

**15.402 Fall 2002**  
**Final Exam**  
*Asteroid Pictures Solution Outline*  
*Courtesy of Prof. John Chalmers.*  
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**Answer question 1:**

Since Zizanic is a project of Asteroid Films, one reasonable assumption is that the corporation is profitable and can benefit of debt tax shields, the investment in Zizanic should theoretically be financed in the same fashion as the rest of the company. In practice, since Asteroid's debt/equity ratio is already  $\frac{1}{2}$ , and since the investment in this movie is not backed by hard assets, Zizanic's share of debt should be smaller than for the rest of the corporation – i.e. Asteroid's debt capacity increases proportionally less than the amount invested in the movie. The exact amount is hard to estimate – in the following WACC calculations all assumption ranging between 0 additional debt and the same share of debt as the rest of the company would be acceptable, as long as this issue concerning debt capacity is carefully spelled out.

**Answer Question 2:**

In order to estimate WACC, we have to estimate the cost of equity and cost of debt for the project. We also assume that Asteroid finances Zizanic with the same share of debt as the rest of the company.

- Since both Asteroid pictures and Pixar derive most of their profits from movies, they should have similar returns on assets. We decide to use Pixar as a comparable<sup>1</sup>. We start by using Pixar's equity beta estimated with monthly return since there will be less noise. Since Debt = 0,  $\beta_A = \beta_E = 1.30$ . Using CAPM, if we assume that the market risk premium is 7.5%,  $r_A = 2\% + 1.3(7.5\%) = \mathbf{11.75\%}$ .
- Asteroid Pictures has a credit rating of BBB (same as Harrah's Casinos). Comparable debt in the market has a 5.8% YTM. Also, Asteroid's market value of debt is \$935M, given its current market price (\$93.5/\$100).

In this question full credit was given only to people who explained **WHY** they chose a certain beta, a certain RD or a certain Rf rate.

The two data points above allow us to write:

$$r_A = r_D \times \frac{D}{D+E} + r_E \times \frac{E}{D+E}$$

$$11.75\% = 5.8\% \times \left[ \frac{0.935}{2+0.935} \right] + r_E \times \left[ \frac{2}{2+0.935} \right]$$

$$\text{Therefore } r_E = \mathbf{14.5316\%}$$

$$\begin{aligned} \text{WACC} &= r_D (1-t) \times \frac{0.935}{2.935} + r_E \times \frac{2}{2.935} = \\ &= 5.8\% \times (1-40\%) \times \frac{0.935}{2.935} + 14.5315\% \times \frac{2}{2.935} = \mathbf{11.0109\%} \end{aligned}$$

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<sup>1</sup> The best answer would acknowledge the fact that Pixar is a much smaller company and might not be completely meaningful as a comparable. As a cross check, MGM and Harrah's (companies of comparable size) asset betas can be used to estimate the asset beta of a company invested 100% in movies.

**Answer Question 3:**

In the APV calculations the discount rate should be that of an all-equity firm:  $r_A$ . We found above that  $r_A$  for Asteroid is **11.75%**.

**Answer Question 4:**

a)

	Today 2002	2003	2004	2005	
<b>+ Revenues from Operations</b>					
First year (theatres)		45			
Following (videotapes @ \$20 each)+B7			10	5	
Increased Profits from other movies		1.5	1.5	1.5	
<b>- COGS</b>					
Videotapes production @ \$4 each			-2	-1	
<b>- Depreciation (3 years)</b>		-16.6	-16.6	-16.6	
<b>EBIT</b>		<b>29.9</b>	<b>-7.1</b>	<b>-11.1</b>	
<b>- Taxes @ 40%</b>		-12.0	2.8	4.4	Assuming the company has other profits
<b>Earnings BI after Taxes</b>		<b>17.9</b>	<b>-4.3</b>	<b>-6.7</b>	
<b>+ Depreciation</b>		16.6	16.6	16.6	
<b>Capex</b>					
- Purchase of rights	-3				
- Production costs	-46.8				
- Costumes sale delayed	-0.3	0.3			Also interest expense was acceptable
- Sale of production items				1	
<b>NWC</b>					
- Increase in NWC		-0.1	0		
- Decrease of NWC				0.1	
<b>FREE CASH FLOWS</b>	<b>-50.1</b>	<b>34.74</b>	<b>12.34</b>	<b>11.04</b>	

b)

Asteroid would depreciate straight line because the total amount of depreciation it could benefit from for tax purposes would increase. Although when Asteroid sells its assets in year three it would have to pay taxes on the surplus, the capital gains tax rate is lower than the corporate tax rate (40% in this case).

### Answer Question 5:

1) Assuming that the Zizanic project is contributes nothing to the firm's debt capacity, APV = NPV.

#### Valuation:

Discount rate = 11.75%

NPV= APV= **(\$1.22M)**

2) If instead we assume that the project adds to the debt capacity so as to keep the overall D/E ratio constant, results are different.

- NPV is calculated with the same cash flows but using the firm WACC= **11.0109%**. NPV turns out to be (\$0.722M)
- APV is calculated using the same cash flows and Asteroid's cost of equity: 11.75%. The all-equity value of the firm is, as above, **(\$1.22M)**. On top of it we need to add the PV of the interest tax shield. The additional debt issued because of Zizanic is \$15.9M (amount that keeps the firm capital structure constant). Yearly interest payments would be  $\$15.9 \times 5.8\% = \$0.922\text{M}$ . Yearly tax savings would be:  $\$0.922 \times 40\% = \$0.3688$ . The PV of the tax shield is<sup>2</sup>:  $0.3688/(1.02) + 0.3688/(1.02)^2 + 0.3688/(1.02)^3 = \$1.0638\text{M}$ . APV turns out to be: **(\$0.156M)**.

Based on these calculations, Rock should not go ahead with the Zizanic project regardless of how it is financed.

In this question, full credit was given only to students who explained why they were using a certain discount rate rather than another.

### Answer Question 6:

- a) Rock is facing a typical case in which his investment provides access to a real option. By deciding to invest in Zizanic, he can secure the 3-year right of making a decision on whether to invest in the sequel or not. He has almost all the data he needs to value the real option: he knows how much he should pay for Zizanic 2 ( $K$  = strike price); he knows how much the project is worth today ( $S_0$ ); he knows how much time he has to make up his mind ( $T = 3$  years); he knows the relevant discount rates to apply. He is only missing information on the volatility of the value of the project. He does have volatility information for comparable firms. Clearly these volatility estimates will be substantially lower than the volatility of a single movie because the firms are somewhat diversified relative to a single project. However, the volatility provides a starting point to develop a reasonable volatility estimate.
- b) If we assume that the movie business is very volatile, and we use a  $\sigma$  of 50%, the value of the option will be (assuming exercise in 2005). I don't expect you to be able

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<sup>2</sup> Please note that the savings from the tax shield are discounted at the risk free rate, 2% (2-year government notes)

to calculate the Black-Scholes value in your answer here. What I hope you do is think about the option value boundaries.  $C > S - PV(x) \rightarrow C > 1.95 - 1.88 = .07$ . If you think about the values of  $N(d1)$  and  $N(d2)$  you can probably get an even better guess. In addition, some discussion of the importance of volatility to the estimates is also important.

If you had a computer you could have calculated the Black-Scholes value:

- PV (exercise price) =  $\$2M / (1.02)^3 = \$1.884M$
- PV (call value) =  $N(d1) \times S_0 - N(d2) \times PV(K) = N(d1) \times 1.95 - N(d2) \times 1.884$ .  $d1 = \log [S_0 / PV(K)] / (\sigma \times T^{1/2}) + (\sigma \times T^{1/2}) / 2$ ;  $d2 = \log [S_0 / PV(K)] / (\sigma \times T^{1/2}) - (\sigma \times T^{1/2}) / 2$ .  $d1 = 0.4727$ ;  $d2 = -0.3932$ .  
Therefore PV (call value) =  $N(0.4727) \times 1.95 - N(-0.3932) \times 1.884 = 0.6818 \times 1.95 - 0.347 \times 1.884 = \$0.69M$

**NOTE:** In this question credit was given only to the students who talked about the volatility (always the most important variable in option pricing), realized that the volatility could be estimated from the data provided, and showed that they were aware that a single project is always more volatile than a whole firm!

- c) The value of the option should be added on top of the DCF value identified previously. This makes the investment worth more! Accounting for real options makes the investment a profitable one!

**Answer to question 7:**

- First, if Mom & Dad sell their other holdings they will be less diversified and their required rate of return will increase, since CAPM is based on the assumption that investors are diversified. This will cause an increase in hurdle rates, and the firm will forego many investment opportunities. Selling the company to a diversified investor increases its value.
- Second, in an M&A transaction there might be potential to create value by introducing better management, cutting costs, exploiting synergies.
- Third, several studies have showed that, on average, the significant premiums are paid in M&A transactions. Though there is no assurance that Asteroid is a good target for an acquisition.