

ECO 4378

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Position Delta

- The delta of a security or portfolio measures the sensitivity of the value of the position (or portfolio) with respect to the price of the underlying asset.
- For example, if a call option on IBM stock has delta 0.7, this means that if the IBM stock price goes up by \$1, the value of the call option will go up by 70 cents.
- Delta ranges between -1 and 1.
- Each share of the underlying asset, by definition, is one delta point.
- A long position in a call option has positive delta, whereas a short position in a call option has negative delta. Accordingly, buying call options increases the delta, whereas selling (writing) call options decreases delta.
- A long position in a put option has negative delta, whereas a short position in a put option has positive delta. Accordingly, buying put options decreases the delta, whereas selling (writing) put options increases delta.
- **Exercise 1:** Suppose it is February 10, 2006 and you have a portfolio of 1000 shares of a stock and the current stock price is \$40. You want to reduce your position delta by 40%. Suppose call option contracts on the stock with March expiration and strike price \$38 have a delta of 0.480 and they trade at \$2. How many of these call contracts should you buy or sell to reduce the position delta by 40%?

$$1000 - N * 100 * 0.48 = 600 \Rightarrow N = 8.33$$

- **Exercise 2:** Suppose you have a portfolio of 400 shares of a stock. If you buy 20 call contracts on that stock with delta 0.35 and sell 15 put option contracts on the same stock with delta -0.28, what is your final position delta? Note that each call (put) contract gives the right to buy (sell) 100 shares of the stock.

$$400 + (20 * 100(0.35)) - 15 * 100 * (-0.28) = 1520.$$

- **Exercise 3:** Find the portfolio delta for the following portfolio:

- 5000 shares of a stock.
- Short position in 20 call contracts on the stock with delta 0.355.
- Long position in 10 put contracts on the stock with delta -0.250 .

$$5000 - 20 * 100(0.355) + 10(100)(-0.250) = 4040$$

- **Exercise 4:** If the following portfolio has 1200 delta points, what is x ?:

- x shares of a stock.
- Long position in 10 call contracts on the stock with delta 0.480.
- Short position in 20 put contracts on the stock with delta -0.300.

$$\begin{aligned} 1200 &= x + (10 * 100(0.48)) - 20(100) * (-0.3) \\ \Rightarrow x &= 120 \end{aligned}$$

- **Exercise 5:** Consider the following portfolio:

- 1000 shares of a stock.
- Short position in 5 call contracts on the stock with delta 0.240.
Suppose the portfolio owner wants to increase the portfolio delta to 2000, and a put option contract on the stock with delta -0.220 is available. How many put contracts should the owner buy or sell to increase portfolio delta to 2000?

$$1000 - 5(100)(0.24) - (N * 100 * (-0.22)) = 2000 \Rightarrow N = 51$$

- **Exercise 6:** Suppose the following two portfolios have the same delta. Find x .

- **Portfolio A:** 500 shares of a stock and 20 short call contracts on the stock with delta 0.25.
- **Portfolio B:** x shares of a stock and 40 long put contracts on the stock with delta -0.25 .

$$\Delta_A = 500 - 20(100)(0.25) = 0$$

$$\Delta_B = x + 40(100)(-0.25) \Rightarrow x = 1000$$