividend stock price would fall.

2. Cash in must equal cash out. Revenue required to retire shares must equal the revenue raised from the sale of debt.

$$P_{repurchased} \; N_{repurchased} = D_{issued}$$

   I have assumed that the transaction costs associated with the exchange are zero. This is technically incorrect, but in practice the transactions costs are small for large transactions such as this one. The number of shares repurchased are therefore:

$$N_{repurchased} = \frac{D_{issued}}{P_{repurchased}}$$

3. What is $P_{repurchased}$? As soon as the debt for equity transaction is announced, the market will change its assessment of the value of UST's equity. Equity value will increase by the amount of the tax shield and decrease by the expected costs of financial distress. In an efficient market, this updating will occur rapidly. Therefore, assuming the transaction takes place as planned, any effect that the transaction has on firm value will be incorporated into the price at which shares are repurchased. That is, $P_{repurchased} = P_{new}$.

4. The value of the equity remaining after the transaction must equal the value of the firm minus the value of the debt: $V_{new} - D_{new}$. After repurchasing $N_{repurchased}$ shares, the number of shares remaining will equal: $N_{old} - N_{repurchased}$.

$$\begin{aligned} P_{new} &= \frac{E_{new}}{N_{new}} = \frac{V_{new} - D_{issue}}{N_{old} - N_{repurchased}} \\ &= \frac{V_{new}}{N_{old}}\left(\frac{N_{old}}{N_{old} - N_{repurchased}}\right) - \frac{D_{issue}}{N_{repurchased}}\left(\frac{N_{repurchased}}{N_{old} - N_{repurchased}}\right) \\ &= \frac{V_{new}}{N_{old}}\left(\frac{N_{old}}{N_{old} - N_{repurchased}}\right) - P_{repurchased}\left(\frac{N_{repurchased}}{N_{old} - N_{repurchased}}\right) \end{aligned}$$

   The new share price is a weighted average of the repurchase price and the first term (V_{new} / N_{old}). Because the repurchase price equals the new share price, they both must also equal the new value of the firm divided by the old number of shares outstanding. (When shares are repurchased at fair value, equity holders that do not participate in the share repurchase are not diluted.) Note that if there are no changes to the firm (MM holds), then $V_{new} = V_{old}$. In this case, the stock price remains at $30.

On the other hand, if the transaction increases the value of the firm ($V_{new} > V_{old}$), then the new stock price will be greater than \$30. This is the case when the NPV of financing is positive.

Estimating Default Probabilities from Promised Yields

We wish to estimate the default probability of a corporate bond using the spread between the promised return and the expected return on a bond. If the promised interest rate exceeds the expected rate of return on the bond, the market must be assuming a positive probability of default on the bond. We are going to use the difference between the promised and expected return on the bond to estimate this probability of default.

The first step is to write the bond price as the discounted value of the expected cashflows to the bond. We will assume that the probability of default is the same each year. Thus if the probability of default is p, then the probability of receiving the interest payment the first year is $(1 - p)$. The probability of receiving the interest payment the second year is $(1 - p)^2$. The probability for subsequent years is calculated the same way. Now we need the portion of the expected cashflow that comes in default. The probability of the bond defaulting the first year is p. In default we assume that bond holders receive 65 percent of what they were promised: $(1 + r_{promised})$ 1000. Sixty-five percent is the historical fraction that bond holders have received on defaults of senior debt occurring between 1974 and 1993.[4] The probability that the bond defaults the second year is $p\ (1 - p)$. Subsequent year's probability is calculated in the same way. Thus the bond price can be written as:

$$
\begin{aligned}
P_{Bond} &= \sum_{t=1}^{\infty} \frac{(1-p)^t\ (r_{promised})\ 1000 + p\ (1-p)^{t-1}\ 0.65\ (1+r_{promised})\ 1000}{(1+r_D)^t} \\
&= \frac{(r_{promised})\ 1000\ (1-p) + p\ (0.65)\ (1+r_{promised})\ 1000}{r_D + p} = 1000
\end{aligned} \qquad (1)
$$

Notice we have written this expression for a perpetuity as opposed to a bond with a finite maturity.

The last piece we need is the discount rate or the expected rate of return on debt. We will use the CAPM and estimates of debt betas to calculate the expected rate of return on debt. See the following table. This equation now has only one unknown – the implied probability of default. In the following table, I have solved for the probability of default for each promised/expected spread.

In deriving the probability of default, I have assumed that the bonds are not callable and are as liquid as treasuries. Thus any differences in the promised yield between corporate bonds and treasuries are attributable to differences in their default risk. If corporate bond yields are higher because they are less liquid than treasury securities, this will cause us to over estimate the probability of default.

If you do not find equation (1) intuitive, go back and look at the example of a risky bond from lecture 2. Then use the information in the following table to calculate the expected return on a one year bond. Assume that the return in default is $0.65\ (1 + r_{promised})$. The calculated expected return should be close to the number reported in the following table.

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[4] *Corporate Bond Defaults*, Moody's Investor Service, 1993, p. 8.

Default probabilities implied by promised yield spreads for long term corporate bonds

	S&P Rating			
	AAA	AA	A	BBB
Promised Yield[5]	7.68%	7.83%	8.04%	8.32%
Beta[6]	0.19	0.20	0.21	0.22
Expected Yield[7]	7.32%	7.40%	7.49%	7.57%
Probability of Default	0.97%	1.15%	1.45%	1.99%

When calculating interest payments, use the interest rates from these tables. You should also assume that the debt is sold at face value. Therefore the promised rate (r_p) and the coupon rate (r_c) are the same.

Calculating the NPV of Expected Costs of Financial Distress (CFDs)

The difficulty with calculating the expected costs of financial distress is estimating the dollar loss the firm experiences if it becomes bankrupt. The following calculation assumes the firm suffers financial distress only if it is in bankruptcy. In practice, financial distress can occur in firms which are not in, but may be near, bankruptcy. If the probability of bankruptcy is p, then the expected costs of financial distress are equal to:

$$NPV[\ CFD\ ] = \sum_{t=1}^{infinity} \frac{p\,(1-p)^{t-1}\,Loss}{(1+r_{Debt})^{t}} = \frac{p\ Loss}{r_{Debt}+p}$$

Why is this the correct expression? The expected loss is the loss times the probability that the firm experiences financial distress. For the firm to experience distress in year t, it must not experience it in the

[5] The promised yields for long term corporate bonds are for December, 1992.

[6] Fama, Gene and Ken French, 1993, "Common Risk Factors in the Returns on Bonds and Stocks," *Journal of Financial Economics*, 33, 3-56, Table 4. The betas are estimated for bond returns rated Aaa, Aa, A, and Baa by Moodys. These betas are estimated using the value-weighted equity index as the market portfolio.

[7] To calculate the expected return, I used a 30 year risk free rate of 5.7%. This is based on a thirty year bond yield of 6.8% minus a risk premium of 1.1%. The market price of risk is 8.5%.

first t-1 years (which has a probability of $(1- p)^t$) and then experience it in the t-th year (which has a probability of p). The number you need to guess at is the *Loss*. If the firm experiences financial distress, how much additional value will be lost if the firm has debt in its capital structure.

Calculating the NPV of the Tax Shield When the Firm is Liquidated upon Default

Usually, we assume that debt is perpetual and that the tax shield has the same risk profile as the debt. In reality, many firms that go bankrupt are liquidated and are therefore unable to capture the tax benefit of debt in perpetuity. To calculate the present value of the tax shield when the firm is liquidated upon default, we need to discount the expected cash flows from the tax shield:

$$PV[TS] = \sum_{t=1}^{infinity} \frac{(1-p)^t \tau r_{promised} D + p(1-p)^{t-1} \tau r_{default} D}{(1+r_D)^t}$$

$$= \sum_{t=1}^{infinity} \frac{(1-p)^{t-1} \tau r_D D}{(1+r_D)^t} = \frac{\tau r_D D}{r_D + p}$$

