

ESSAY **16****American versus European
Options**

A European option can be exercised only at expiration. An American option can be exercised any day prior to expiration.¹ Thus, an American option is a European option with the additional right to exercise it any time prior to expiration. This feature naturally raises the interesting question of whether this right is worth something and, if so, how much. In what follows, I shall ignore taxes, transaction costs, market liquidity, and the possibility that investors might be irrational. I shall use options on stock as the example.

It turns out that for call options, the right to exercise early can be quite trivial. If there are no dividends on the underlying stock, then there is no reason to exercise an American call early. The call could never sell for less than the exercise value. For most people who hear this statement for the first time, it sounds impossible to believe. The tendency is to think that a call that is deep in-the-money on a non-dividend-paying stock that is not expected to go any higher should be exercised. But exercise is simply not the best thing to do. If you are not optimistic on the stock, there is no reason to hurry up and exchange the option for the stock. You would not be any happier holding a stock that is going nowhere, and to make matters worse, you would be out the interest on the money spent to buy the stock with the option.

The reason the call will always sell for no less than its exercise value is that regardless of how high the stock is, it can always go higher. An exercised call is a dead call, and the investor can benefit no further from leveraging the stock price increases; nor can she benefit from the downside protection of the call.

If you are still not convinced, consider this example of a call with a strike of \$100. Let us say you are at expiration and the stock is worth more than

¹ As I noted in Essay 5, these names have nothing to do with America and Europe.

\$100. If you had not exercised it early, you would exercise it now, paying \$100 and acquiring the stock. If you had exercised it early, you would now be holding the same stock, but you paid out the \$100 to acquire it at an earlier date and you would be out the interest on \$100 from the day you exercised it until today.

In the alternative outcome where the stock is worth less than \$100, consider what would happen. If you had not previously exercised it, you would now let it expire. If you had previously exercised it, you would be holding a stock worth whatever its price is today plus you would have paid out \$100 earlier and would be out the interest on the \$100. If the current price of the stock is less than \$100, then the current price of the stock is definitely less than \$100 plus the interest you have lost. So in either case, you are worse off having exercised the call early. In short, why pay the exercise price early? When you get to expiration, you will be absolutely no better off. It is like paying a bill early and throwing away the right to decide whether you actually want to keep the merchandise.

Not exercising early does not mean that you should do nothing before expiration. An option on a stock that you expect to go no further should be sold or offset.

If, however, there are dividends on the stock, it might pay to exercise the call early. Exercising it early would leave you in the same position as in the preceding example, but now you would also have a dividend plus the interest on it, which could be enough to make up the difference. You never exercise early to capture the dividend except at the last instant before the stock goes ex-dividend. Otherwise, you are paying the exercise price out earlier than necessary. In short, the known stock price drop that occurs at the ex-dividend date can be avoided by exercising early. This does not mean that you always exercise early at the ex-dividend instant. Whether to exercise early is determined by, among other things, how large the dividend is and how much time remains or, more specifically, how much time value remains in the option's price. Exercising throws away the time value component of the option's price.

Of course, in practice, there could be other reasons for exercising early. Some large institutions with deep-in-the-money calls could choose to exercise early rather than take a large illiquid transaction to the floor where the trade will tell others about their position or result in a decline in the price. Also, the transaction cost of exercising an index option early can be lower than the cost of liquidating the options. Call options granted to employees and executives that cannot be sold or offset with a short sale of the stock might reasonably be exercised early.

American puts on stocks without dividends always have some possibility of being exercised early. For example, suppose you owned an American put

on a stock that went bankrupt. By bankrupt, I mean that the company is dead and will not come back to life. Thus, I am ruling out a reorganization of the company or restructuring of its debts. Consequently the stock is worth zero. In that case, you are holding an option to sell the stock for the exercise price, and there is absolutely nothing gained by waiting until expiration to exercise it. The bankruptcy case is one obvious situation, but bankruptcy is not required to justify early exercise. Let us look at a more likely case.

Suppose you are holding an American put at expiration. The exercise price is \$100. Let the stock be worth less than \$100. You exercise the put and pick up the difference between the stock price and \$100. Had you exercised it early, you would be better off because you would have gotten the \$100 earlier and could have picked up the interest on it. You could have shorted the stock at that time and covered the short position at expiration. In other words, if you had known the put would end up in-the-money, you would have been better off to have exercised it early.

Suppose the put ends up out-of-the-money. Had you exercised it early, you would have picked up the \$100 early, invested it to earn some interest, and you could have shorted the stock at whatever its price was at that time. Now at expiration you cover the short position. If the stock price now at expiration exceeds the exercise price plus the interest you earned on it, you would end up with a deficiency and you would wish you had not exercised it early. Thus, if the stock price ends up above the exercise price, it is possible that you would have been better off exercising early, but it is also possible that you would have been better off waiting. As noted, if the stock ends up below the exercise price, you would definitely be better off having exercised early. Of course, all of this is after the fact and proves only one thing: You could conceivably be better off exercising early.

Finding out exactly when to exercise early is a difficult task and can be accurately computed only with an American put option pricing model or procedure like the binomial model, which we cover in Essay 28. Some approximation methods, however, are available. It is easy to say that you exercise when the market price is driven to the exercise value, but then you are just following the market, which had to have used an option pricing model to establish that the current market price is the exercise value.

Dividends complicate things quite a bit. When a company pays a dividend, it helps put option holders because it works to constrain the stock's growth. Consequently, early exercise is less likely to occur the higher the dividend. When early exercise is justified, it will nearly always be the case that exercise should occur immediately *after* the stock goes ex-dividend. That is, if you are going to exercise the put early, you might as well do it after the stock price drops. Again, an option pricing model is necessary to tell you the optimal time to exercise early.

The exact manner in which the right to exercise early is factored into the option's price is taken up in Essays 35 and 36.

FOR MORE READING

- Hull, John C. *Options, Futures, and Other Derivatives*, 6th ed. Upper Saddle River, NJ: Prentice-Hall, 2006, chaps. 9, 11.
- Jarrow, Robert A., and Andrew Rudd. *Option Pricing*. Homewood, IL: Irwin, 1983, chaps. 5, 6.
- Jarrow, Robert A., and Stuart M. Turnbull. *Derivatives Securities*, 2nd ed. Mason, OH: Thomson South-Western, 2000, chap. 7.
- McDonald, Robert L. *Derivative Markets*, 2nd ed. Boston: Addison Wesley, 2006, chaps. 9, 10, 12.

TEST YOUR KNOWLEDGE

1. Why would you not exercise an American call early when there are no dividends on the stock and you believe the stock has reached its maximum price?
2. Why does a dividend make an American call potentially attractive for early exercise?
3. What makes an American put (assume no dividends) attractive for early exercise in contrast to an American call?
4. Why do dividends make American puts less attractive for early exercise?