Chapter D4 – Risk Management
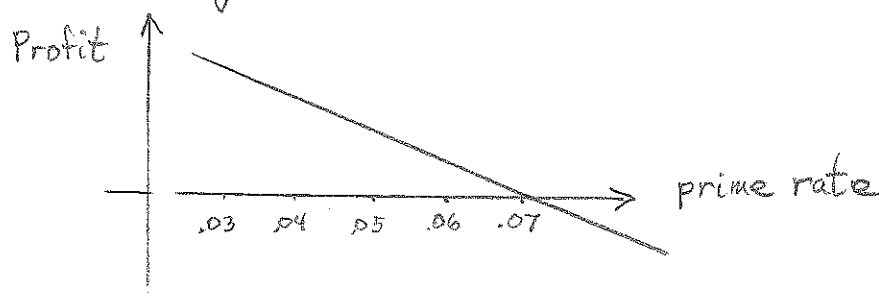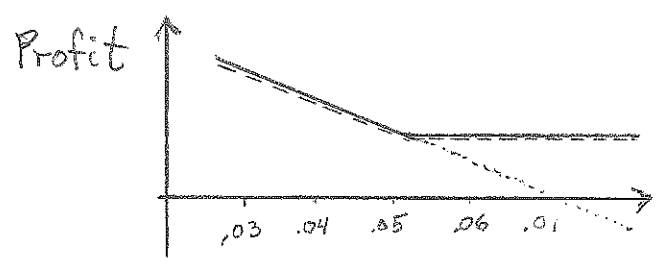
One of the main purposes in the use of derivatives is to provide a hedge against an exposure to risk.

Example: The manager of a large construction company wins a bid on a building. One year from today, the manager will need to borrow $1M for the two year construction period. Currently the prime rate is 3.5%. The manager views potential profits as a function of the prime rate and if prime exceeds 7.1%, then the job will not be profitable.

To insure the profitability of the project the manager buys a call option that

guarantees the ability to secure the needed loan at 5.2% if the prime rate exceeds 5.2% one year from today. The combined position (solid line) is seen below.
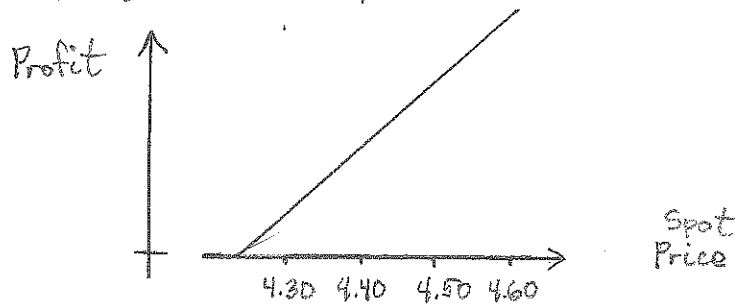

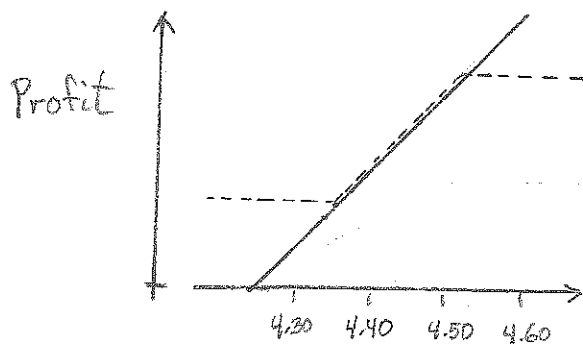This call option will cost the manager a premium. But the strike value of 5.2% is so far from the money that it won't cost very much. Hence the actual profit (hashed-line above) is only slightly below the combined position. Here the call option is used to insure a minimum level of profitability for a future buyer. If the option strike was moved from 5.2% to 4.6%, it would raise the flat part of the solid line, but the cost of the option would also rise.

Example: A dealer has 1M ounces of copper available is six months. The current selling price of copper is $4.46 per ounce. The dealer's profit function in the sale is pictured below.

The dealer buys a $4.35 strike put for $0.22 per ounce and sells a $4.52 -strike call for $0.28 per ounce. The net effect of these transactions is shown below

as the hashed line. If the price is fairly stable, this is an improved position

Why do firms use derivatives?

1. To <u>Hedge</u> — place bounds on the influence of risk factors

2. To <u>Speculate</u> — belief that an asset or index will rise or fall in the near future.

3. To <u>Reduce Transaction Costs</u> — an option is sometimes less expensive than restructuring a position; eg. an option on a loan interest is less expensive than refinancing the loan.

4. To <u>Avoid Regulation or Taxation</u> — can avoid the scrutiny of a governmental agency, can be used to convert income to capital gains or vica versa.
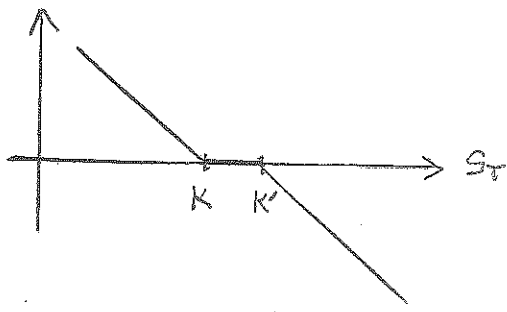
Reasons for caution in derivatives?

1. Transaction Costs — market maker commissions, bid-ask spreads, etc

2. Expertise Costs — need to have the position change carefully checked to understand all of the exposure possibilities.

3. Managerial Controls — trading can lead to unintended exposures and financial dependencies.

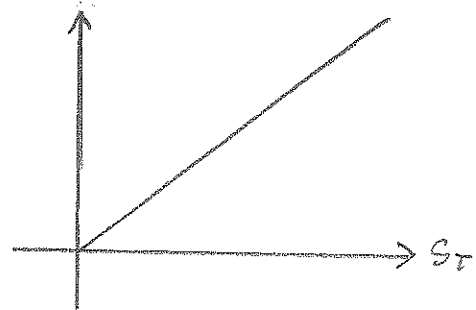4. Tax and Accounting Complications — appropriate expertise must be available.

Zero-Cost Collars

The owner of an asset can buy a put at K and sell a call at K' $(K < K')$ creating a flat region (a collar) between K & K' in the position diagram. By adjusting the values of K and K', it is possible to make the premium paid for the put to equal the premium received for the call. This is a zero-cost collar.
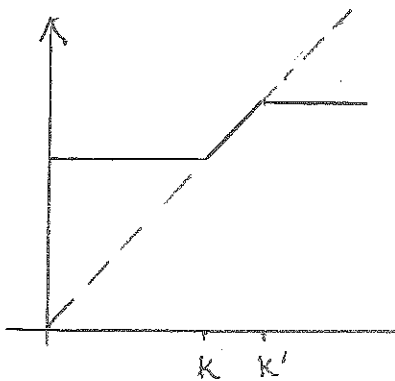

Combined Put-Call Position

Asset Owner Position

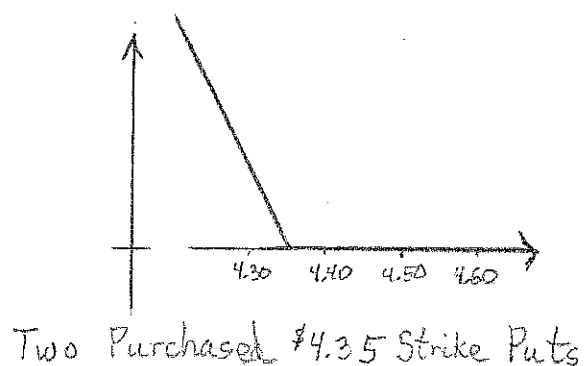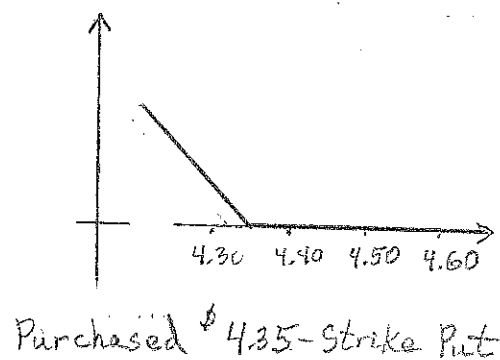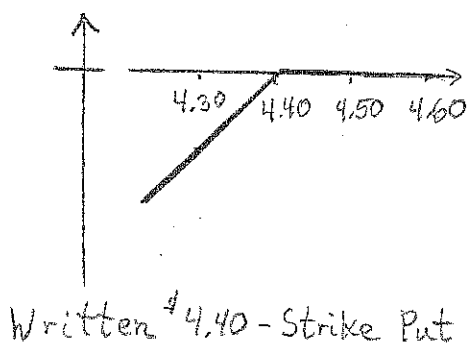Combined Position

Ratio Spread + Pay Later Strategies

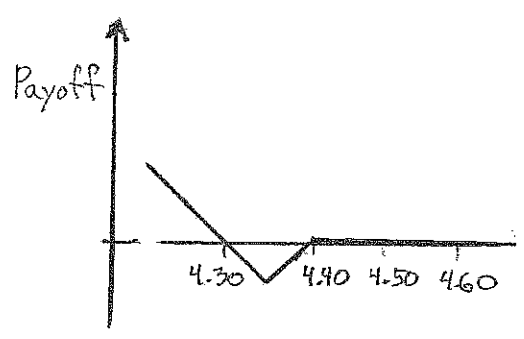A **ratio spread** occurs when we buy m K-strike calls and sell n K'-strike calls ($K \neq K'$). It can also be constructed with puts, which we now illustrate using the setting of the example on page D4-3. The current price of copper is $4.46/oz.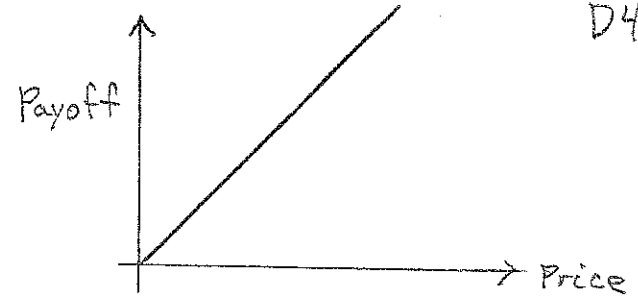 To protect against a falling price, we write a $4.40-strike put for a premium of $0.34 and buy two $4.35-strike puts for $0.17 each. The net premium to us is
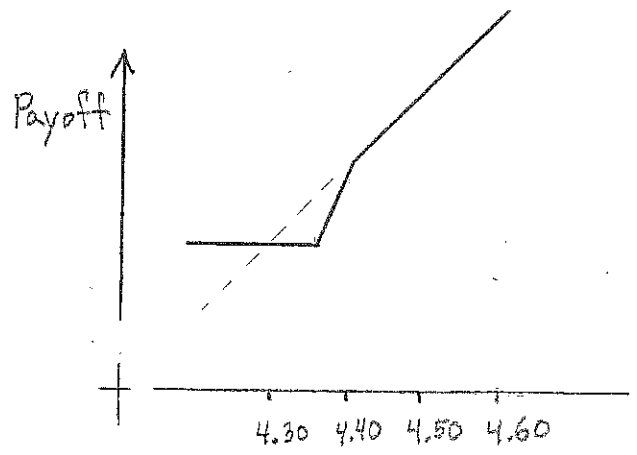
$$\$0.34 - 2(\$0.17) = 0.$$

Written $4.40-Strike Put

Purchased $4.35-Strike Put

Two Purchased $4.35 Strike Puts

Three Puts Combined

Own Asset

Combined Payoff (Three Puts + Ownership)

The **solid** line shows the combined position. If the price is $4.40 or above the profit equals the original. If the price goes below $4.35 the profit does not decrease. Thus the insurance against a falling price only alters the profit when it is needed, i.e. when the price falls below its current $4.46 value. This is described as a paylater strategy because the insurance is only paid when needed.

Exercise D4-A

Your company is trying to insure against a decrease in the price of a product it will sell one year from today. The current price is $50 and the risk-free interest rate is 4%. The company must chose between entering into a one-year short forward contract with a forward price of $52 or buying a one-year 50-strike put at a premium of $4.94. For what range of spot prices at expiration would the profit of the forward exceed the profit from the put?

Exercise D4-1 Which of the following derivatives would help to insure a company against declines in the price of a product that it sells?
   (i) a long forward contract
   (ii) a purchased call
   (iii) a written put

Exercise D4-2 Suppose the risk-free interest rate is 5% and the table below desribes properties of one-year call options.

Srike Price	Call Premium
$110	$8.42
125	7.60
140	4.12

If the spot price at expiration is $120, find the (largest profit) - (smallest profit) among purchases of these options at expration.