

Name: _____

Section: _____

Finance II (441)

Professor Eisfeldt/Sapienza

Corporate Finance Final: Spring 2004

- 1) Time limit: you have two hours to complete the exam.
- 2) The exam is closed book/closed note. Scratch paper and a formula sheet are provided and you may not use any outside materials except for a calculator or excel.
- 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!

Question	Points
1 (50)	
2 (65)	
3 (50)	
4 (75)	
Final Exam	

1) Short Discussion Questions.

- A) Al Merrick Surfboards (AMS) is considering going public. The assets of AMS are currently valued at \$10M, most of which is comprised by the value of the brand name. The book value of AMS's assets is \$3M. Al Merrick currently owns 100% of the equity of AMS, which is 2.5M shares. Al would like to raise \$2M to open stores in Hawaii and California. How many shares and at what price does AMS need to IPO to ensure that there is no dilution of Al's equity if there are no transactions costs associated with the issue?(10)
- B) You have been hired as the CEO of Asset Holdings LLC. The firm is currently financed only with equity. The firm has all of its assets invested in government T-bills. The firm is currently worth \$1B.
- (i) If you sell the T-bills and invest the money in a gold mine will the value of the firm's equity rise or fall? Explain. Gold prices and the return on gold from mines are uncorrelated with the stock market. (10)

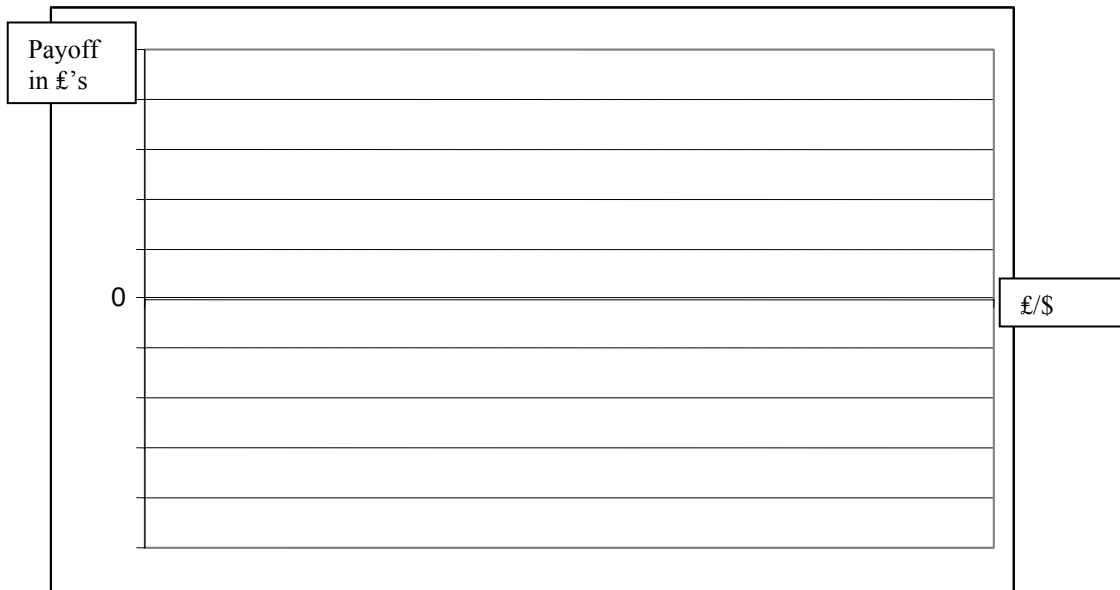
- (ii) If you sell the T-bills and invest the money in the gold mine, would the expected return on your firm's equity rise or fall? Explain. The standard deviation of the annual percentage change in gold prices is about 15% and gold prices and the return on gold from mines are uncorrelated with the stock market. (10)
- (iii) Instead of investing in the gold mine, a consultant recommends that you liquidate a portion of your T-bill portfolio in order to repurchase a portion of your firm's equity shares. She points out that when firms announce an equity repurchase their stock prices rise on average. What are your thoughts on this course of action in the case of this specific firm? Explain. (10)

- C) KKR has just purchased a manufacturing firm. The market value just prior to purchase was \$700M and the book value was \$1B. The firm was all equity before the buyout. KKR borrowed \$1.05B and used the proceeds from this debt issuance along with some equity capital to buy the firm for \$1.5B. How will KKR make money on this deal? Explain as precisely as you can, I'm looking for a qualitative answer.(10)

- 2) Cadberry's, a candy maker with 60% of its operations and sales in the UK and 40% in the US, would like to borrow \$150K to generate interest tax shields and thus raise the value of the firm. The debt is a one-year debt and it is issued at face value. Since the firm is currently all equity, treat the debt as having zero default risk. If Cadberry borrows in the US market, it will have to pay 16.6% interest. If the firm borrows in the UK market it will have to pay 6%. Assume that there are no regulatory or tax barriers to borrowing abroad.
- A) The exchange rate is currently £0.55/\$. In other words, with one dollar Cadberry's can buy 0.55 British Pounds. What is the firm's obligation in British Pounds next year if it borrows \$150,000 in the UK bond market? (10)
- B) Cadberry's can buy British Pounds and sell dollars one year hence through a futures/forward contract. Cadberry's can lock in a price of £0.50/\$ for a delivery in one year. The forward market seems to imply that the British Pound is going to appreciate and the dollar is going to depreciate ---each dollar buys fewer British Pounds. Which is better from Cadberry's perspective ---borrowing in the US or borrowing in the UK and *at the same time* entering into the forward contract to buy British Pounds next year at a fixed price? Explain (10)

- C) Draw the gross payoff diagram for a trader who purchased one British Pound for delivery in one year through a futures contract. Today's futures price for contracts expiring in one year is £0.50/\$. The horizontal axis is the £/\$ exchange rate in one year and the vertical axis is in £'s. Make sure your diagram is clearly labeled. (15)

(Hint: Think about the payoff of the futures contract if the £ depreciates to £0.60/\$ and if the £ appreciates to £0.40/\$. In which case would it turn out to have been beneficial to lock in a price of £0.50/1\$?)



- D) Several financial analysts have predicted that the expected exchange rate in one year will be £0.53/\$ not £0.50/\$. Based on these data, your investment banker believes that the forward price is wrong. Your investment banker shows you historical data which shows that over the last 30 years, the forward price has underestimated the expected one year spot price of the £/\$ exchange rate. Do you think that he is correct in saying that the market is wrong? Clearly motivate your answer. (10)

E) Based on the above data, can you say something about the exchange rate risk? Is it a systematic or idiosyncratic risk? Explain completely (10).

F) Based on the above data is Cadberry's paying a risk premium, receiving a risk premium, or neither by entering into the forward contract? Explain. (10)

3) VeriSign, Inc. (Nasdaq: VRSN) is the world's largest provider of Internet trust services offering domain name registration services, authentication, and validation for digital signatures. The current draft of the EU Directive for electronic signatures will give digital signatures the same legal status as physical signatures and substantially improve the business of VeriSign in Europe. Currently, there is uncertainty about whether the European Directive will be passed. VeriSign has only two assets – assets in place and a positive NPV project. The value of the assets in place and the value of the investment project depend on whether the EU directive for electronic signature is passed. Probability of this event is given in the table. In all states, the positive NPV project requires an initial investment of \$60. Throughout this problem, assume that managers try to maximize the wealth of the original shareholders.

	EU Directive is not passed	EU Directive is passed	Expected
Probabilities	80%	20%	
Assets in Place	60	140	
Investment Cost	60	60	
NPV[Expansion]	20	25	

A) In order to undertake the positive NPV project the firm must raise \$60 in equity (assume the firm is credit rationed so debt is not an option). If managers must issue equity and invest before they know whether the EU directive is passed, what percentage of the firm must original equityholders give up in order to raise the \$60 necessary to undertake the positive NPV project? Using this percentage, calculate the wealth of original shareholders for the various scenarios given the table below. (15)

	EU Directive is not passed	EU Directive is passed
Do Nothing (Do not issue and do not invest)		
Issue Equity and Invest		

B) If managers have political connection inside the EU and know in advance whether the directive will be passed or not, in which states will they invest? Why? (10)

C) Assuming that managers know whether the directive will be passed or not before issuing and investing (and the market realizes that managers have informational advantages) what percentage of the firm must original equity holders give up in order to raise \$60? (10)

D) Again assume that managers know whether the directive will be passed or not before issuing and investing (and the market understands that managers have informational advantages). If managers announce their intention to issue equity and invest, what would you expect to happen to VeriSign's stock price? Explain (15)

4) On April 2nd 2003, Yahoo! raised \$7.5M by issuing a compound security. The security is a bond which gives the owner of the bond the right to one Yahoo! share if the owner pays \$41 and gives up the bond. Each bond has a face value of \$50. The zero-coupon, zero-interest bonds mature in 5 years, and cannot be redeemed by Yahoo! before maturity. The bonds have a face value of \$50 and were sold for a price of \$42 each. Yahoo!'s common stock was trading at \$23.88 when the compound security was issued. At the time of the issuance Yahoo!s was an all equity firm and the number of outstanding shares was 1,530,000.

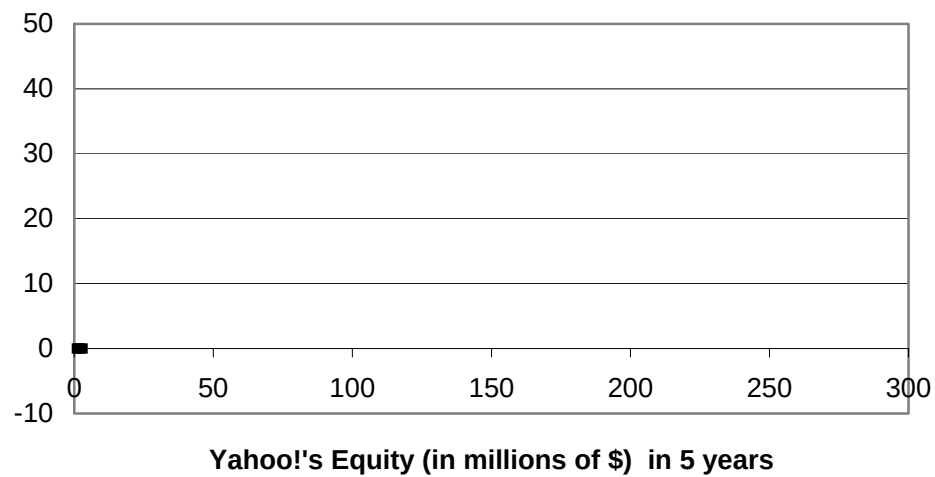
A) An article in the WSJ reported that the issuance had been a very good deal for Yahoo!. According to the WSJ article the money raised by Yahoo! could be used for "future potential acquisitions" (for example, Overture) and the issuance had allowed Yahoo! to raise capital very cheaply: "Yahoo! is selling equity with a 71% premium through the convertible". Do you agree with this analysis? Explain completely (10)

B) What will happen to the number of shares outstanding and to the value of Yahoo! when the options in this compound security are exercised? Be as precise as possible. (10)

C) At the time of the issue, a five-year zero-coupon bond with a face of \$1000 and identical default risk sold for \$699.81. What was the value of the option portion of the compound security at the time of issue? Explain completely. (20)

D) Draw the payoff diagram for the compound security holders, as a function of Yahoo!'s total equity value at expiration. Assume that none of the options have been exercised prior to the expiration date in 5 years. Make sure your diagram is clearly and completely labeled. (25)

Payoff to Yahoo!'s Compound Security Holders



E) Suppose the market suddenly realizes that the volatility of Yahoo!'s common equity has been underestimated. What do you think it will happen to the value of the compound security? Explain completely. (10)

Facts and Formulas

Value of a perpetuity:
$$V_{\text{cashflows}} = \sum_{t=1}^{\text{infinity}} \frac{C}{(1+r)^t} = \frac{C}{r}$$

Value of a growth perpetuity:
$$V_{\text{cashflows}} = \frac{C}{r - g}$$

Value of a T year annuity:
$$V_{\text{cashflows}} = \sum_{t=1}^T \frac{C}{(1+r)^t} = \frac{C}{r} - \frac{C}{r(1+r)^T}$$

Asset β : Since $A=D+E$
$$\beta_{\text{Assets}} = \beta_{\text{Debt}} \frac{\text{Debt}}{\text{Debt} + \text{Equity}} + \beta_{\text{Equity}} \frac{\text{Equity}}{\text{Debt} + \text{Equity}}$$

If there are two types of assets:
$$\beta_{\text{Assets}} = \beta_{\text{Asset1}} \frac{\text{Asset1}}{\text{TotalAssets}} + \beta_{\text{Asset2}} \frac{\text{Asset2}}{\text{TotalAssets}}$$

Equity β :
$$\beta_{\text{Equity}} = \beta_{\text{Asset}} + \frac{\text{Debt}}{\text{Equity}} (\beta_{\text{Asset}} - \beta_{\text{Debt}})$$

Expected rate of return on equity:
$$r_{\text{equity}} = r_{\text{assets}} + \frac{D}{E} (r_{\text{asset}} - r_{\text{debt}})$$

Capital Asset Pricing Model:
$$E[r_{\text{project}}] = r_{\text{risk free}} + \beta_{\text{project}} E[r_{\text{market return}} - r_{\text{risk free}}]$$

Equations and Facts, continued

Payoff to a call option:
$$\begin{aligned}\text{Payoff} &= \text{Max} \{ 0, \text{Price of Stock} - \text{Strike Price} \} \\ &= \text{Max} \{ 0, S_t - X \}\end{aligned}$$

Payoff to a put option:
$$\begin{aligned}\text{Payoff} &= \text{Max} \{ 0, \text{Strike Price} - \text{Price of Stock} \} \\ &= \text{Max} \{ 0, X - S_t \}\end{aligned}$$

NPV of a project:
$$\text{NPV}[\text{ Project } | \text{ Capital Structure is Irrelevant }] + \text{NPV}[\text{ Financing }]$$

Weighted Average Cost of Capital:
$$r_{\text{WACC}} = r_E \frac{E}{D + E} + r_D (1 - \tau) \frac{D}{D + E}$$

Payoff of a Forward or Futures Contract:

Long: $(CV_t - X)$

Short: $(X - CV_t)$

where X is the futures price and CV_t is the commodity value at date t .

Forward or Futures Price:

$$\text{Futures Price}_0 = E_0[\text{Commodity Value}_1] \left(\frac{1 + r_{\text{riskfree}}}{1 + r_{\text{commodity value}}} \right)$$

Suggested answers
Short Discussion Questions.

A) This is not a question on IPOs. It is a question on how to evaluate equity (lectures 3, 7, 8-12). There are currently 2.5M shares in a firm with a market value of \$10M, thus the share price before the IPO is \$4. For there to be no dilution, the price must remain \$4 so that AI still has equity worth \$10M after the issue. For the price to remain \$4, AMS must be able to issue 500,000 shares at a price of \$4 to raise the \$2M necessary to fund the store openings. The total firm value after IPO will be \$12M and the total number of shares will be 3M, which is consistent with the \$4 share price.

B)

(i) This is not a question about risk, it is about asset and hence equity **value**. Whether the value of the equity changes depends upon whether the investment in the gold mine is a positive NPV project or not. If the gold mine investment is positive NPV, the value of the firm and its equity value will rise by the amount of the positive NPV. If the gold mine investment is a negative NPV project, then the value of the firm will fall by the size of the negative NPV. Investments in financial securities are zero NPV investments unless you have inside information about the value of the security. The sale of the T-bills, the value of which is known to the market, does not change the value of the firm.

(ii) The sale of the T-bills and the investment in the gold mine will increase the variability of the asset and hence the equity cashflows. You are exchanging a risk-free asset for an asset with variable cash flows. But, we were told that gold returns are uncorrelated with market returns, so the gold mine cash flows have a beta of zero and all of the risk in the gold mine cash flows is idiosyncratic. Idiosyncratic doesn't affect the expected return. Thus, the overall risk of the firm would be unchanged by investing in the gold mine.

(iii) Manager's who maximize the wealth of current shareholders are more likely to issue equity when the equity is overvalued than when it is undervalued. Since the market can figure this out, equity issues will be a signal to the market that the equity is undervalued and the stock price will consequently rise on the announcement of a repurchase. **In this case, however, there is no asymmetric information. T-bills are traded assets whose value is easily observed.** Therefore, we should not expect the firm's stock price to rise.

C) KKR is doing a leveraged buyout. The value they create will likely come from replacing management, and implementing incentives to cut costs and reducing free cash flow problems through the required interest payments on the debt. They will provide incentives by linking the new managers' pay to performance. They will make money by then selling the firm for more than the \$1.5B they bought it for. Notice also that the introduction of debt into the capital structure alone will create value if there are profits to apply the tax shield to.

1) CADBERRY

- A) The firm will borrow £82.5M=\$150,000*0.55 today. Given the interest rate of 6%, next year the obligation will be £87.45M.

You did not have to state this, but the differences between the two interest rates may be explained in several ways. The main reason why there is a difference of interest rates across countries is exchange rate risk. Also, without knowing the expected exchange rate we cannot tell which debt security has lower expected costs. Even if we find out that the expected costs of borrowing in £'s is lower than the expected costs of borrowing in U.S. dollars this does not mean that borrowing in the British market is an arbitrage opportunity. The difference between borrowing costs may be due to risk exposure and does not represent a risk free arbitrage opportunity.

- B) By using the forward contract, Cadberry can eliminate its exposure to exchange rate risk. The forward contract perfectly hedges the exchange rate risk of the denominated debt. If Cadberry borrows in the UK market or in the U.S. market its liability in dollars will be identical:

$$\frac{0.55(1.06)}{0.50} = 1.166$$

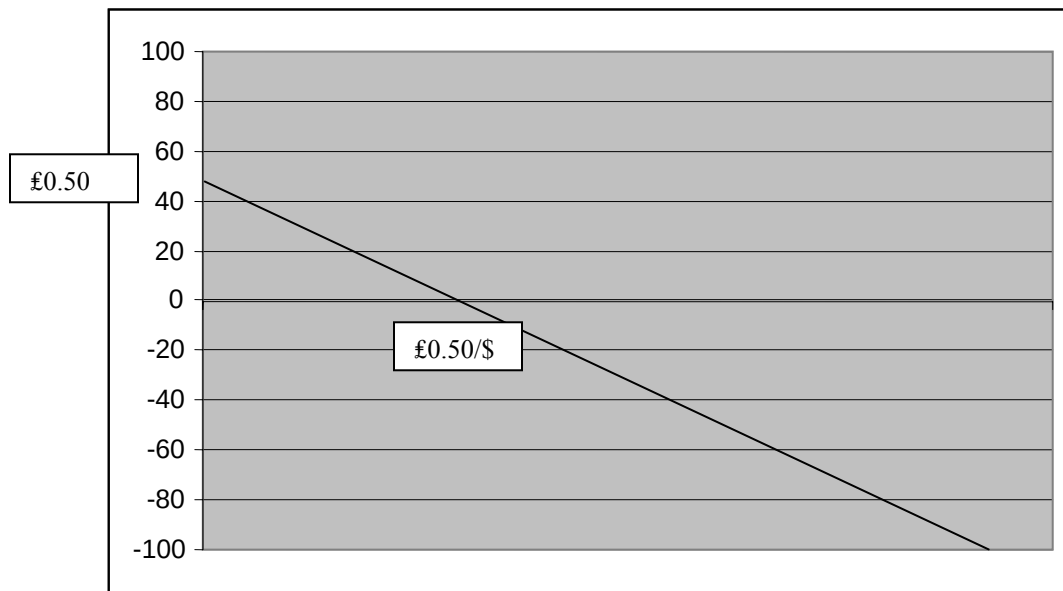
In the absence of market frictions this must be true—otherwise there would be a riskless arbitrage opportunity. The cost of borrowing domestically versus borrowing abroad should be identical if you can hedge the exchange rate risk and there are no legal or tax frictions, since the timing and cashflows are equal.

To see this, record the cash flows from borrowing in yen and entering into the forward contract and note that they are identical to the ones from borrowing in dollars.

	t=0	t=1
cashflow in £'s	+£82.5	-£87.45
exchange rate	0.55 £/\$	0.50£/\$
cashflow in \$'s	+ \$150,000M	- \$174,900M

If we borrow in \$'s, we pay \$150,000*(1.166)=\$174,900, the same amount as above.

- C) The trader purchased £'s for delivery in one year at the price of £0.50/\$. Thus, if the exchange rate rises (the dollar appreciates), the payoff of the futures contract will be negative. For example, if the exchange rate rises to £0.60/\$, Pounds will cost less than the futures price of £0.50/\$, i.e. £'s will be cheaper in the open market than through the contract. However, since this is not an option the trader must still purchase the £'s at the higher futures price, and so receives a negative payoff. Notice the payoff is a linear function of the underlying's value -- this is not an option. Your diagram must have a negative slope and show the payoff is zero when the exchange rate is £0.50/\$, as well as labeling the slope, the y intercept (also at £0.50), or another interior point



- D) In this case, your investment banker empirical data shows that the futures price is a biased estimate of the future spot exchange rate. It is wrong to conclude that the forward price is wrong, it simply reflects a risk premium. We can write the futures price as:

$$\text{Futures Price}_0 = E_0[\text{Commodity Value}_1] \left(\frac{1 + r_{\text{riskfree}}}{1 + r_{\text{commodity value}}} \right)$$

In this case, since the futures price exceeds the expected future spot price, we know that the expected return on exchange rate risk is greater than the risk free rate, hence it has a beta greater than zero.

- E) From part E) (see above equation) we know that the exchange rate risk is priced ($r_{\text{commodity value}} > r_{\text{riskfree}}$) and hence the cash flows from holding exchange rate risk have a positive beta. Since exchange rate risk (which is the risk being hedged or traded through the futures market) is priced, it must be systematic risk. Intuitive answers received partial credit.
- F) Cadberry wants to buy £ and sell dollars one year hence. If they buy £ through the futures contract they can purchase £0.50 for one dollar. Cadberry will pay more in expectation by entering into the futures contract. Since they will lose money on average in the futures contract, they are **paying** a risk premium. They are willing to do this because they are disposing of systematic risk. Remember, I have abstracted from the transactions costs of trading. These include both the explicit commissions paid by Cadberry as well as the trading losses since some investors are better informed than Cadberry.

One can also see that they need to pay a risk premium since they are buying a security with a payoff that depends negatively on a positive beta commodity (hence it has a negative beta). To own a negative beta security, you must pay a risk premium (the return is less than the risk free rate.)

3) Capital structure with asymmetric information

- A) The first step is to calculate firm value in each of the two states. In each state, firm value will equal the value of assets in place plus the NPV of the project plus \$60 contributed by new equity holders. Therefore, in the low demand state, firm value will be 140 and in the high demand state firm value will be 225. The expected firm value is:

$$E[\text{Firm Value}] = (.80)(140) + (.20)(225) = 157$$

New shareholders will contribute \$60 cash in exchange for \$60 worth of equity. Therefore, new equity holders will demand k percent of the firm:

$$k * E[\text{Firm Value}] = 60$$

$$-k = \frac{60}{157} = .38$$

Wealth of Original Shareholders		
	NOT PASSED	PASSED
Do Nothing	60	140
Issue Equity and Invest	86.5 $(=(1-.38)*140)$	139 $(=(1-.38)*225)$

B) When managers are better informed than the market (they know the level of demand before they decide to issue equity) they will only issue equity in the low demand state. When demand is low and equity is issued, original shareholders' wealth is \$86.5. This is greater than the \$60 wealth obtained via the alternative of doing nothing. However, in the high demand state, equity is so mis-priced that original shareholders are better off if managers forgo the positive NPV project and refrain from issuing new equity. By doing nothing, original shareholders' wealth is \$140. This is greater than \$139 obtained by issuing equity and investing.

C) New shareholders know that managers only issue equity when demand is low. Therefore, conditional on equity being issued, new investors conclude that the true (post-equity-issue) firm value is \$140. They will invest \$60 as long as they get \$60 worth of the firm. Therefore:

$$k * 140 = 60$$

$$-k = \frac{60}{140} = .429$$

D) Prior to the equity issue announcement, the market estimates that the firm is worth between 92 $(.8*80 + .2*140)$ and 97 $(.8*80 + .2*165)$.

We know that management will issue and invest only in the low demand state. Therefore, as soon as the announcement that equity will be issued and the investment project will be undertaken (but before equity is issued) is made, the market updates its estimates of the value of assets in place and the value of the investment project. The market now knows with certainty that assets in place are worth 60 and the positive NPV project is worth 20. This implies a firm value of 80, down from the pre-announcement estimate. Therefore, because of the negative signal regarding firm value, stock price will fall.

4. Yahoo!'s Convertible Bond

A) The WSJ article may be comparing the strike price of the option to the current stock price of Yahoo! (23.88). For the option component to become in the money the stock price has to appreciate by 71%. However, this difference does not mean that equity has been sold at a premium. Alternatively, the article may be comparing the price of the convertible bond to the current stock price of Yahoo! (23.88). That comparison is not meaningful, because it does not take into account the value of the bond component.

B) First, you need to calculate how many convertible bonds there are. Divide the amount that Yahoo! is raising in cash (7.5M) by the market price of the bond (42). There are 178,571 convertibles. The number of shares will increase by 178,571 shares. The option will bring in 7.32M in cash ($\$41 \text{ exercise price} \times 178,571 \text{ convertibles}$), thus the value of Yahoo! will increase by 7.32M.

C) In order to calculate the value of the option, you have to calculate the value of the bond component. You know that a straight bond pays 7.4% in interest rate. (to check that this is true you need to calculate $(1000/(1+.074)^5)$). To calculate the straight bond component imbedded in the convertible, you should use the following formula
Bond component = $50/(1+.074)^5 = 34.99$
Therefore, the option component imbedded in the convertible is equal to
Option component = $42 - 34.99 = 7.009$

D) The option should be exercised when $P_{\text{After Exercise}} - \$41 > 50$. So, the stock price after exercise has to be bigger than \$91. The intuition is that by choosing to convert, the convertible bondholders will forego the 50 of the face value of the bond and they need to pay 41 dollars. So the value of each share after conversion should be bigger than \$91.

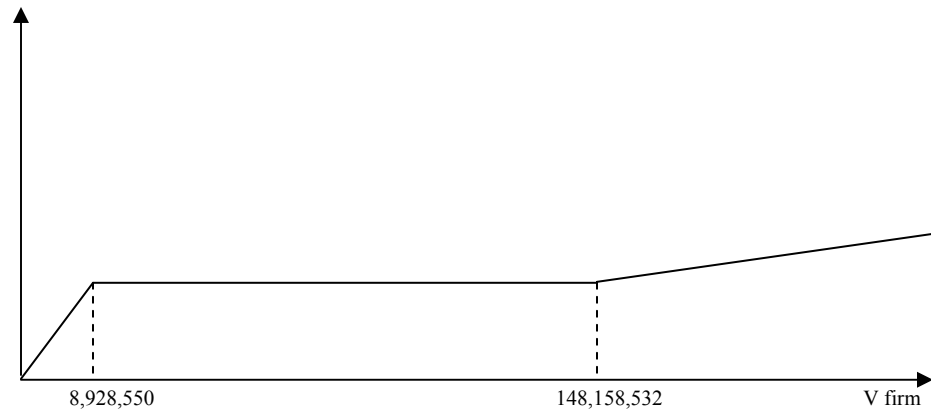
Equivalently, in terms of firm value, we have $(\text{Firm Value After Exercise}) / (\# \text{ of shares after exercise}) > \91 .

From parts B, we know that the value of the firm will increase by \$7.32M and the number of shares will increase by 178,571 shares after exercise. In terms of firm value, this means that to exercise we need that:

$(\text{Firm Value} + 7.32\text{M}) / (1,530,000 + 178,571) > \91 , or

Firm Value $> \$148,158,532$.

Your graph should be a 45 degree line from zero to \$8,928,550 then the graph will be a straight line till the value of the firm is equal to 148,158,532 and then an increase at a slope of 10% for every \$1000 increase in equity value. The slope is computed as the fraction of equity owned by the owners of the exercised warrants, or $178,571/(1,530,000+178,571)$.



Partial credit was given for the option like shape of the payoff, for the correct kink point and for the correct slope.

E) The effect of increased volatility on this convertible bond will be uncertain. The debt component of the convertible will be less valuable, the option component will be more valuable.