NORTHWESTERN UNIVERSITY
KELLOGG GRADUATE SCHOOL OF MANAGEMENT

Kathleen Hagerty
Investments
EMP 34

# Final Exam

This is an open book exam. The exam is due at 8:30 a.m. Saturday, June 8. Please write your answers on the exam. **Show your work!** (This allows me to give you partial credit if there is a mistake some where along the way.)

I. Answer the following true or false and explain why.

a. The most important characteristic in determining the variance of a well-diversified portfolio is the variance of the individual stocks.

b. By diversifying one's portfolio, an investor protects herself from market movements.

c. A risky security cannot have a return less than the riskfree rate.

d. If a firm wishes to buy insurance against a price decline it would buy a call.

II. From 1980 to 1986 the returns on a portfolio of corporate bonds were the following:

| Year | Long Term Corporate Bonds r(s) |
|---|---|
| 1980 | -2.6% |
| 1981 | -1.0% |
| 1982 | 43.8% |
| 1983 | 4.7% |
| 1984 | 16.4% |
| 1985 | 30.1% |
| 1986 | 19.9% |

What was the average return, variance and the standard deviation this portfolio over this period?

III. Suppose you are deciding how to invest $1000 and there are two risky stocks. Consider the following information:

| | Stock A | Stock B |
|---|---|---|
| Expected Return | 25% | 35% |
| Standard Deviation | 30% | 45% |

a. Draw the expected return and standard deviation combinations available assuming the correlation between the stocks is 1. Are there any possible combinations of the two stocks you would eliminate?

b. How would the expected return and standard deviation combinations change if the correlation was 0. (Just draw this loosely. You don't have to figure out the precise numbers) Are there any possible combinations you would eliminate? If so indicate them on your graph.

c. Now suppose the correlation is 0 and there is a riskfree asset such as a T-Bill available. The rate of return on the T-Bill is 10%. Now draw the combinations of expected return and standard deviation that are available. Are there any possible combinations you would eliminate? If so indicate them on your graph.

IV. Suppose the expected return on the market portfolio is 15%, the variance of the market portfolio is 25% and the T-Bill rate is 5%.

a. Suppose I want an expected return equal to 10%, what is the least amount of risk (i.e. standard deviation) that I have to take on? What fraction of my investment do I put in the market portfolio and what fraction do I put in T-Bills?

b. Suppose a firm has a beta equal to 1.1 and a standard deviation equal to 25%. What should the expected return on this stock equal? If you forecast that the stock will have an expected return equal to 14%, should you buy the stock or short the stock?

V. Consider the following prices for derivatives:

Futures Price for delivery in six months $397/lb.

Option Prices for delivery in six months

| Strike Price | Call | Put |
|---|---|---|
| 370 | 27.00 | .80 |
| 380 | 17.50 | 1.30 |
| 400 | 5.30 | 8.10 |
| 420 | 1.50 | 24.30 |

A. Suppose your firm plans to **buy** platinum six months.

i. If you want to lock in a price for platinum should derivatives position should you take? What is the cost of this position? What price have you locked in?

ii. Suppose that you wanted to insure that you never paid more than $400 per ounce (ignoring the initial cost of the derivatives position), what derivatives position should you take? How much does this cost? What would be your highest net cost of platinum? Draw your unhedged and your hedged position.

iii. Suppose you find this insurance expensive. Give two ways to lower the cost.

B. Suppose your firm plans to **sell** platinum six months.

i. If you want to lock in a price for platinum should derivatives position should you take? What is the cost of this position? What price have you locked in?

ii. Suppose that you wanted to insure that you never receive less than 380 per ounce (ignoring the initial cost of the derivatives position), what derivatives position should you take? How much does this cost? What would be your lowest net revenue from platinum? Draw your unhedged and your hedged position.

iii. Suppose you find this insurance expensive. Give two ways to lower the cost.

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I. Answer the following true or false and explain why.

a. The most important characteristic in determining the variance of a well-diversified portfolio is the variance of the individual stocks.

**False, the variance of a well-diversified portfolio depends upon the market risk not the total risk.**

b. By diversifying one's portfolio, an investor protects herself from market movements.

**False, an investor is protected against idiosyncratic moves in individual stocks.**

c. A risky security cannot have a return less than the riskfree rate.

**False. The realized return could always be less than the risk-free rate. If the beta was negative then even the expected return could be less than the risk-free rate.**

d. If a firm wishes to buy insurance against a price decline it would buy a call.

**False, the firm should buy a put.**

II. From 1980 to 1986 the returns on a portfolio of corporate bonds were the following:

| Year | Long Term Corporate Bonds |
|---|---|
| 1980 | -2.6% |
| 1981 | -1.0% |
| 1982 | 43.8% |
| 1983 | 4.7% |
| 1984 | 16.4% |
| 1985 | 30.1% |
| 1986 | 19.9% |

What was the average return, variance and the standard deviation this portfolio over this period?

$$\text{Average} = \mu = \frac{\sum_{s=1}^{7} r(s)}{7} = 15.9\%$$

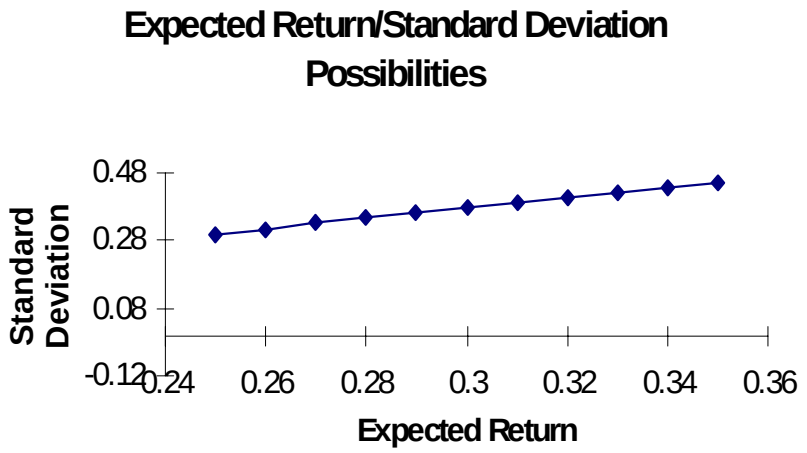
$$\text{Variance} = \sigma^2 = \frac{\sum_{s=1}^{7} (r(s) - \mu)^2}{7} = 291.6$$

$$\text{STD} = \sqrt{\sigma^2} = \sigma = 17.07\%$$

III. Suppose you are deciding how to invest $1000 and there are two risky stocks. Consider the following information:

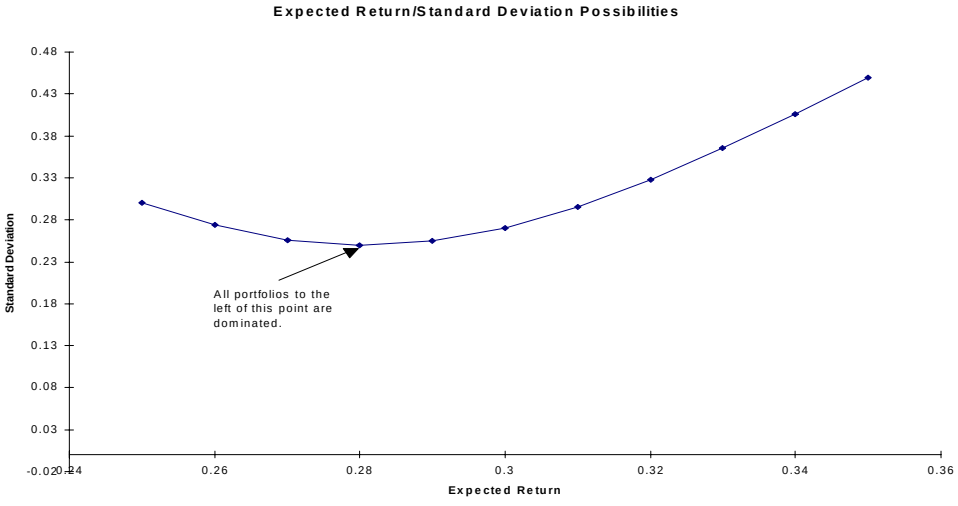
| | Stock A | Stock B |
|---|---|---|
| Expected Return | 25% | 35% |
| Standard Deviation | 30% | 45% |

a. Draw the expected return and standard deviation combinations available assuming the correlation between the stocks is 1. Are there any possible combinations of the two stocks you would eliminate?

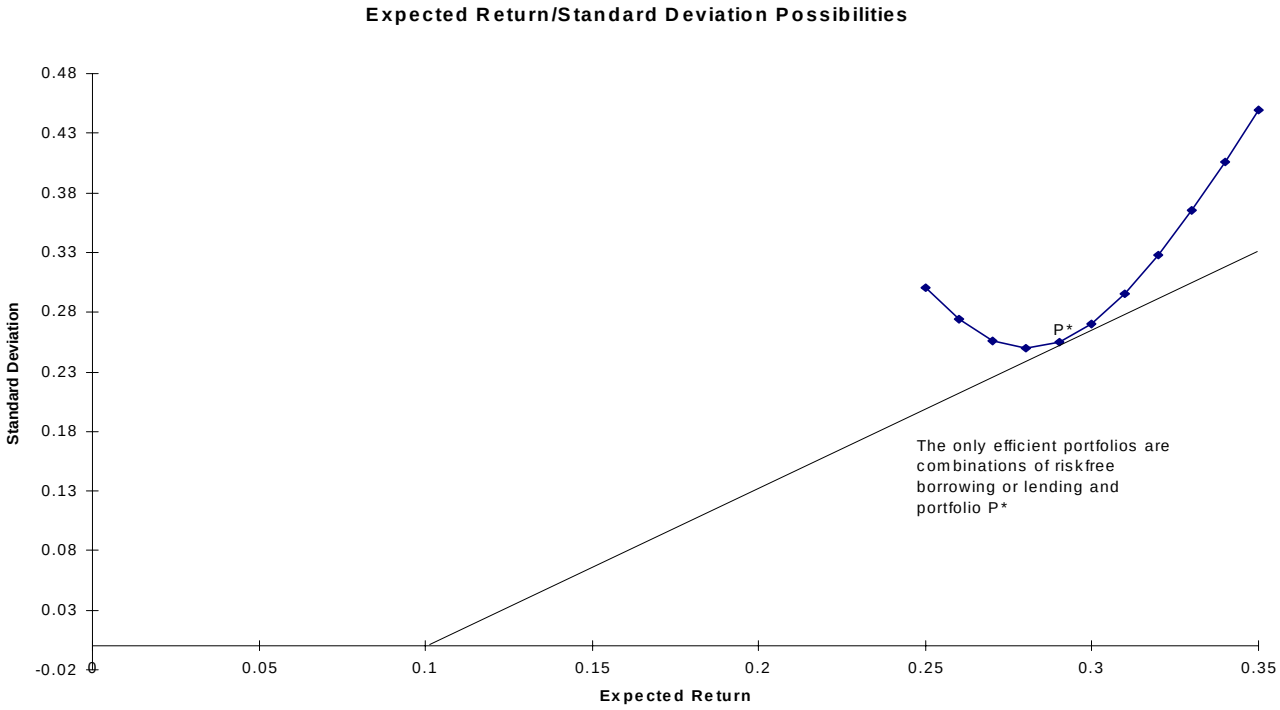



**There are no combinations which are dominate and hence could definitely be eliminated from consideration.**

b. How would the expected return and standard deviation combinations change if the correlation was 0. (Just draw this loosely. You don't have to figure out the precise numbers) Are there any possible combinations you would eliminate? If so indicate them on your graph.



c. Now suppose the correlation is 0 and there is a riskfree asset such as a T-Bill available. The rate of return on the T-Bill is 10%. Now draw the combinations of expected return and standard deviation that are available. Are there any possible combinations you would eliminate? If so indicate them on your graph.



IV. Suppose the expected return on the market portfolio is 15%, the variance of the market portfolio is 25% and the T-Bill rate is 5%.

a. Suppose I want an expected return equal to 10%, what is the least amount of risk (i.e. standard deviation) that I have to take on? What fraction of my investment do I put in the market portfolio and what fraction do I put in T-Bills?

**Let w be the fraction of the portfolio invested in the market portfolio. If you want a 10% return, then the portfolio proportions must satisfy:**

**$10\% = w*15\% + (1-w)*5\% \Longrightarrow w = .5$**

**If 50% of the portfolio is in the market then the standard deviation is:**

**$w*\sigma_{mkt} = .5*25\% = 12.5\%$**

b. Suppose a firm has a beta equal to 1.1 and a standard deviation equal to 25%. What should the expected return on this stock equal? If you forecast that the stock will have an expected return equal to 14%, should you buy the stock or short the stock?

**$ER = .05 + 1.1 * (.15 - .05) = .169 = 16.9\%$**

**You should short the stock since you think the stock is overvalued.**

V. Consider the following prices for derivatives:
Futures Price for delivery in six months $397/lb.

Option Prices for delivery in six months

| Strike Price | Call | Put |
|---|---|---|
| 370 | 27.00 | .80 |
| 380 | 17.50 | 1.30 |
| 400 | 5.30 | 8.10 |
| 420 | 1.50 | 24.30 |

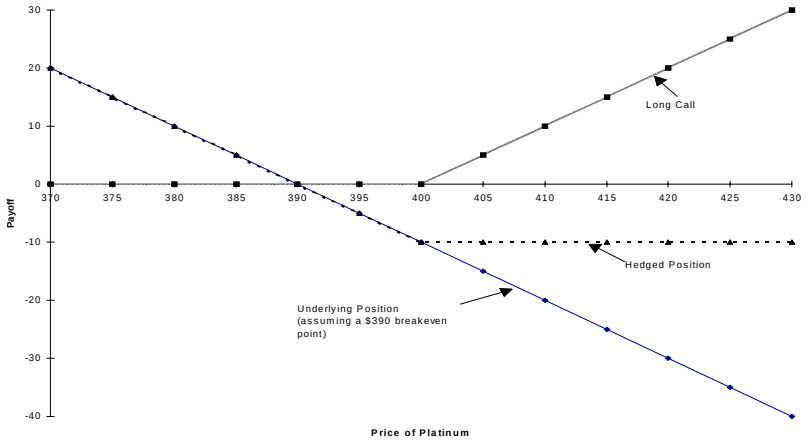
A. Suppose your firm plans to **buy** platinum six months.

i. If you want to lock in a price for platinum should derivatives position should you take? What is the cost of this position? What price have you locked in?

**To lock in a price you should go long a future. The cost of the future is $0. You have locked in a price of $397/lb.**

ii. Suppose that you wanted to insure that you never paid more than $400 per ounce (ignoring the initial cost of the derivatives position), what derivatives position should you take? How much does this cost? What would be your highest net cost of platinum? Draw your unhedged and your hedged position.

**Buy a call with a strike price of $400. The cost of the call is $5.30. The highest net cost of platinum would be $405.30**



iii. Suppose you find this insurance expensive. Give two ways to lower the cost.

**Raise the strike on the call**
**Sell a put**

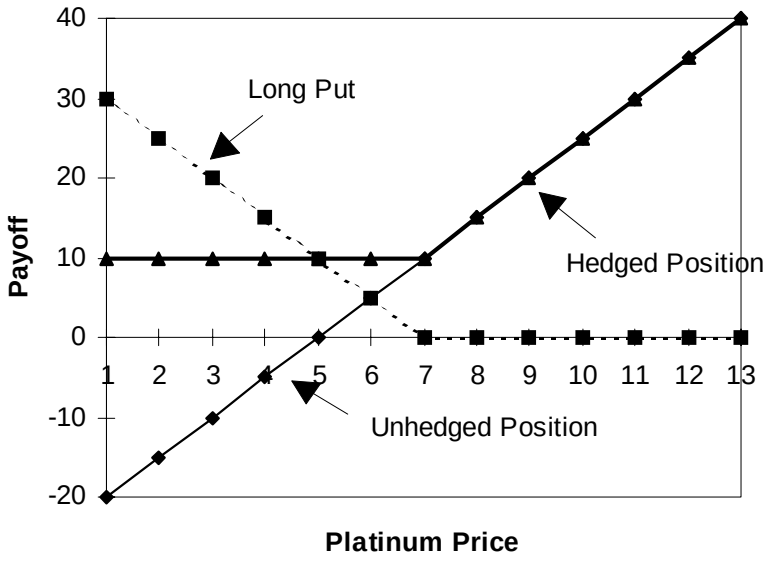
B. Suppose your firm plans to **sell** platinum six months.

i. If you want to lock in a price for platinum should derivatives position should you take? What is the cost of this position? What price have you locked in?

**Sell a future**
**cost = $0**
**Locked in $397/lb**

ii. Suppose that you wanted to insure that you never receive less than 380 per pound (ignoring the initial cost of the derivatives position), what derivatives position should you take? How much does this cost? What would be your lowest net revenue from platinum? Draw your unhedged and your hedged position.

**Buy a put with a strike price of $380, cost = $1.30, lowest revenue = $380 - $1.30 = $378.70**




iii. Suppose you find this insurance expensive. Give two ways to lower the cost.

**Lower the strike price on the put**
**Sell a call**