

14. Options Markets

- Introduction
 - Terminology and Trading
 - Types of Options
- Payoffs and Profits at Expiration
 - Intrinsic value - profit made if the option was exercised immediately.
 - Time value - difference between current option price and intrinsic value
- Common Option Strategies
 - Protective put, covered call, straddle, strangle, collar, bull-call spread, butterfly spread, others
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- Options trading on CBOE (index options)
 - <http://www.cboe.com>

Terminology

- Option - a contract giving holder the right, but not the obligation, to buy (sell) an asset at a fixed price (“strike” or “exercise” price) at any time on or before a given date (“expiration” date).
- Exercise
 - using the option contract to buy (sell) the underlying asset.
 - American - can be exercised any time before expiration (most common)
 - European - can be exercised only at expiration E.g., equity index options.
- Call option
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- Put option
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- Other
 - Intrinsic value - profit made if the option was exercised immediately.
 - Time value - difference between current option price and intrinsic value
 - In the Money - exercise of the option would be profitable

Payoffs at Expiration

- .Quotes – Contracts are for 100 shares, so contract costs $price * 100$.
 - Prices increase with time to expiration
 - Calls with low strikes worth more than corresponding puts
 - Calls with high strikes worth less than corresponding puts
 - Expire on third Friday of expiration month; trade in nickel increments.
 - Option quotes on Web <http://finance.yahoo.com>
 - Consider options with strike of $E = \$80$ and stock price at expiration of S_T .

| Final Stock Price | Payoff to Long Call | Payoff to Long Put |
|-------------------|---------------------------------|---------------------------------|
| 74 | | |
| 77 | | |
| 80 | | |
| 83 | | |
| 86 | | |
| Payoff at S_T | $\text{Max}[(S_T - X), 0]$ | $\text{Max}[(X - S_T), 0]$ |
| Profit | $\text{Max}[(S_T - X - C), -C]$ | $\text{Max}[(X - S_T - P), -P]$ |
| Option Written | $\text{Min}[-S_T + X + C, +C]$ | $\text{Min}[-X + S_T + P, +P]$ |

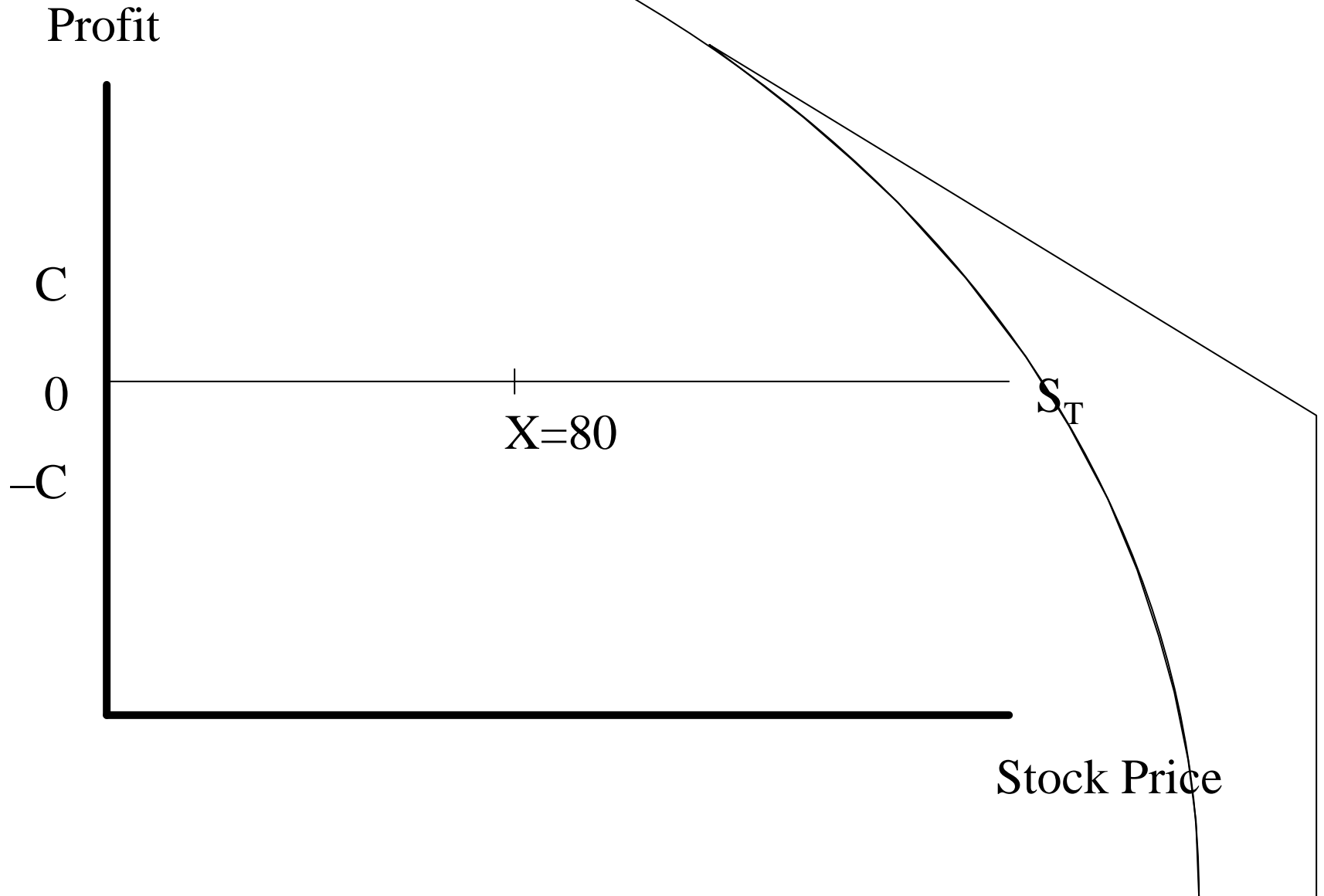
Trading

- OTC – market is relatively small, but allows contract to be tailored
 - Need to hedge your \$5M of incentive-based call options?
- Exchanges – CBOE (some electronic afterhours trading), Amex
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 - Options on indiv stocks expires within 3 mo (otherwise LEAPS)
 - Strike prices set at \$2.50 or \$5 intervals; market makers post bid and ask.
 - Flex options – traders on exchange may tailor some terms for large trades.
- Option Clearing Corporation –
 - All trades cleared by OCC members (brokerages). Self-regulating.
 - OCC randomly assigns firms to honor exercise.
 - Writer posts margin depending on asset, money-ness, covered.
- Margins on naked option written
 - 100% of proceeds from sale plus 20% of underlying share price less the amount (if any) by which the option is out of the money
 - 100% of the proceeds of the sale plus 10% of the underlying share price.
 - Cannot buy options on margin.

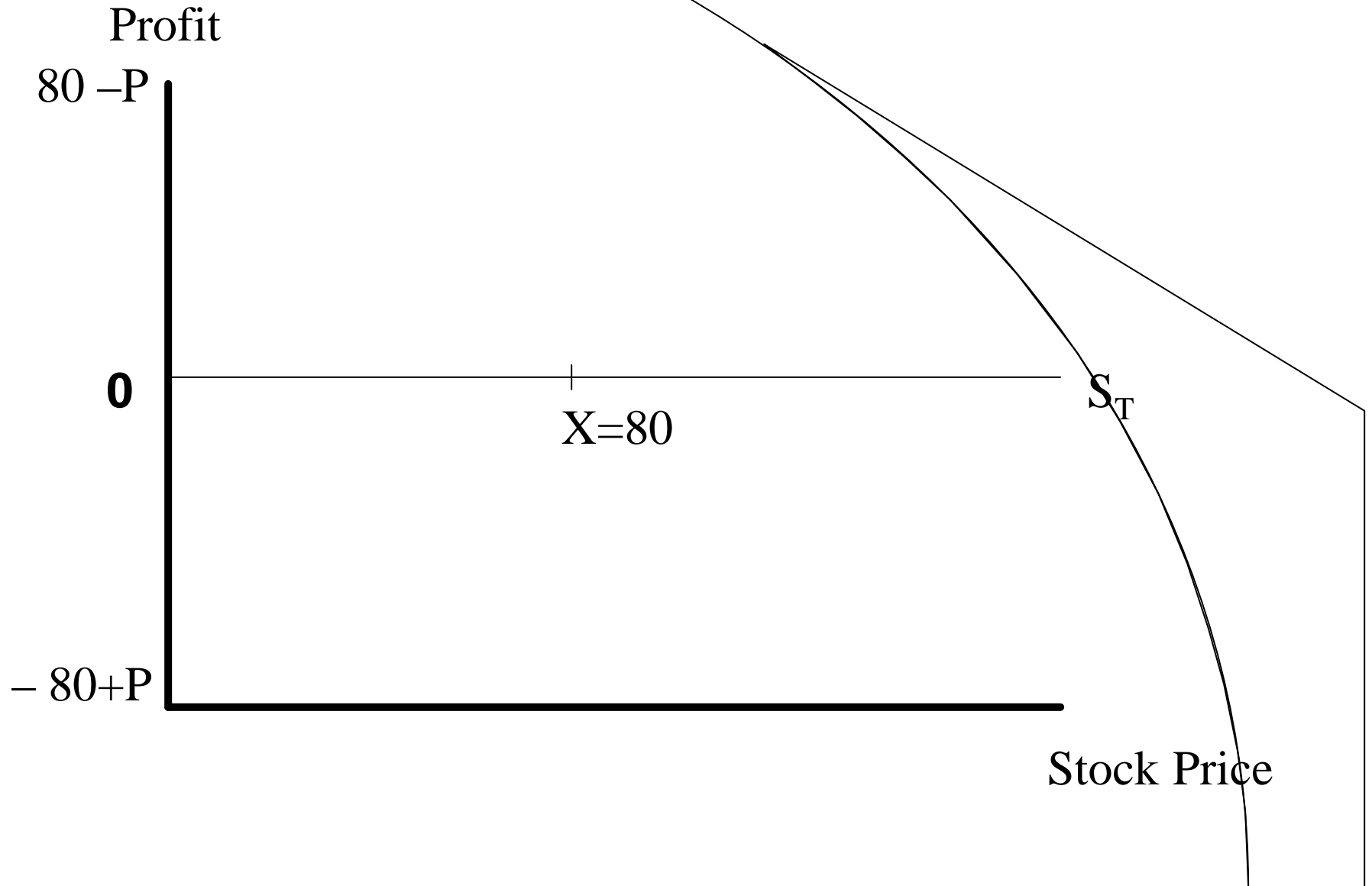
Types of Options

- Stock Options
 - Options on individual stocks.
- Index Options
 - CBOE - SP500 (SPX), SP100 (OEX), NASDAQ-100, DJIA, Russell 2000, Nikkei....
 - Amex - SP Midcap, Japan index, Hitech sector, Pharmaceutical sector, etc...
 - Cash Payoff (not underlying assets); Contract multiplier is 100
 - Options on exchange traded funds (ETF) have similar effect
- Foreign Currency Options
 - Traded on CME, CBOE, Philadelphia SE since 1982.
- Interest Rate Options
 - Traded on Amex and CBOE
 - T-bills, T-notes, T-bonds, CD's; GNMA pass-throughs
 - Interest rate futures - T-bonds, munis, LIBOR, Eurodollar
- Futures Options
 - Options on futures contracts; Foreign currency and commodities
 - Call – holder acquires long futures, plus excess of futures over strike price.

Call Profits: Graph at Expiration



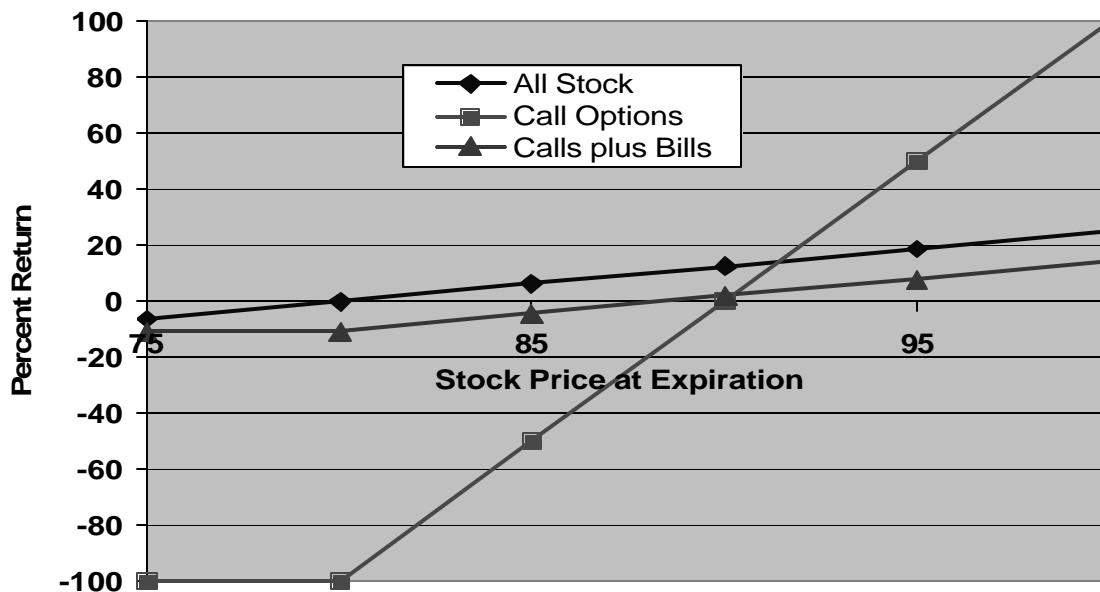
Put Profits: Graph at Expiration



Payoffs: Are Options Risky? (I)

Consider the following investments ($I_0=8,000$) and payoffs.

| Portfolio \ Ending Share Price | \$75 | \$80 | \$100 |
|---|------|------|-------|
| (A) 100 Shares @ \$80 | | | |
| (B) 800 Calls @ \$10 (X=\$80) ! | | | |
| (C) 100 Calls & \$7,000 in T-bills @ 2% | | | |



Option Strategies

- Stock and Options
 - Protective Put - long stock and long put.
 - Covered Call - long stock and write call.
- Combinations – mixtures of calls and puts.
 - Straddle - long call and long put (same exercise price).
 - Collar – long stock, write calls, long puts.
- Spreads - combination of two or more options on same asset with differing exercise prices or times to expiration
- Option strategies - many others available
 - Strangles, butterfly spreads, etc.
- Creating “synthetic” securities - using options to mimic the performance of actual long/short positions in an underlying asset. May have lower trading costs.
 - Ex: Buy DJIA except Boeing and Alcoa
Buy CBOT DJIA Calls; Buy AMEX Puts on Boeing and Alcoa

Strategies: Protective Put

- Long position in Stock ($S_0=100$)
- Long put ($X=100$ and $P_0=2.67$ for one-month)

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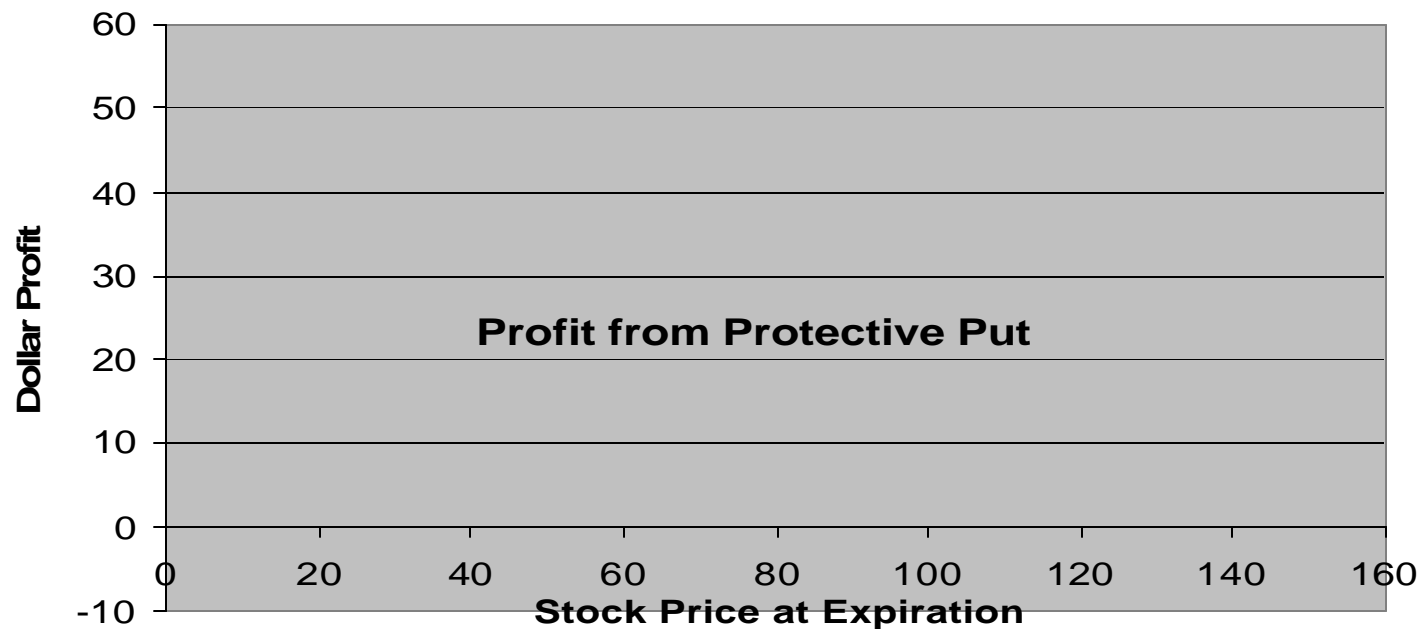
● Initial Cost: $S_0 + P_0 = 102.67$

Max Profit: Unlimited, if the stock price rises

Max Loss: $X - (S_0 + P_0) = -2.67$, if $S_T < X$.

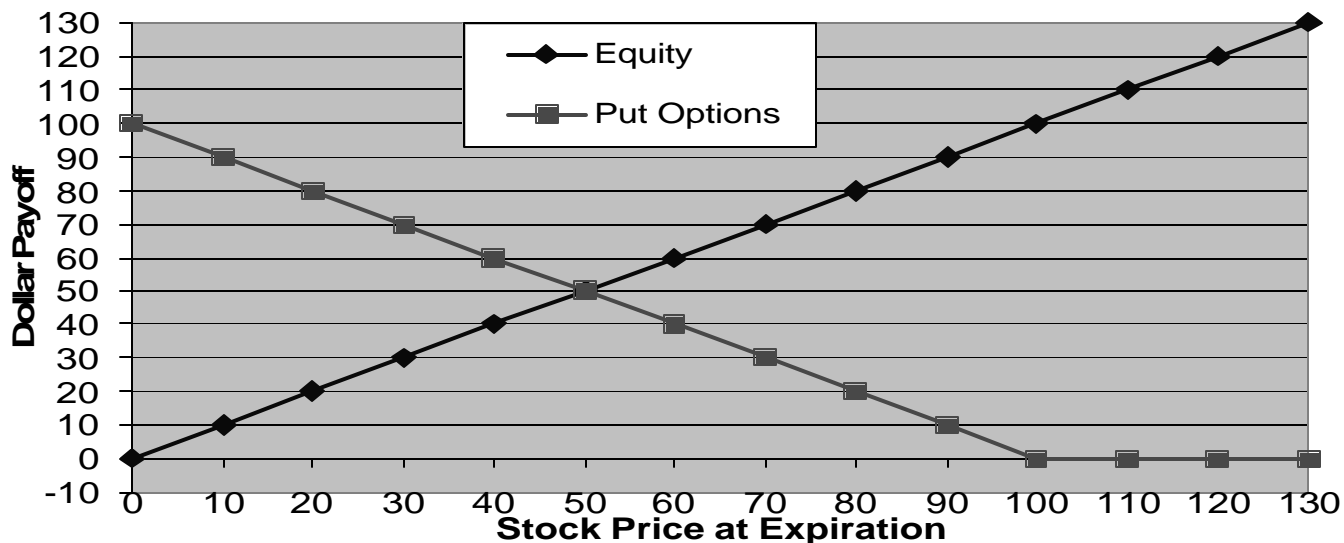
Breakeven: $S_0 + P_0 = 102.67$

Bullish but defensive risk posture. Profit: $\max(X, S_T) - (S_0 + P_0)$

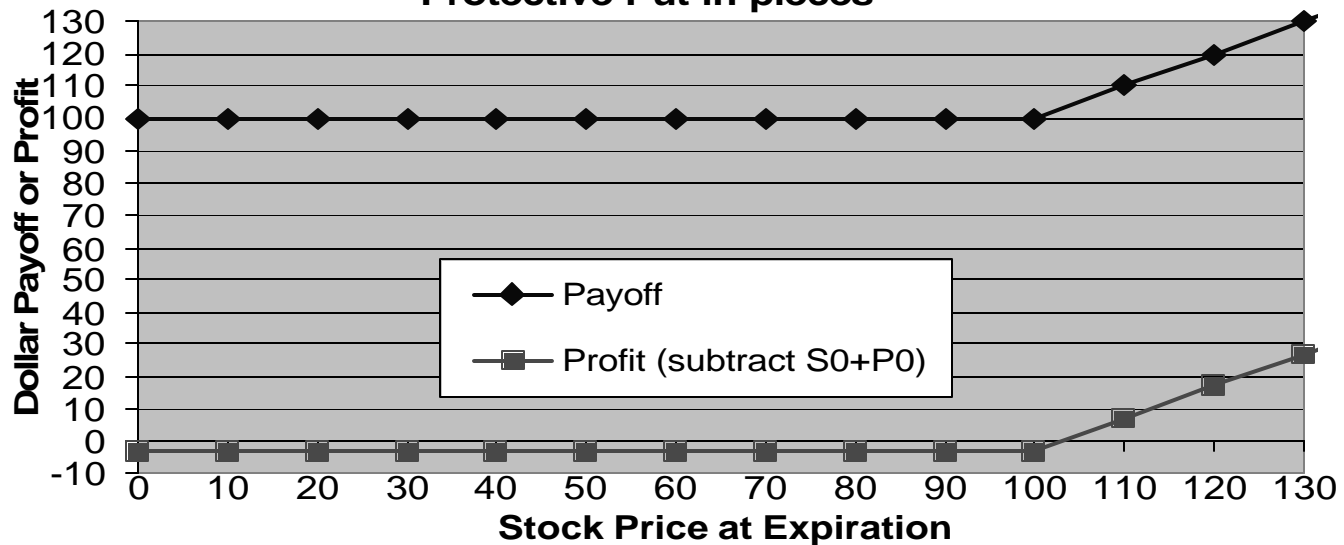


Strategies: Protective Put (in parts)

Protective Put in pieces



Protective Put in pieces



Strategies: Covered Call (buy-write)

- Long position in stock (current price of 100)
- Write call option at $X=100$ ($C=3.085$ for one month)

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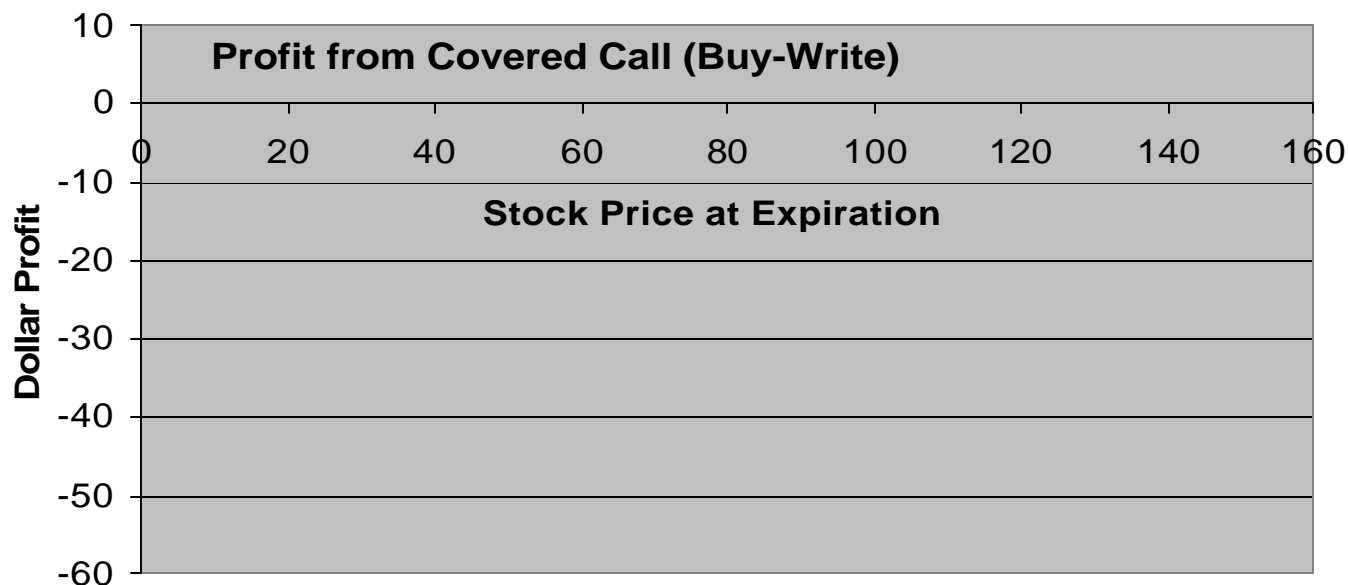
- Neutral to mildly bullish with defensive risk posture.

Initial Cost: $S_0 - C_0 = 96.915$

Max Profit: $X - (S_0 - C_0) = 3.085$, if the call finishes in-the-money

Max Loss: $-(S_0 - C_0) = -96.915$, if the asset price falls to zero

Breakeven: $S_T - C_0 = 96.915$



Strategies: Bull Call Spread

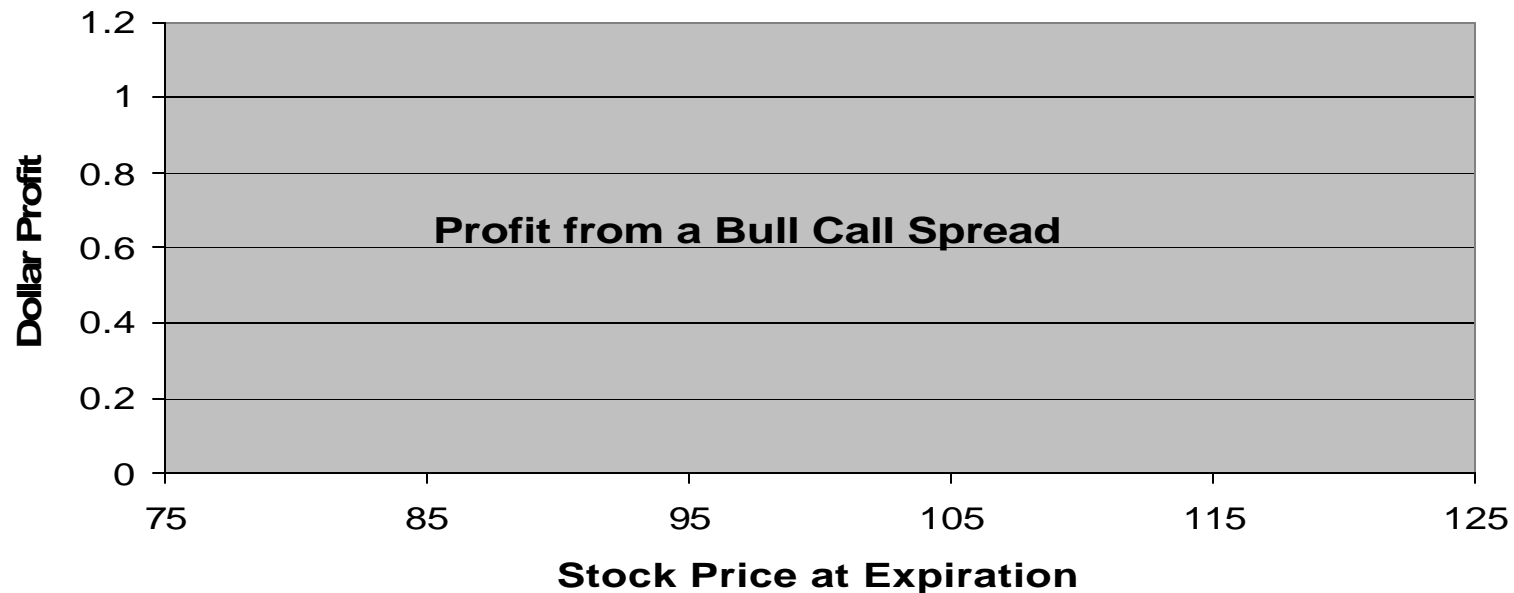
- Buy call at low X ($X_L=95$; $C=6.286$ for one month)
- Write call at high X ($X_H=105$; $C=1.208$ for one month)
- Mildly bullish with defensive risk posture.

Initial Cost: $C_L - C_H = 6.286 - 1.208 = 5.078$

Max Profit: $(X_H - X_L) - (C_L - C_H) = 4.922$, for any price above X_H

Max Loss: $-(C_L - C_H) = -5.078$, if the asset price falls below X_L

Breakeven: $X_L + C_L - C_H = 100.078$



Combination: Straddle

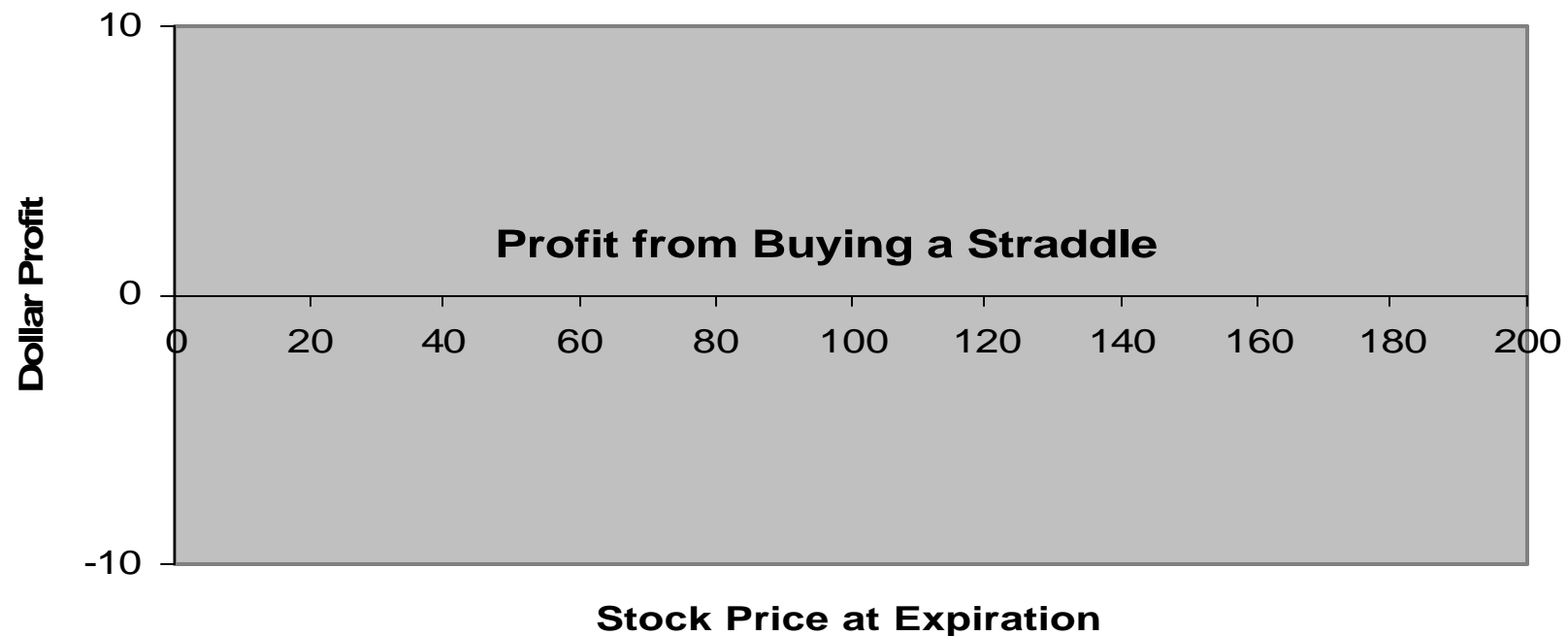
- Buy call ($X=100$; $C_0 = 3.08$ for one month)
- Buy put ($X=100$; $P_0 = 2.67$ for one month)
- Neutral on price direction, high volatility; speculative but limited risk.

Initial Cost: $C_0 + P_0 = 5.75$

Max Profit: Unlimited, if S_T rises sharply; $X - (C_0 + P_0) = 94.25$, if $S_T = 0$

Max Loss: $-(C_0 + P_0) = -5.75$, if $S_T = X$

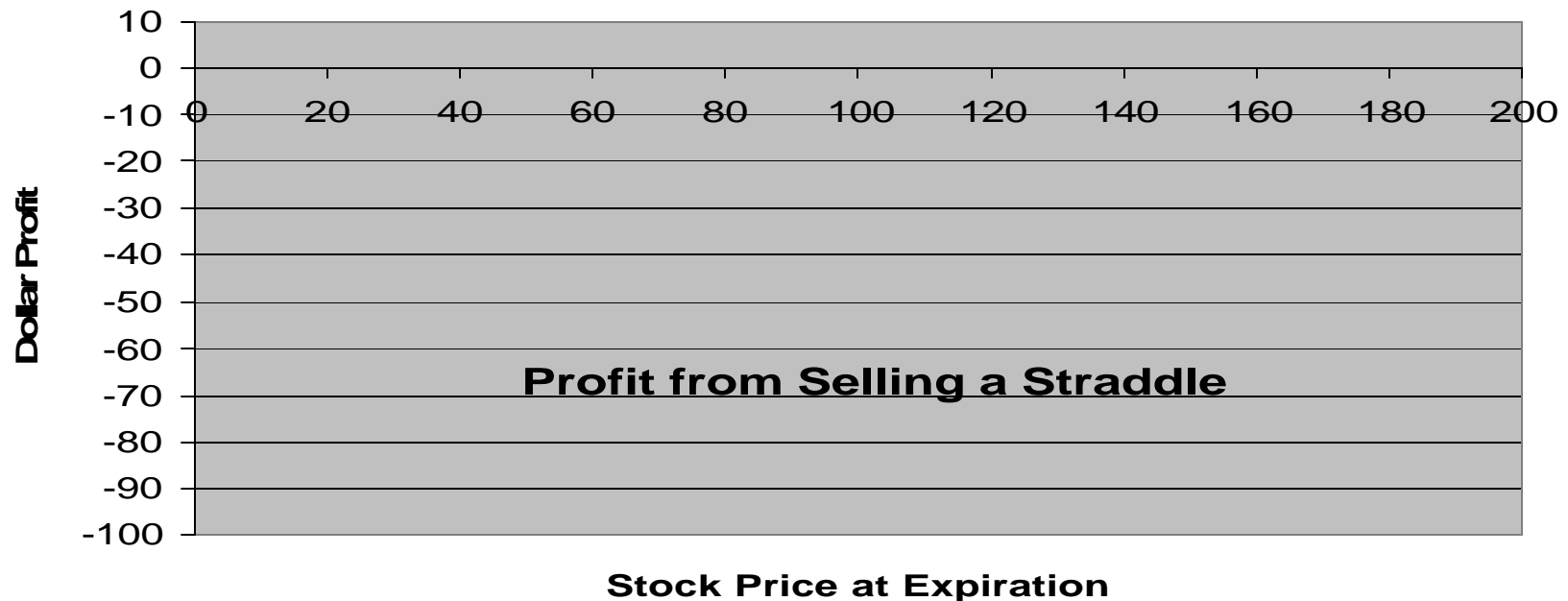
Breakeven Price: $X + (C_0 + P_0) = 105.75$, and $X - (C_0 + P_0) = 94.24$



Combination: Sell Straddle

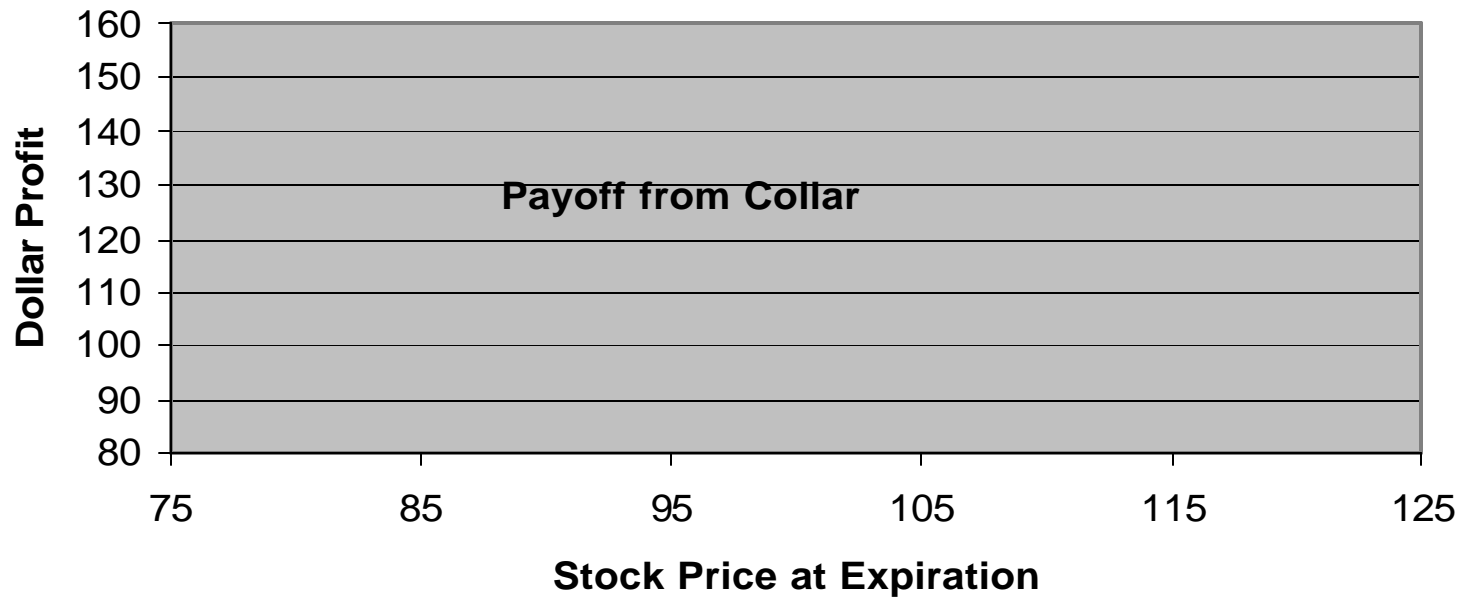
- Write put (X=100)
- Write call (X=100)

- Initial Cost: Credit of $C_0 + P_0 = 5.75$
- Max Profit: $C_0 + P_0 = 5.75$, if $S_T = X$
- Max Loss: Unlimited, if S_T rises sharply, and $C_0 + P_0 - X = -94.25$, if $S_T = 0$.
- Breakeven: $X + C_0 + P_0 = 105.75$, or $X - C_0 - P_0 = 94.25$



Combination: Collar

- Suppose you own a stock with price of \$100.
- Write a call (X=\$105)
- Purchase put (X=95)



Option-like Securities

- Employee Stock Options - given to employees as part of benefits package
 - Incentive SO (VP+) vs Non-qualified SO (different tax treatment)
 - ESOs vest in 1-3 yrs; May expire in 10 yrs; Cannot be sold;
 - In bubble many exercised, incurred tax liability (AMT), then stock crashed.
- Equity – call option on assets of a levered firm, with E equal to par value of debt.
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- Bonds
 - Call provision on bond - Allows company to repurchase bond before maturity.
 - Put bond - Allows bondholder to require company to repurchase bond
 - Convertible Bonds - converted into common shares at option of bondholder
 - conversion price is effective price paid for stock
 - conversion ratio is number of shares received when bond is converted
- Warrants - call option issued by corp in conjunction with other securities
 - Can be detached from orig securities and sold separately; usually long-term.
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Exotic Options

- Asian Options -
 - Depend on average price of underlying asset.
- Barrier Options
 - Depend on final price and whether price has penetrated a “barrier”. E.g., down and out.
- Lookback Options
 - Depend on minimum of maximum price of underlying asset.
- Currency-Translated Options
 - Asset or exercise price denominated in foreign currency.
- Binary Options
 - Fixed payoffs depending on whether some condition is met.

Options: Tips for the Savvy Investor

- Options are traded on many financial assets.
- Options are risky for uninformed investors.
 - Many option traders are informed investors
 - The wrong position may completely wipe out your investment, plus cause additional liability (potentially infinite).
 - Writing “naked” options is rare.
- Options can be used to hedge risks or lock-in gains
 - For many investors, options on ETFs may be useful
- Options can be combined to make very specific “bets”
- Markets can be thinly traded
 - Quoted prices may be stale.