Name: _____

Finance II (441) Professors Matsa

Corporate Finance Final: Practice Exam B

1. Time limit: you have two hours to complete the exam.

2. The exam is closed book/closed note. You may not use any outside materials, including a computer. I highly recommend using a calculator. Potentially useful formulas have been included on the last page of the exam.

3. Point totals for each question are specified in parentheses. There are 240 total points.

4. Circle your numerical answers. This makes it easier for me to find them. If you get stuck on the math, tell me what the correct answer should be based on your intuition.

5. Unless the question specifies otherwise, there are no taxes or transaction costs.

6. As always, I expect you to abide by the honor code. I trust that no one will give or receive assistance which gives them an unfair advantage over other students.

7. Concise answers will be rewarded.

Good Luck!

Return my exam to my mailbox: First year Second year PT

Permission to Return Exam in Mailbox

The Family Educational Rights and Privacy Act (FERPA) is intended to protect students from the unauthorized disclosure of their personal information. One aspect of the law would require that graded assignments be either handed out directly to students or be placed in sealed envelopes before placing in mailboxes.

In order to facilitate a quicker turnaround, this release gives permission for this exam to be returned directly to my student mailbox.

_____

(signature)

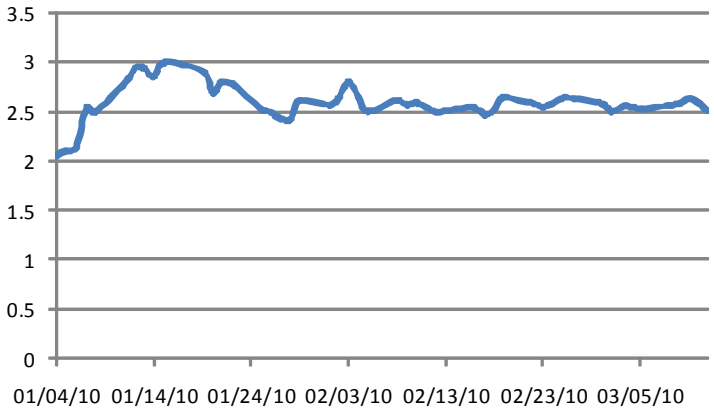
Final Exam

Question (max)	Score
1 (60)	
2 (35)	
3 (90)	
4 (55)	
Final exam (240)	

Course Grade Overall

Assignment	Score
Final exam	
Midterm exam	
Homework	
Course total	

1) West Coast Bancorp Inc. (WCBO) is a bank holding company for West Coast Bank, which operates 65 locations in Oregon and Washington State. West Coast Bank combines the sophisticated products and expertise of larger banks with the local decision making, market knowledge and customer service of a community bank. WCBO has no outstanding bonds or bank loans. Instead the bank is financed by deposits and equity. There are 20M shares currently outstanding. The graph shows recent movements in West Coast Bancorp's stock price.



A) As with many banks, West Coast Bancorp is short of equity capital. On December 21, 2009, they announced their intention to raise $5 million of equity capital through a rights offering. The company gave stockholders non-transferable rights (on the 21st of December) to buy up to 5 million common shares at a subscription price of $1/share. Each shareholder received 0.25 subscription rights for each share of common stock they owned. Each subscription right entitles the holder to purchase one new share of common stock at the subscription price on or before March 16h, 2010 (tomorrow). When West Coast Bancorp announced the rights offering and distributed the rights last December, would you expect the stock price to have risen or fallen on the announcement? Explain completely. (15)

B) Why did West Coast Bancorp choose to raise equity capital using a rights offering rather than using a public equity issue? Explain completely. (15)

C) Given the current stock price of $2.50 per share, should shareholders exercise their rights? You should explain how exercising the rights affects the investor's total wealth? (15)

D) The return on West Coast Bancorp's equity (dividends plus capital gains) over the last 12 months was 15.9%. Should the expected return on equity be higher or lower in the next 12 months? Assume the risk-free rate and market risk premium have not changed. Explain completely. (15)

2) Short Discussion Questions.

A) In class, when valuing a futures contract we discounted the futures price at the risk-free rate. If you entered into a forward contract to sell pork bellies to Tyson, a major bacon processor, how would you determine the discount rate you would use for the forward price? Explain completely. (10)

B) When Cadbury and Kraft merged, the volatility of assets of the combined firm was less than the volatility of assets of either Kraft or Cadbury prior to the merger. Explain how this reduction in risk affects the combined firm's cost of capital. (10)

C) Penton Business Media Holdings Inc, publisher of 113 trade magazines such as Ward's AutoWorld, Restaurant Hospitality and National Hog Farmer filed for bankruptcy. Their assets are now worth $841M, significantly less then their debt payments. A year prior to the bankruptcy filing, their assets were worth $1.4B. Is the fall of over $550M a good estimate of the costs of financial distress for Penton? Explain. (15)

3) Petrobras engages in oil exploration and production activities in Argentina, Bolivia, Ecuador, Peru, and Venezuela. The value of Petrobras' assets one year from today depends upon the state of the world next year and is specified in the table below. Assume that the correct discount rate is 9% for all cash flows (i.e. all βs are zero and the risk free rate is 9%). Assume the managers do not know the state of the world. Assume the states are equally likely and managers maximize the wealth of current common shareholders. Round your answers to one decimal (10.0 pesos or 10.0%).

Values in 2005	State 1	State 2	State 3	State 4		
Asset Value ($M)	140	250	300	410		

A) Back in 2005, Petrobras sold preferred equity for $220M. This is both the liquidation value and what the preferred was sold for. The preferred matures next year. The preferred equity pays a contractually specified dividend equal to 10% of the liquidation value at the end of each year. This year's dividend has already been paid. The preferred equity holders will receive the liquidation value of the preferred (220M) plus the dividend one year from today. What is the current market value of the preferred equity? Explain completely. (10)

B) How would your answer to A) have changed if the asset β had been positive? Assume the distribution of cash flows does not change. This assumption applies only to question 3-B). Give me a brief qualitative answer with a logical explanation. Don't calculate any numbers. (5)

C) Petrobras just discovered that they can spend an additional $100M today and purchase a new oil field. The value of the oil field investment will be either $110M or $130M next year (see table). Would a firm invest in this project in an M&M world? Explain briefly. (10)

Values in 2005	State 1	State 2	State 3	State 4		
Asset Value ($M)	140	250	300	410		
Oil Field Value ($M)	130	110	130	110		

D) If Petrobras sold shares of common equity to new investors to finance the 100M investment, what fraction of the common equity would the new investors own? Explain completely. (15)

E) Would the current common equity shareholders want to sell \$100M of common equity (to new outside investors) and make the new oil field investment? If the decision to issue common equity and invest changes the old shareholder's wealth, describe the source of this wealth creation or destruction completely. Remember Petrobras's managers do not know the true state of the world and the market knows they don't know the true state of the world. (20)

F) An alternative way to finance their project is for Petrobras to sell off a fraction of their existing assets ($100/V_{existing\ assets}$) and invest the proceeds in the oil field investment. If this was not prohibited by the preferred contract and Petrobras could sell these assets for their true value, would the preferred holders want to allow this? Explain completely, but calculate as few numbers as possible. (15)

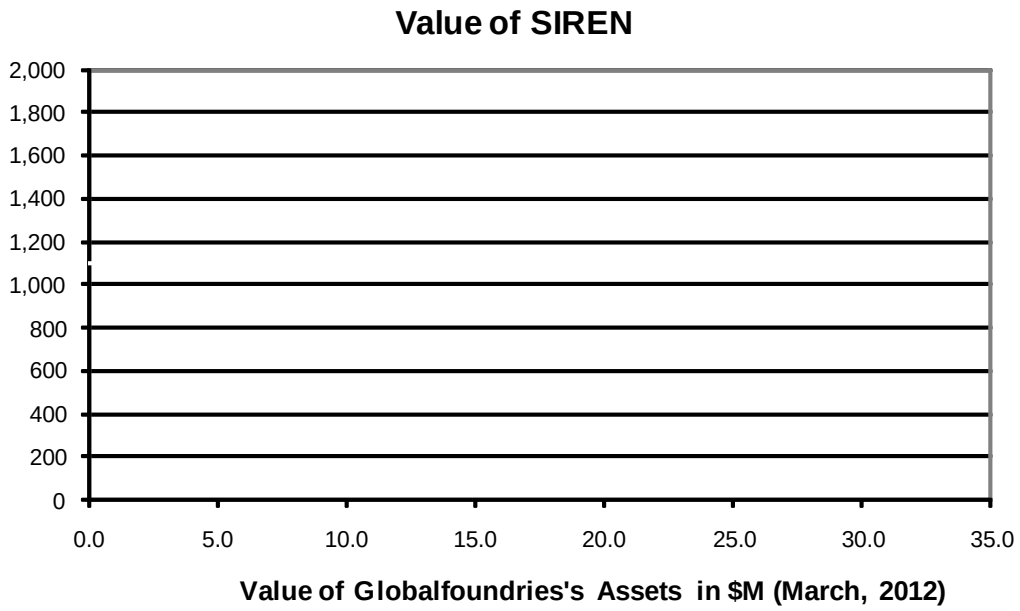
G) Assume that the existing preferred equity contract prohibits Petrobras from financing the project with asset sales or by issuing debt or additional preferred equity. Is it possible to renegotiate the promised dividend rate on the preferred so that both the preferred equity holders and common equity holders will be better off? Explain completely. (15)

4) Globalfoundries issued 5,000 Step-up Interest Rate Equity Notes (SIRENs) on March 10th, 2010. Their CFO, Sheldon Cooper, explained at the time it was to upgrade their chip manufacturing capacity. The SIRENs mature on March 10th, 2012. Each bond has a face value of $1000. These bonds were sold for par value and have a coupon rate which increases over time. The coupon rate is 3% the first year and 10% the second year. Interest payments are made on March 10th, 2011 and March 10th, 2012. In addition to the increasing interest, each bond can be converted into stock at the owner's discretion. This conversion can be made at any time until March 8th, 2012. When investors convert, they give up the SIREN and receive 20 shares of stock. Prior to the SIREN issue, Globalfoundries had 300,000 shares outstanding, no debt, and is not expected to pay dividends on their stock in the next 3 years.

A) What cash flows do the SIREN investors receive at the end of the first and second year if the SIRENs don't default? Explain completely. (5)

B) How high must the stock price be in two years for the SIREN holders to exercise their option? Explain completely. (15)

C) Draw the payoff diagram for one SIREN as a function of Globalfoundries's asset value on March 8th, 2012. Make sure the figure is well labeled. (20)



D) At the time of the SIREN issue, a one-year zero-coupon bond with a face of $1000 and identical default risk sold for $900 while a two-year zero-coupon bond with a face of $1000 and identical default risk sold for $810. What was the value of the conversion option in each SIREN instrument at the time of issue? Explain completely. (15)

Equations and Facts

Risk premiums:

$$E\left[r_{Market} - r_{risk-free}\right] = 8.0\%$$
$$E\left[r_{Long\ government\ bond} - r_{risk-free}\right] = 1.1\%$$

Return on an asset:

$$r_{asset} = r_{risk-free} + \beta_{asset}\left(r_{market} - r_{risk-free}\right) + \varepsilon$$

Expected rate of return on equity:

$$r_{equity} = r_{asset} + \frac{D}{E}\left(r_{asset} - r_{debt}\right)$$

Annuity formula:

$$PV = \sum_{t=1}^{N} \frac{C}{(1+r)^t} = \frac{C}{r} - \frac{1}{(1+r)^N}\frac{C}{r} = \frac{C}{r}\left[1 - \frac{1}{(1+r)^N}\right]$$

Payoff to options:

$$Call\ Payoff = Max\left[S_t - X, 0\right]$$
$$Put\ Payoff = Max\left[X - S_t, 0\right]$$

NPV of a project:

$$\text{NPV[Project]} = \text{NPV[Project | Capital Structure is Irrelevant]} + \text{NPV[Financing]}$$

Weighted Average Cost of Capital:

$$\text{WACC} = \text{r}_\text{E}\,\frac{\text{E}}{\text{E}+\text{D}} + (1-\tau)\text{r}_\text{D}\,\frac{\text{D}}{\text{E}+\text{D}}$$

1-Year Futures Price:

$$\text{Futures Price}_0 = \text{E}_0\left[\text{Commodity Value}_1\right]\left(\frac{1+\text{r}_{\text{risk-free}}}{1+\text{r}_{\text{commodity value}}}\right)$$

Solutions to Corporate Finance Final: Practice Exam B

1) West Coast Bancorp rights offering

A) The stock price will drop upon the announcement and issuance of the warrants, because it is extremely likely that equity will be issued at below the current market price. Selling equity for less than its value lowers the value of each share. The market can forecast that this will happen (with very high probability) and so the stock price will drop today. For example, if the stock price prior to announcement was $2.25 then the stock price would be expected to drop to $2.00/share.[1]

The reason that the stock price drops is NOT because the rights issue is a signal that the equity value or stock price are higher than their true value. When a firm announces an equity offering, the stock price drops on average because the market expects that firms which are over valued by the market (the stock price is too high) are more likely to issue equity than firms which are under valued by the market (the stock price is too low). By issuing over valued equity to new shareholders, the managers can increase the wealth of current shareholders (see Lecture 10). The logic is not the same with a rights offering. West Coast Bancorp is issuing equity to their current shareholders. Remember the rights offerings are non-transferable. Because the equity is being sold to the current shareholders, there is not an incentive to sell the equity when the stock price is too high. The rights issue effectively eliminates the mispricing of equity, and any associated signal.

B) West Coast Bancorp most likely raised capital using a rights offering instead of issuing public equity in order to avoid selling under-priced equity and transferring wealth from their current shareholders to new shareholders. Managers often have better information than the market about the true value of the bank's assets. For example, they have more updated information about the recent performance of the bank's loan portfolio. Managers try to avoid selling equity to new shareholders when the true value of the equity is greater than the market price. With the rights issue, the sellers of the equity (current shareholders) and the buyers of the equity (current shareholders) are the same. Because the buyers and the sellers of the equity are the same, it does not matter if the market price is too low. A firm with positive NPV projects who finds an equity issue an expensive source of capital because the market price is too low will thus prefer a rights offerings.

Some of you pointed out that West Coast Bancorp's stock price shot up in early 2010. If managers were expecting that increase, then an equity issue would have been especially expensive for current shareholders. It turns out that the price jumped early in 2010 because WCBO sold some "bad" assets. It is plausible to believe that this deal was already in the works before the rights issue.

[1] If the stock price is $2.25/share before the announcement, then the equity value is $45M (20*2.25). If the market expects all the rights to be exercised, then $5M in cash will be paid into the firm (5M rights at $1/right). Remember, each of the 20M shares receives 0.25 rights or a total of 5M rights. This means the total equity value will rise to $50M, and the total number of shares will rise to 25M. The stock price will fall to $2.00/share [50M/25M].

This doesn't mean the wealth of the current shareholders will fall. If it was certain that the rights would be exercised (the information value is zero) and this will happen soon (the time value of money is zero), then the rights are worth their intrinsic value of $1/share [2–1]. Since each share comes with a 0.25 a right, the shareholder finds that their stock drops in value by 25 cents but they are given a 0.25 a right which is worth 25 cents [0.25 * 1].

C) Shareholders should exercise the warrants, because the strike price is $1.00 per share and the current stock price is $2.50 per share. Given the market price of the stock and the strike price on the warrant, the market will assume that the rights will be exercised. Thus, the decision to exercise will not raise the shareholders wealth relative to its current value.[2] If shareholders do not exercise the rights, however, this will lower their wealth.

It may help to illustrate the logic with a numerical example. Because the rights (options) are in the money and expire in one day, their value is equal to their intrinsic value (1.50 = 2.50-1.00). Thus, an investor who owns 4 shares will own one warrant as well. The four shares are worth 10.00 [4 * 2.50] and the warrant is worth 1.50.[3] The shareholder's portfolio is thus worth 11.50 today. When the shareholder exercises their right tomorrow, they will contribute 1 dollar (the strike price). Thus they will start with 12.50 (the portfolio value of 11.50 plus one dollar). Tomorrow, after exercising the rights, they will have 5 shares which will be worth 2.50 each or 12.50 total.[4] If the shareholder does not exercise their right, they will have 4 shares worth 2.50 plus the dollar. The total value of their portfolio will be 11.00. The loss of the value (1.50) is the value of the right. It is worth 1.50 today, but will expire worthless tomorrow if not exercised.[5]

D) Uncertain. West Coast Bancorp is increasing its equity through the rights offering and thus their leverage will decrease. They have no bank loans or bonds outstanding, but they are partially financed by debt in the form of deposits. The reduction in leverage will lower the equity β and the expected return on equity relative to the prior 12 months.

However, this does not mean that the expected return will be lower than 15.9%. The return of 15.9% over the last 12 months is the *realized* return. It is the prior year's expected return on equity plus the deviation from the expected return. If the deviation from the expected return was negative, then the expected return was above 15.9% before the equity issue. Now it is lower, but it may be above or below 15.9%. Without more information about last year's *expected* return we cannot determine whether the expected return over the next 12 months will be above or below 15.9%.

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[2] The decision to exercise does not reveal the market's opinion about the value of the stock, only that the price is greater than $1/share. Of course, the CEO of West Coast Bancorp had a different spin on the situation. Robert D. Sznewajs, President & CEO, said, "The significantly oversubscribed rights offering along with the private placements of $155 million during the fourth quarter of 2009 represent the belief our shareholders have in the Company." (http://finance.yahoo.com/news/West-Coast-Bancorp-Announces-prnews-1465809305.html?x=0&.v=1)

[3] This means the market value of the equity plus the market value of the warrants is 57.5M [20 * 2.50 + 5 * 1.50].

[4] The market value of the equity plus warrants (which is the same as the market value of the bank's assets minus the deposits) was 57.5 yesterday. 5M of cash is paid in today when the rights are exercised. This means the market value of the equity is now 62.5M. Given there are now 25M shares, the stock price will be 2.50 tomorrow.

[5] This analysis assumes everyone exercises their rights, which should happen. It does not take a lot of sophistication to figure out you should buy a $2.50 share of stock for $1.00. If not everyone exercises the right, you are still strictly better off exercising the right, but your payoff will be even greater if the market price assumed that everyone would exercise their rights. When the market discovers that not everyone exercised their rights, that there was less dilution than expected, the stock price will rise.

For example, assume only 4M of the 5M warrants were exercised. Then the equity value will be 61.5 (57.5M from the prior footnote plus the 4M of cash which is paid in when only 4M of the rights are issued). There will be 24M shares (the original 20M plus 4M new shares when only 4M of the rights are issued). In this case the stock price will be 2.56. This doesn't change our conclusion about whether you should exercise your right. Our investor who exercises his right will have five shares at 2.56 (12.813 minus the dollar strike price is worth 11.813) versus our investor who does not exercise the right will have four shares worth 2.56 each or 10.250. The warrant is actually worth 1.563. It is worth more when you know what to do and others do not. Let's call that the value of education.

2) Short discussion questions

A) We discount a futures price at the risk free rate because it has no risk (i.e., we assume the exchange never defaults on the payment). The futures price portion of a futures contract is effectively like a risk-free bond. The forward price, in contrast, is a promise by Tyson to pay you the forward price next year. The correct discount rate for the forward price is thus the promised rate of return for a Tyson bond or loan with similar default characteristics (similar probability of default and similar payment in default). The current promised return on Tyson debt would be a good estimate and then you would want to adjust it for differences in priority between the bond/loan and your futures contract.

B) The fact that the combined firm (Kraft plus Cadbury) is less risky than either of the original firms means the reduction in risk described in the question is a reduction in idiosyncratic risk. Systematic risk cannot be reduced through a merger or by combining positive-beta assets in a portfolio. The β of the combined firm cannot be less than both Kraft and Cadbury's asset β (it is the average of Kraft and Cadbury's asset β). Because the shareholders of the two firms are well diversified, they do not bear idiosyncratic risk and thus the reduction in idiosyncratic risk will not change (reduce) the cost of capital for the combined firm.

C) The fall in the value of the assets is not a good estimate of the costs of financial distress. The fall of $550M is economic distress plus financial distress. Thus $550M is an upper estimate of the costs of financial distress. Remember, the costs of financial distress are the difference in the loss of value of a levered Penton Business Media Holdings relative to the loss of value of an unlevered Penton when a negative shock occurs. The recession has lowered ad spending and the movement of advertising dollars to the internet has further hurt special interest magazines. These developments would cause the value of Penton to fall whether or not the firm was levered or all equity. To know how much more the value of Penton fell because it was levered (i.e., to value the CFD), we would have to examine how much of the drop in advertising and circulation was due to concern about Penton's survival. For example, if advertisers knew Penton was at risk of going bankrupt and thus desperate to generate current income, they may have pressured Penton to cut their pricing in exchange for purchasing ad space.

3) Optimal capital structure at Petrobras. The importance of priority.[6]

A) The market value of the preferred equity is 198.6M. Based on the liquidation value (220M) and the contractually specified dividend rate (10%), owners of the preferred are promised 242M at the end of next year. They will receive this as long as the assets of Petrobra are greater than 242. Thus from the table, the firm will default on the preferred in state 1. The preferred equity holders will receive 242 (as promised) in states 2 through 4. In stated 1, they will receive 140. Thus the value of the preferred today is 198.6M.

$$P_{Preferred} = \frac{0.25(140) + 0.75(242)}{(1+0.09)} = \frac{216.5}{(1+0.09)} = 198.6$$

[6] In answering this question it was helpful to recognize the similarities of debt and preferred equity. Debt has a face value, whereas preferred equity has a liquidation value. Debt has a contractually specified coupon rate, whereas preferred equity has a contractually specified dividend rate. Preferred equity, like debt, can have a specified maturity. In this case it was six years (2005 to 2011). Both preferred equity and debt have a higher priority than common equity. If a firm has only debt or only preferred equity the risk and return of the debt or preferred equity will be very similar. If a firm has both debt and preferred equity in its capital structure, then the debt has a higher priority.

The question didn't ask, but if you calculated the promised return on the preferred it must be greater than 10%, because the preferred is now selling for less than the face value (220). The promised return has risen to 21.8% [242/198.6 - 1]. The probability of default must have risen, and the value of the preferred has fallen accordingly.

Table I	Values in 2011					2010
	State 1	State 2	State 3	State 4	Expected	PV
Asset Value	140	250	300	410	275.0	252.3
Preferred Equity	140	242	242	242	216.5	198.6
Common Equity	0	8	58	168	58.5	53.7

B) The market value of the preferred would have to be lower. The expected cash flow to the preferred would not change. However, if the assets have systematic risk and thus the asset β is positive, then the preferred will inherit some of this systematic risk. The preferred β will be positive as well. The preferred will have lower cash flows in recessions than in booms. This means the discount rate for the preferred would have to be greater than 9%. The same cash flows and higher discount rate means a lower value of the preferred.

C) A firm in an M&M world would take this project, because it has a positive NPV. The NPV of the project is 10.1.

$$NPV\left[Expansion\right] = -100 + \frac{0.50(110) + 0.50(130)}{(1+0.09)} - 100 + \frac{120}{(1+0.09)} = 10.1$$

D) We must sell the new common shareholders 72.2% of the equity in exchange for the $100M cash infusion. To determine the fraction of Petrobras' common equity that must be sold in exchange for 100M pesos, we first need to calculate the value common equity, which depends upon the value of Petrobras's assets (the assets in place plus the value of the expansion project) and the value of the preferred equity (because CE = A - PE). Because neither the manager nor the market know the state of the world, we will take expectations across the four states.

The expected future value of the assets is the sum of the original asset value plus the future value of the new oil field (i.e., 275 + 120 = 395).[7] The present value of the assets is 362.4 [252.3+110.1]. Based on the possible asset values, the preferred is now risk free (the asset value is always greater than the promised preferred payment). The value of the preferred has thus risen to 222, an increase of 23.4.

$$P_{Preferred} = \frac{0.25(242) + 0.75(242)}{(1+0.09)} = \frac{242}{(1+0.09)} = 222.0$$

[7] You could have valued the firm as the assets in place [252.3 = 275/(1+0.09)] plus the NPV of the project [10.1 = -100 + 120/(1+0.09)] plus the cash infusion [100]. This gives a total asset value of 362.4. This is also the value of the common plus preferred equity. However, to calculate the value of the preferred (and thus the common equity), we need to calculate the payoff in each state, take the average, and discount the result at 9%.This is why it was necessary to build the table.

The value of the common is therefore 140.4, i.e., the asset value (362.4) minus the value of the preferred (222.0). Alternatively, you could have calculated the cash flow to equity in each state and then discounted the expected common equity cash flow (153) at 9%. This also gives us a common equity value of 140.4. Thus for 100 the new shareholders will demand 71.2% of the equity (i.e., 100 / 140.4).

Table II	Values in 2011					2010
	State 1	State 2	State 3	State 4	Expected	PV
Asset Value (original)	140	250	300	410	275	252.3
Asset Value (new)	130	110	130	110	120	110.1
Asset Value (total)	270	360	430	520	395	362.4
Preferred Equity	242	242	242	242	242	222.0
Common Equity	28	118	188	278	153	140.4

Some students calculated the percentage based on the asset value, not the common equity value (i.e., 27.6% = 100 / 362.4). This would be correct if there were no preferred equity. However, we are selling common equity, which has a lower priority than preferred equity. The common equity holders (both new and old) thus only get paid after the preferred is paid in full.

E) The current common shareholders will be unwilling to sell equity to new investors and purchase the oil field, because this lowers their wealth. By issuing new common equity and investing, the old (current common) shareholders will raise their wealth by the NPV of the project (10.1) and lower their wealth by the NPV of financing (since it will turn out to be negative). To calculate this change in wealth, we need to compare their wealth if they don't issue and invest with their wealth if they do.[8]

If the current common shareholders choose to do nothing (not issue equity and not purchase the new oil field), then the value of their equity (100% of the common equity) is 53.7 [58.5 / (1 + 0.09)] (see Table I). If the current shareholders sell 100M of equity and purchase the new oil field, the total value of common equity will be 140.4 (Table II). However, the current common equity shareholders will only own 28.8% [1 - 0.712] of the common equity. The value of their equity will fall from 53.7 to 40.4 [0.288 * 140.4]. Thus by issuing and investing, the value of the current common shareholders wealth will fall by 13.3 [40.4 - 53.7].

[8] The issue described in this exam question is one that you will see again. Most recently it was a major issue for the banks in the fall of 2008. Many of them had debt which was riskier and lower valued then when they issued it. The banks needed capital to fund project and to satisfy regulators. However, there was resistance on the part of the banks to issue new equity. One of the reasons was the problem you examined in this question. If the banks had raised equity capital, there would have been a large transfer from the equity to the debt holders. The extra capital (and associated projects) would have made the debt safer and more valuable. If, as in this case, the transfer to the debt holders (preferred equity in this question) is greater than the value of the projects, then current shareholders will choose not to raise equity. This is one possible argument for the government providing equity capital to the banks. If the equity was correctly priced, the current shareholders would lose (question 3E). Thus the current shareholders would only accept these terms (if they have choice) if the new equity holders lose. The government can do this, but then it would be a transfer from taxpayers to the debt holders of the banks – which effectively is what happened.

This calculation shows that the current common shareholders will not want to issue new outside equity and invest, but it does not explain why. We still need to explain the source of the drop in the current common shareholder's wealth. The value of assets rise by the NPV of the project (10.1) and this raises the value of the current shareholder's wealth. The NPV of the new equity issue is zero in this case. Remember, the managers do not know the state of the world, so the equity issue is correctly priced (a zero NPV). In exchange for 100M pesos in cash, the new shareholders are given 100M pesos in common equity [0.712 * 140.4]. None of the value is transferred to the new equity holders.

Because the wealth of current common shareholders drops, there must be another term in the NPV of financing. This other term is the change in wealth of the preferred shareholders. The capital infusion and investment makes the preferred equity safer, and thus more valuable. Now the preferred equity does not default in state 1, so the value of the preferred rises from 198.6M (our answer in A) to 220 [242/(1+0.09)] (see Table II). While the value of the firm's assets rise by 10.1, the value of the preferred rises by 23.4. Because more than one hundred percent of the NPV of the project is transferred to the preferred equity holders, the original common equity holders are worse off by 13.3M pesos [23.4 – 10.1].

$$\begin{aligned}
\text{NPV}[\text{Project}] &= \text{NPV}[\text{Project} \mid \text{CSI}] + \text{NPV}[\text{Com Equity Issue}] + \text{NPV}[\Delta \text{ Pref Equity}] \\
&= 10.1 + \left[100 - 0.712(140.4)\right] + \left[198.6 - \frac{244}{(1+0.09)}\right] \\
&= 10.1 + 0 - [198.6 - 222.0] \\
&= 10.1 + 0 - 23.4 = -13.3
\end{aligned}$$

F) The preferred equity holders would want to allow the asset sale if the funds were invested in the oil field project. The reason is that this two step transaction raises the value of the preferred. The asset sale is a zero NPV by assumption (they sold the fraction of the existing assets for their true value) and the investment is a positive NPV. Thus the expected future value of the assets is higher, as is the current value of the assets (the NPV of the project is 10.1). This isn't sufficient for the preferred owners to be better off. They also care in which state cash flow is lost (from the asset sale) and in which state cash flow is gained (from the expansion project).

Because Petrobras would be selling a fraction of the existing assets (40%=100/252.3), the value of the existing assets will shrink by the same percentage (40%) in each state. This means the asset value shrinks the least in state 1 (the cash flow from existing assets is the lowest: 0.4 * 140 = 55.5) and by the most in state 4 (the cash flow from existing assets is the highest: 0.4 * 410 = 162.5). The new project returns approximately the same amount of value in each state (slightly more in states 1 and 3 [130] than in states 2 and 4 [110]). Thus the asset sale and investment moves cash from state 4 (when there is more than enough to pay off the preferred) to state 1 (when there was not enough money to pay off the preferred). The asset sale and the investment are a value increasing hedge from the perspective of the preferred equity holder. Since this transaction raises the mean and lowers the variability of the asset value, it makes the preferred safer and more valuable. The preferred holders would want to allow this transaction.

Preferred, and especially debt contracts, often have covenants that prohibit asset sales that are not paid out to the preferred or debt holders since they don't know what kind of project the firm will invest in. Thus it is better to prohibit these transactions and then if

the firm wants to do them, the firm can come back to the preferred or bond holders and ask permission (renegotiate).

G) Investing in the oil field exploration project raises the asset value by 10.1 and the value of the preferred by 23.4 (i.e., by too much). If the promised yield on the preferred could be lowered so that the value of the preferred rises when the investment is made but by less than 10.1, this would solve the problem. Thus any reduction in the promised payment to preferred that leaves the value of the preferred above 198.6 (the promised payment must be greater than 216.5) but less than 208.7 when the project is taken (the promised payment must be less than 227.5) will work. Promised payments below 216.5 will not work, because the preferred lose and the common gain more than 10.1; the preferred will not agree to this change. Promised payments above 227.5 will not work, because the preferred still gain more than 10.1 and the common equity holders lose; the common equity holders will not agree to this change. Where between 216.5 and 227.5 the two parties agree is a function of bargaining power.

A reduction in the promised payment may seem like it creates a loss for the preferred holders. This is true only if the equity holders incentive to take the positive NPV project is not changed. Remember, with the current promised payment on the preferred, the equity holders will not invest in the project and the preferred is worth 198.6. A lower promised payment (below 227) will cause the equity holders to invest in the project and this will raise the value of the preferred above 198.6.

To help with the intuition, let me work through a numerical illustration. If the contractually specified payment on the preferred is lowered from 242 to 225 (i.e., the preferred dividend rate is lowered from 10% to 2.3%), then the equity holders will choose to take the project. If the equity holders choose to take the project, then the preferred is risk free. Thus the value of the preferred will rise from 198.6 to 206.4, and increase of 7.8.

$$V_{\text{Pr}eferred} = \frac{225}{(1+0.09)} = 206.4$$

Because the increase in the preferred is less than the NPV of the project, the current equity holders would be willing to raise external equity (although the percent they now sell will be different) or to contribute the equity themselves. In either case, their wealth will increase by 2.3 [10.1 - 7.8].[9]

$$\begin{aligned}
\text{NPV}[\text{Project}] &= \text{NPV}[\text{Project} \mid \text{CSI}] + \text{NPV}[\text{Com Equity Issue}] + \text{NPV}[\Delta \text{ Pref Equity}] \\
&= 10.1 + \left[100 - 0.641(156.4)\right] + \left[198.6 - \frac{225.0}{(1+0.09)}\right] \\
&= 10.1 + 0 - [198.6 - 206.4] \\
&= 10.1 + 0 - 7.8 = 2.3
\end{aligned}$$

[9] If the promised payment on the preferred is written down to 225, then the preferred is worth 206.4 if the project is taken. Because the assets are worth 362.4 and the preferred is worth 206.4 if the project is taken, then the equity (old and new together) is worth 156.0. Thus for $100, the new equity holders will demand 64.1% of the firm. The old shareholders will retain 35.9% of the equity which is worth 56.0 [0.259*156]. This is an increase of 2.3 over the original value of 53.7 – exactly the same as we found with our NPV calculation.

4) Globalfoundries SIREN issue[10]

A) Each bond will pay $30 [$1000 * 0.03] on March 10th, 2011. Then on March 10th, 2012 each bond will pay either $1,100 [1000 * (1.10)] if the bond holders choose not to convert or 20 P_{stock} if the bond holders choose to convert prior to March 8th, 2012, where P_{stock} is the stock price.

If you calculated the total payments, the answer is larger by 5,000. The total cash payment would be pay $150,000 on March 10th, 2011, and then either $5,500,000 or 100,000 times the stock price on March 1, 2012.

B) On March 8th, 2012 each bond holder has the choice of receiving $1,100 in two days (which has a present value of $1,100) or 20 shares of stock (which has a present value of 20 times the stock price). The bondholders will only convert if the value of the stock is greater than the forgone interest and principal payments.

$$20\,P_{stock} > 1100$$

$$P_{stock} > \frac{1100}{20} = 55 = P_{conversion}$$

The stock price must be greater than $55 per share for the SIREN owners to convert.

C) To draw the payoff diagram, we need to first find the kinks in the diagram. When the assets are worth less than $5.5M (the total promised payment on March 10th, 2012), the firm defaults on the SIREN and the SIREN investors receive all of the firm's assets. Thus each SIREN owner receives the value of the firm's assets divided by 5,000. When the firm's assets rise to $5.5M, the bond holders now receive their full promised payment of $1,100 per SIREN.

The second kink occurs at the point where the conversion value (20 shares of stock) exceeds the bond value ($1,100). This occurs (as we saw in B) when the stock price rises to $55.00 per share or the asset value is $22M (55 * 400,000).[11]

The last step is to calculate the slope of the line above $22M. Once the asset value rises above $22M, the SIREN investors will convert and own one quarter of the firm. Each SIREN owner will own 20/400,000 of the firm's assets (each SIREN converts into 20 shares and there will be 400,000 shares outstanding). Thus for every $2M increase in

[10] For aficionados of Greek mythology, the Sirens were creatures who inhabited an island which was surrounded by dangerous rocks. The Sirens sang so beautifully that all who heard them were drawn to them and thus crashed their ships upon the rocks. Odysseus escaped them by having himself tied to the mast of his ship and plugging his crews ears with wax so they could not hear the Siren's song. (And you thought those high school or college literature classes would never be valuable in business.)

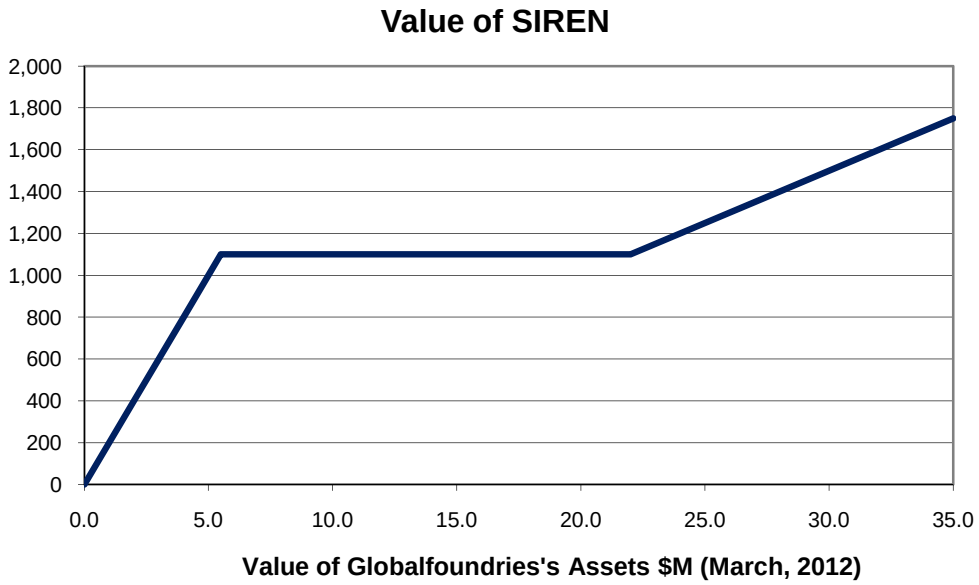
SIRENs were developed and first issued by First Boston. Michael's Stores was one of the first firms to issue them. They were sold as convertible bonds with high interest rates (in this case 10% in the second year). However, you only receive the high coupons in the later years if the issuer doesn't force conversion (since we didn't talk about this in class, I did not include this issue in the question).

[11] There are two ways to calculate the stock price at the point where the SIREN investor is indifferent to converting or not. If the assets are worth $22M and the SIREN investor does not convert then the stock price will be $55/share. If the SIREN investor does convert the stock price will also be $55/share.

$$P_{Stock\ without\ conversion} = \frac{22{,}000 - 5{,}500}{300} = 55$$

$$P_{Stock\ with\ conversion} = \frac{22{,}000}{400} = 55$$

value, the payoff to the SIREN rises by 100. Your picture should thus connect the points (0,0), (5.5M, 1,100), (22M, 1,100), and (35M, 1,750).



D) SIREN is a bond (with rising interest payments) plus a conversion option. To value the straight bond we need to know what a dollar of interest or principal in one or two years is worth. We can extract this from the price of the zero coupon bonds since they have the same default risk. Thus the bond portion of the SIREN is worth 918.

$$V_{Bond\ portion\ of\ SIREN} = 30\left(\frac{900}{1000}\right) + 1{,}100\left(\frac{810}{1000}\right) = 918$$

Because the SIREN sold for 1,000, the value of the conversion option on the 20 shares is worth 82 [1000 – 918] or 4.10 per option [82/20].

Several of you also noted that the zero coupon bond prices imply a discount rate of 11.1% for both the one year and two year cash flows. (e.g. 1000/900 - 1 = 0.111). Thus you could also have valued the bond portion of the SIREN by discounting the cash flows at 11.1%.

$$V_{Bond\ portion\ of\ SIREN} = \frac{30}{(1+0.111)} + \frac{1{,}100}{(1+0.111)^2} = 918$$

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