

Finance 340 – Financial Management I

Summer 2002

Final Exam Sample Problem Solutions

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T-Th 1:30-4:30

- 1) Fernie Mining Corporation 7% semiannual coupon bonds are currently trading at \$1,050; they have 12 years remaining until maturity. Fernie preferred stock has a par value of \$100 with a 8.25% promised dividend, paid quarterly; the preferred stock is currently trading at \$110 per share. Fernie common stock currently sells for \$45 per share. Its latest dividend was \$5.19 per share; dividends are expected to grow by 4% per year for the foreseeable future.

The risk-free rate is currently 4.5% and average return on the market as a whole is 12.5%. Fernie's beta is 1.31.

When using the bond-yield-plus-risk-premium approach, Fernie assumes that its common equity requires a 9.1% risk premium over its own bonds.

Fernie's corporate marginal tax rate is 40%, and its capital structure includes 50% common equity, 35% debt, and 15% preferred stock.

Fernie is considering two different technologies for a new mine it will be opening next year. These technologies are mutually exclusive, so one of the two can be implemented.

Technology A will require an initial investment of \$2.5 million, and will generate annual net revenues of \$750,000 for each the first 3 years and \$300,000 for each of the following 7 years.

Technology B is more expensive to implement, but will allow the mine to be more productive longer. This technology will require an initial investment of \$3.3 million, and will generate revenues of \$625,000 for each of the next 10 years.

- a) What is Fernie's weighted average cost of capital (WACC)? Hint: In calculating the cost of Fernie's equity, take the average of the values calculated based on the discounted cash flow, CAPM, and bond-yield-plus-risk-premium approaches.

The component cost of debt is $P/Y = 2$, $N = 24$, $PV = -1,050$, $PMT = 35$, $FV = 1,000 \Rightarrow I = 6.40\%$.

The cost of preferred stock is $8.25 / 110 = 7.50\%$.

The cost of common equity must be calculated using each method.

– DCF: $k_s = \frac{D_1}{P_0} + g = \frac{5.19(1.04)}{45} + 0.04 = 16\%$.

– CAPM: $k_s = k_{rf} + \mathbf{b}_s(k_m - k_{rf}) = 0.045 + 1.31(0.125 - 0.045) = 15\%$.

– BYPRP: $k_s = 6.40 + 9.10 = 15.5\%$.

Thus, the cost of common equity is $k_s = (16 + 15 + 15.5) / 3 = 15.5\%$.

The firm's WACC is therefore $WACC = 0.35 \times 6.40 (1 - 0.40) + 0.15 \times 7.50 + 0.50 \times 15.5 = 10.22\%$.

- b) Calculate the payback period for each technology. If Fernie requires any project to pay back its initial investment within 4 years, which technology will it accept?

Technology A – $\$750,000 \times 3 = \2.250 million. Thus, in the 4th year there are still $\$250,000$ in up-front costs to recover. $250 / 300 = 0.83$, so payback occurs in 3.83 years for Technology A.

Technology B – Since this technology provides constant annual cash flows, payback occurs in $3,300,000 / 625,000 = 5.28$ years.

Based on the payback method, only Technology A is acceptable.

- c) Calculate the discounted payback period *for Technology A only* given the WACC calculated in part a.

<u>Year</u>	<u>Cash Flow</u>	<u>DCF</u>	<u>Cum. DCF</u>
0	(\$2,500,000)	(\$2,500,000)	(\$2,500,000)
1	750,000	680,457	(1,819,543)
2	750,000	617,363	(1,202,180)
3	750,000	560,119	(642,061)
4	300,000	203,273	(438,788)
5	300,000	184,425	(254,363)
6	300,000	167,324	(87,039)
7	300,000	151,809	64,770
8	300,000	137,733	202,503
9	300,000	124,962	327,465
10	300,000	113,375	440,840

Thus, payback occurs during the 6th year. Since $87,039 / 151,809 = 0.57$, the discounted payback period for Technology A is 6.57 years.

With a payback requirement of 4 years, this project is no longer acceptable on a discounted payback basis.

- d) Calculate the net present value (NPV) of each technology. Based on this method, which of these two technologies should Fernie choose?

Technology A – Although we completed the table above for the total cumulative discounted cash flows, we can calculate the NPV using the irregular cash flow worksheet as well. $CF_0 = -2,500,000$, $C_01 = 750,000$, $F_01 = 3$, $C_02 = 300,000$, $F_02 = 7$, $I = 10.22 \Rightarrow NPV = \$440,840$.

Technology B – Because this technology has constant cash flows, you need not use the irregular cash flow worksheet. Simply use the TVM keys to calculate the present value of the cash flows and subtract off the required initial investment: $P/Y = 1$, $N = 10$, $I = 10.22$, $PMT = 625,000$, $FV = 0 \Rightarrow PV = -3,804,326$. Thus, $NPV = 3,804,326 - 3,300,000 = \$504,326$.

Based on NPVs, Fernie should choose Technology B.

- e) Calculate the internal rate of return (IRR) for each technology. Based on this method, which of these two technologies should Fernie choose?

Technology A – With the above information entered into the irregular cash flow worksheet, calculate $IRR = 15.45\%$.

Technology B – In the TVM keys, enter $PV = -3,300,000$ and solve for $I = 13.69\%$.

Based on IRRs, Fernie should choose Technology A.

- f) Calculate the modified internal rate of return (MIRR) for each technology. Which should be chosen based on this method?

Technology A – First compound all positive cash flows to the terminal date. Because we have two mini-annuities, this is fairly easy to do. First, calculate the date 3 value of the first 3 cash flows: $P/Y = 1, N = 3, I = 10.22, PV = 0, PMT = 750,000 \Rightarrow FV = -2,487,784$. Use this as a present value as of date 3, and compound it along with the final 7-year annuity of \$300,000 up to date 10 (the terminal date): $N = 7, PV = -2,487,784, PMT = -300,000 \Rightarrow FV = 7,781,718$.

Next use this as a future value to calculate the MIRR based on the terminal value and the initial investment: $N = 10, PV = -2,500,000, PMT = 0 \Rightarrow I = 12.02\%$.

Technology B – This one is even easier, because the cash flows are a single annuity. The terminal value is \$10,066,577 ($N = 10, I = 10.22, PV = 0, PMT = -625,000$). Thus, the $MIRR = 11.80\%$ ($PV = -3,300,000$).

Based on MIRRs, Fernie should choose Technology A.

- g) If you have done everything correctly thus far, you should have a conflict between the IRR and NPV methods. In light of these conflicting recommendations, which technology should be chosen? Explain.

Generally speaking, the NPV method is more reliable. After all, it generates an up-front cash value for each technology and, as we have said many times, cash is king.

Thus, even though Technology A has the higher IRR, MIRR and better payback period, Fernie should still choose Technology B.