Corporate Finance Mod 23: American Options, practice problems

** Exercise 23.1: American Options

An investor owns American put and call options on stock XYZ. The options expire on September 30. On September 15, the stock pays a dividend of $3 per share. (Actually, the ex-dividend date is September 15.)

A. Might it be worthwhile to exercise the call option right before the dividend is paid?
B. Might it be worthwhile to exercise the put option right before the dividend is paid?

Part A: The stock price declines by the amount of the dividend paid to shareholders (adjusted for tax effects).

When the stock price declines, the value of the call option declines. It *may be* worthwhile to exercise the call option right *before* the dividend is paid.

Illustration: Suppose the call option expires on September 30 and the exercise price is $50. On September 15, the stock pays a dividend of $3 per share, and the stock price is $100 before the dividend and $97 after the dividend. It is unlikely that the share price will decline below the exercise price, so the investor will almost surely exercise the option. Exercising before September 15 gives the investor the $3 dividend.

Illustration: Suppose the call option expires on September 30, the exercise price is $100, and the risk-free interest rate is 12% per annum. On *July* 15 (not September 15), the stock pays a dividend of $1 per share, and the stock price is $100.50 before the dividend and $99.50 after the dividend.

Exercising the call option before the dividend is paid gives $0.50. Even if the stock price increases above $100 by September 30 and the investor exercises the call option then, the value of waiting 2½ months is the investment income on the $100 exercise price: $\$100 \times (1.12^{2.5/12} - 1) = \$2.39$. The present value of this investment income at the dividend date is $\$2.39 / 1.12^{2.5/12} = \$2.33$. The extra investment income alone makes it worthwhile to wait until September 30 to exercise the call option. In addition, if the stock price declines between July 15 and September 30, the investors avoids the loss by waiting and not exercising the call option.

Part B: When the stock price declines, the value of the put option increases. The investor would always wait until *after* the dividend is paid to exercise an American put option.

** Exercise 23.2: American options

Three month *American* call and put options on ABC stock sell at an exercise price of $65 on January 1.

On March 1, the stock price has not changed, the risk-free interest rate has not changed, and the stock price volatility has not changed. The options have one month to expiration instead of three months.

A. Has the call option value increased, decreased, or stayed the same since January 1?
B. Has the put option value increased, decreased, or stayed the same since January 1?

Parts A and B: Compare two American options, Y and Z, with the same attributes except that option Y has 3 months to maturity and option Z has 1 month to maturity.

! The investor can exercise option Z any day in the next month.
! The investor can exercise option Y any day in the next three months.

Option Y has all the possible exercise dates as option Z plus two more months of possible exercise dates. Option Y is worth more than option Z, whether it is a call or put option.

This comparison is valid only for American options, not for European options, which can be exercised *only* on the expiration date.