An options primer for the course, Event-Driven Finance, FRE 6911

Options Primer

- The subject matter of this course is “event-driven finance”
- An event is a change of trading conditions with a temporal focal point
  - In other words, we have a notion of **normal trading conditions**, then some event occurs and prices adjust
  - some types of events are earnings announcements, changes in lending rates, corporate actions, etc.
  - It is assumed we have a pricing model which describes the normal trading conditions
  - Then the presence of an event causes prices to change in its vicinity
  - These changes can be both forward in time as well as backwards!

Options Primer

- A pricing model is a blackbox which takes in inputs and outputs the "fair prices" of securities as a function of the inputs
- You are undoubtedly familiar with the most common of these models
- In this course, we will only make reference to Black-Scholes and its discrete cousin: Cox-Ross
- We will think of this model as describing **normal trading conditions**
- *It is important that you review **Natenberg** if you are insufficiently familiar with equity options or BS*

Options Primer

- The inputs for CR (henceforth we will say BS but usually mean CR) are the calendar time, t, the expiration date, T, the discount rate, r, the implied volatility, σ, the option type, American or European, and the dividend stream. And OF COURSE the stock price, S, and the strike price, K.
- A very important practical fact is that there are multiple interest rates: a long rate, a short rate, a hard-to-borrow rate, broker call, FedFunds, etc…
- When holding an American option would cause future expected returns to fail to exceed the naked stock position the option becomes *an exercise.* Exercising a call produces + stock, exercising a put – stock

Options Primer

- I have not said long stock and short stock because the exercise contributes to an underlying position in the stock. In other words, if I exercise a call but am currently short 400 shares, my net position becomes short 300 shares.
- You need to demonstrate for yourselves (using put-call parity, described later) that exercising a call is equivalent to selling a synthetic put, while exercising a put is equivalent to selling a synthetic call.
- In margin accounts (where all positions reside with a clearing firm) the value of long securities is charged a long rate; the value of short securities is paid a short rate- unless the security is hard-to-borrow. Cash is paid at whatever rate corresponds to the sign (+/-) of the net value of the position.

Options Primer

- Because the long stock holders *pay* the long rate, a call is generally only an exercise when there is a sufficiently large dividend.
- Puts are generally an exercise when the strike price is high enough.
- In rare occasions the spread between long and short rates or the presence of hard-to-borrowness will lead to calls being an exercise.
- The output of BS are two fair prices: C(S,K) and P(S,K), the call and put prices. Of course, C and P are also functions of all the other inputs mentioned above.

Options Primer

- Since BS takes the same inputs to output both a call price and a put price and because it is demonstrable that $C \equiv P \pmod{F}$, where F is the stock forward, we say that there is *put-call parity.*
- The practical effect of put-call parity is that we may trade puts and calls interchangeably subject to the appropriate *hedging*.
- While put-call parity strictly holds only for European options, far from the early-exercise boundaries we can assert a functional put-call parity.
- This is because the risk profiles w/o early-exercise are identical for positions which differ only by the replacement of some puts by calls of the same strike and expiry and vice-versa as long as the *deltas* of the positions are equal.

Options Primer

- The delta, gamma, theta, *vega* of options, also known as the Greeks, are partial differentials of the C and P functions with respect to their various parameter inputs.
- Hence delta is $\partial C/\partial S$, the change in call value as the stock price increases.
- YOU NEED TO KNOW delta, gamma, theta, vega VERY WELL – again see Natenberg
- "Inverting" BS means taking the price of an option and inferring the *implied volatility*, σ, which yields this value (assuming that the additional inputs such as interest rates are understood and agreed to).

Options Primer

- Implied volatilities are the *lingua franca* of finance. When traders and theoreticians speak of volatilities, implied volatilities, vols, etc. they are always stating a value relative to a basic BS model
- The implied vols for parity options are identical in BS
- It is therefore useful to enforce a functional put-call parity in CR for American options where we demand that C(S,K) and P(S,K) have identical σ's.
- We will use this functional put-call parity to cross-check for bad data as well as to extract hard-to-borrowness

Options Primer

- Of practical use, a trader will always buy a cheap option to sell an expensive one. If the price of options in parity fluctuates so that the puts become cheaper temporarily or vice-versa there is a money-making opportunity.

- The theoretical meaning of σ is this: we imagine a landscape of events which buffet the stock price but whose effect can be viewed as smoothed out in the times of our interest.
- This means that standard option theory is a mesoscopic theory; the time scales of pricing and trading are large wrt these events.

Options Primer

- When we choose to introduce a particular event over a time-scale NOT small in our pricing horizon, then the event produces a non-standard pricing. For example, the announcement of earnings on a specified date will mean that the volatility has a structure involving at least two time scales and the plain, featureless σ of BS is insufficient to price options near to earnings.
- Compared to a BS model the prices will diverge. This does not imply tradeability.