

## The Mid-Ocean Club

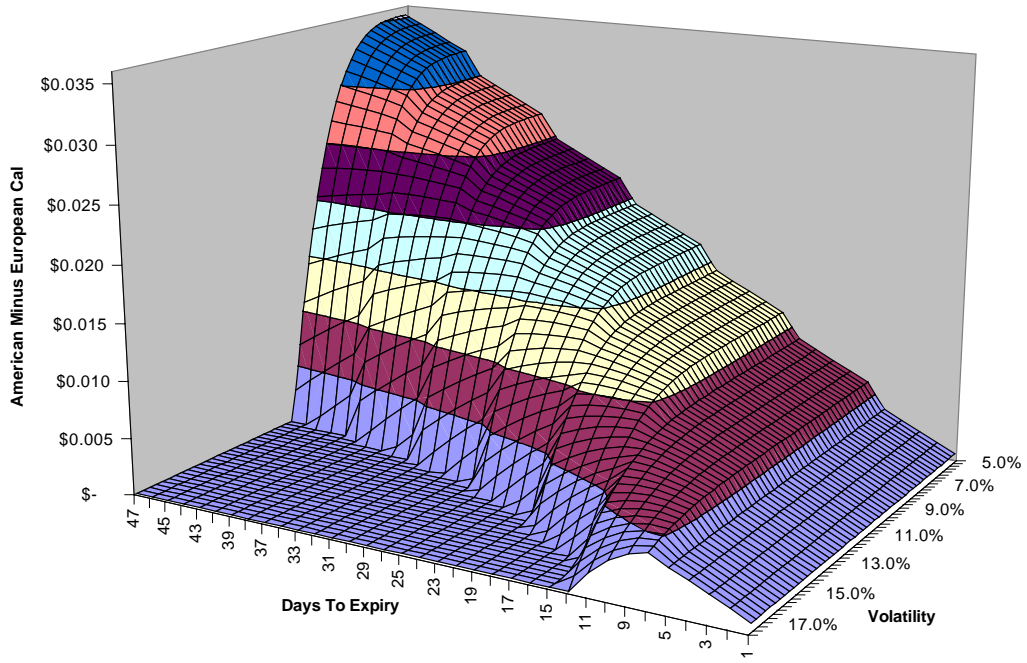
*Editor's note: Cash market derivatives, including so-called exotic options, already dominate risk management in a number of markets. Traders of these instruments use exchange-traded contracts to manage residual risks in their portfolio. Given the size of their trades and the correlation of many large fund positions, these activities can produce outsized effects in exchange-traded markets. This article is the fourth in a series explaining various types of cash-market derivatives.*

Anyone who has ever had to roll out of bed too early on a cold morning to go running, swimming, or commuting certainly must question the value of early exercise. Come to think of it, nothing probably derailed the Japanese economic expansion faster than a few morning calisthenics combined with the company song while a cup of hot tea was having its inevitable effects on the previous evening's repast of seaweed and raw fish.

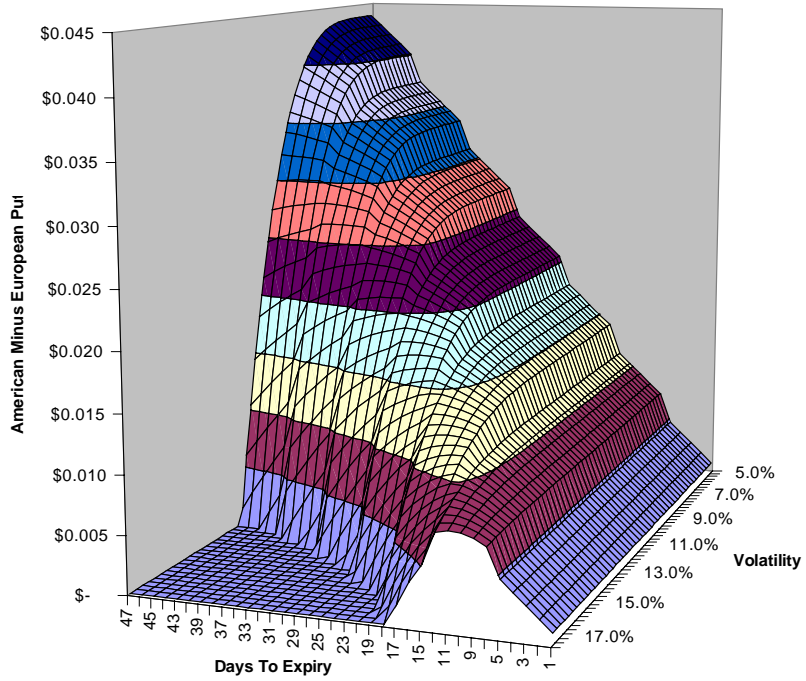
One of the better rules of trading, especially commercial hedging, is "Own the decision points." Quite simply, it is better to do unto others before those of dubious legitimacy do unto you. In the world of option trading, this wisdom translates into the reality that the right to make an early decision is economically valuable. In fact, one model used for valuing American options, the Barone-Adesi & Whaley quadratic approximation model, prices American options by pricing a European option and the value of early exercise itself separately, and then combines the two to approximate the American option.

We learn early on American options can be exercised on or before their expiration date, while European options can be exercised only on their expirations. The more volatile the commodity, the less valuable this right of early exercise will be, as seen below for a \$0.66 in-the-money call option on live cattle with 50 days left to expiration, an underlying price of \$0.709, and an initial volatility of 14.08%. An identical pattern exists for an in-the-money put option, in this case a \$0.77 strike with an initial volatility of 12.47%. The two charts, while similar, are shown from different angles to provide different perspectives on their behavior.

### Value of Early Exercise: Call Option



### Value of Early Exercise: Put Option



The logic behind these price differential patterns is fairly straightforward. Whenever an option is exercised early, the owner abandons the remaining time premium and economically receives the intrinsic value of the option in his acquisition or disposal of the underlying asset. For this reason, it never makes sense to exercise an out-of-the-money option early, as these instruments are entirely time premium without intrinsic value. Early exercise makes sense financially when the interest that could be earned on the funds tied up in an in-the-money option exceed the value of the abandoned time premium on that option. Time premium itself has three components, time, volatility, and interest rates. At high volatility levels, time premium remains significant all the way into the final two weeks. During the final few days, however, the value of early exercise diminishes, implying an optimal window for the right to exercise the option early. Low volatility decreases the value of the time premium, and as a result, early exercise may become more logical even with a significant amount of time remaining.

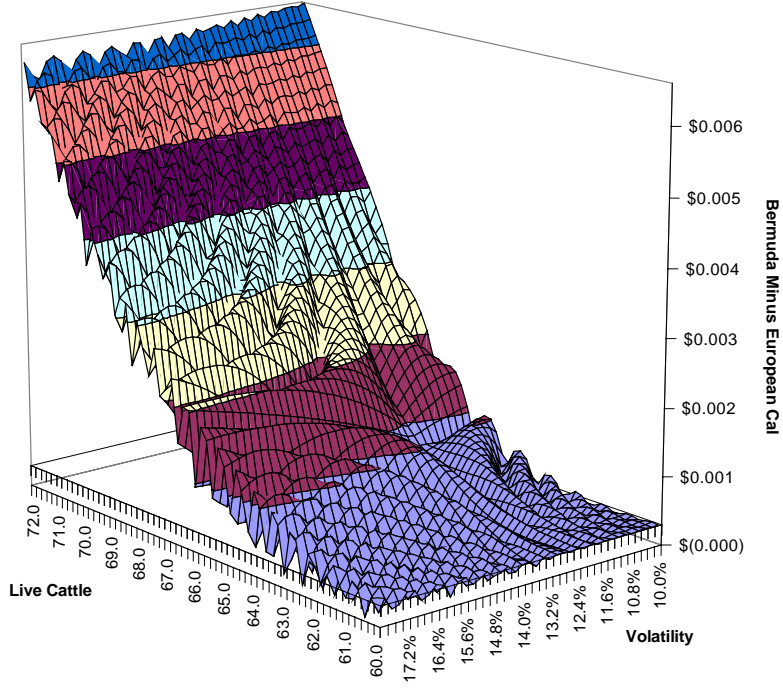
We can arrive at the time and volatility effects on the American-European relationship intuitively by asking ourselves whether we would rather own a limited-risk option or an unlimited risk future or cash market position when the market is volatile. Greater volatility increases the risk of owning a future or cash position as opposed to an option, and therefore makes early exercise less attractive.

### **Welcome To Bermuda**

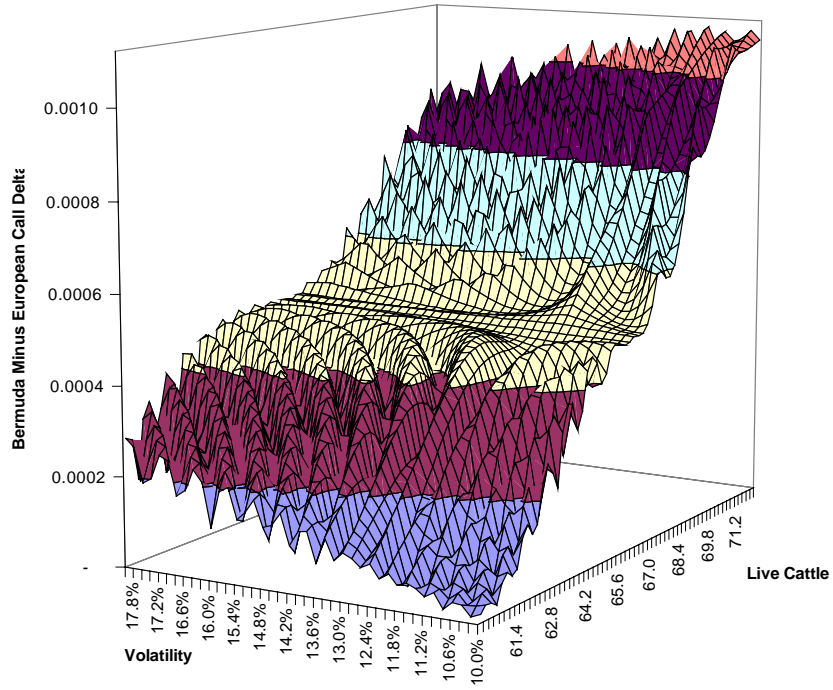
Why pay for an early exercise option you aren't likely to want or need unless your option is significantly in-the-money, the volatility is low, and the remaining time is not so great as to dissuade you from exercising anyway? Bermuda options, so named because the islands lie between Europe and America, (so do the Canary Islands, but the only options for canaries are in the Witness Protection Program) combine features of European and American options. Bermuda options begin their lives as European options, and then, at an agreed-upon date, convert into an American option with an agreed-upon number of early exercise dates. This suits the needs of both buyer and writer; in exchange for a lower initial premium, the writer does not have to worry about a deep-in-the-money option being exercised until a known date, while the buyer avoids paying for a right he does not need. As can be expected, Bermuda options are priced higher than European options and lower than American options in long-dated, low-volatility, and in-the-money situations.

Before we get carried away with the differences between these option classes, we should remind ourselves the cost savings per option at the time and volatility horizons familiar to futures traders are not all that great. We can compare the price and delta at initiation of a Bermuda version of our \$0.66 live cattle call option, with our conversion date set a week before expiration and five early-exercise dates, to those of the corresponding European option. The price differences are so minor, inside \$0.0075, that they reflect minor perturbations of the Bermuda option's binomial pricing algorithm as well as actual economic differences. The delta of the Bermuda call option is higher than the European call option's, with the difference increasing at lower volatility levels and at prices exceeding the \$0.66 strike.

**Bermuda-European Call Spread As A Function of Price And Volatility**



**Bermuda-European Call Delta Spread As A Function Of Price And Volatility**



### **Buy Now, Pay Later**

The switching of the option as a function of time in the Bermuda option has a couple of relatives in the form of forward start and pay-later options. Like the compound options we discussed last month, forward starts represent an option on an option. The problem can be verbalized “How much do I have to pay now to get the right to buy an at-the-money option at some future date – at no extra cost.” The problem is simpler than it appears at first blush; all we have to do to replicate it is a buy-and-hold of the underlying asset between now and the future date. Forward start options are more expensive and riskier than their corresponding compound option.

A pay-later option is an interesting twist on the familiar “... but not the obligation” mantra. The owner of a pay-later agrees to take delivery of the underlying asset if it is in-the-money, and then to pay the premium; the payoff will reflect the difference between the then-prevailing price of the underlying asset and the strike price. The price of these options is greater than those of a corresponding vanilla option to reflect the time value of money. These options are used in commercial hedging applications in financial markets where large price movements are common, such as stock indices and currencies. Their acceptance in these markets reflects the “must-do” nature of many of these trades, especially in the currency markets. A producer of crude oil in Venezuela, for example, must buy the bolivar to pay his workers, regardless of his opinion of the currency.

### **Commodity Relationships**

The currency illustration is an introduction to the next set of options we will cover, those involving currency protections, such as quanto options, rainbow options, and options on commodity spreads. Once again, classifying these options as “exotic” is a misnomer; many commercial trading applications involve commodity spreads, processing margins, and currency risks as much as they do outright positions.

Indeed, many economic assets can be described best as a package of long-term spread options: An electric generating station’s value is nothing more than an option on a “spark spread,” the difference between the price of the electricity it produces less its fuel and operating costs. At this level, we are taking options trading out of day-to-day tactical decision making and placing it squarely in corporate financial planning and strategy. This topic will be addressed toward the end of this series of articles.