Valuation Project

Due Tuesday, 23 April 2019

(This is a group assignment. Groups may have up to 3 members.)

The assignment is to: (a) develop and implement a finite difference method (either Explicit or Crank-Nicolson) to value the financial instrument below or of your choice; (b) select reasonable inputs and estimate the value of the financial instrument; and (c) prepare a short written report documenting your implementation of the valuation model and your result including some kind of sensitivity analysis. The valuation model and documentation must be completed by Tuesday April 23.

Grading will be based on both the complexity of the product and/or valuation model, and how well you carry out the implementation of the valuation model. With a Finite Difference method there should, ideally, be a call, barrier, or early exercise feature.

If you wish to choose your own product (see EDGAR notes at the end) you should select a financial instrument that is interesting (complicated) enough that developing your model is somewhat challenging, but simple enough that developing a valuation model is feasible.

Very Important Remark for all valuation assignments. There are many financial instruments that are too difficult for you to value at the moment. For example, some convertible bonds have complicated path-dependent features, and some hybrid securities are exposed to multiple underlying assets, leading to a high-dimensional problem. (You can probably value some of these instruments, but you would not finish before April 23). **I strongly recommend** that you identify your financial instrument and **come and talk to me about it** beforehand, so that I can help you decide whether you have chosen an instrument that is too difficult.

Auto Callable Contingent Interest Notes (Standard)

Please choose a product from the list below:

Apple:
https://www.sec.gov/Archives/edgar/data/19617/000089109219003035/e4403_424b2.htm
Alcoa
https://www.sec.gov/Archives/edgar/data/19617/000161577419004463/s116905_424b2.htm
NVIDIA
https://www.sec.gov/Archives/edgar/data/19617/000161577419004462/s116904_424b2.htm

Key features:

1. One underlying asset.
2. Contingent coupon payments.
3. Straightforward autocall schedule.
4. **Barrier feature**, although not simply a knock-out. You will have to think very carefully about how to implement the barrier here.

Data: You will need the risk-free rate, the dividend and implied volatility for the underlying asset. These can be obtained from Bloomberg (see note on COMPASS).

Contingent Coupon Buffered Securities (Standard)

Only one of these, on EURO STOXX (so, it's also a Quanto) – this was the last of these issued…

https://www.sec.gov/Archives/edgar/data/895421/000095010317008473/dp80100_424b2-ps1779.htm

Key features:

1. One underlying asset.
2. A quanto, so you'll need extra data and to use the correct PDE.
3. No call features
4. Contingent coupon payments based on a continuous barrier type feature – you'll have to think about this one and it's slightly different from the standard product above but I think ends up easier.

Data: You will need the risk-free rates (USD and Euro), the dividend yield and implied volatility for the underlying index. You'll also need exchange rate volatility and the correlation! These can be obtained from Bloomberg (see attachment on COMPASS)

Callable Monthly S&P 500® Index-Linked Range Accrual Security (Quite challenging)

https://www.sec.gov/Archives/edgar/data/72971/000138713119000012/wfcr1326-424b2_123118.htm

Key features:

1. One underlying asset – S&P 500.
2. **Challenging** path dependent feature to determine coupon payments.
3. Also callable which makes it difficult to value even with Monte Carlo, so you'll have to use finite difference for now.
4. Payment at maturity also depends on stock price level.

Data: You will need risk-free rates, and dividend yields and implied volatilities for S&P500. These can be obtained from Bloomberg and other sources.

Auto Callable Contingent Interest Notes (Challenging)

Rather than a stock, you can try an exchange rate:

Turkish Lira
https://www.sec.gov/Archives/edgar/data/19617/000161577419004429/s116891_424b2.htm

Key features:

1. One underlying asset – now an exchange rate
2. The underlying is now a foreign exchange rate, so you'll need extra data and to use the correct PDE and think carefully about foreign exchange.
3. Contingent coupon payments.
4. Straightforward autocall schedule.
5. Barrier feature is much more complex here as it has some unpleasant path dependency built in. You'll have to think very hard about this one.

Data: You will need the risk-free rate, the dividend and implied volatility for the underlying asset. These can be obtained from Bloomberg (see note on COMPASS).

Using EDGAR

- *Go to http://www.sec.gov/.*
- *Under "Filings \& Forms," click on " Search for Company Filings" (might be below the bottom edge of your screen).*
- *Click on "Company or fund name, ticker symbol, CIK (Central Index Key), file number, state, country, or SIC (Standard Industrial Classification)".*
- *Now you can just put in say " Morgan Stanley," but this is a pain, because Morgan Stanley has maybe 100 subsidiaries and/or related entities, and you will have to figure out which is*

the right one. Better if you know the CIK (= Central Index Key). The spreadsheet on COMPASS: EDGAR_CIK.xls (kindly provided by Neil Pearson) gives you the CIK of some financial institutions and some (old) product types.

- *Put in your CIK. You will get the issuer's filings.*
- *Then there is a little box to filter by " Form Type".*
- *The documents you want will be "424B2" or "424B3".*