**CVA and PFE for Complicated Payoffs**

Suppose we have a portfolio of American vanilla options with payoffs of the form

Suppose the hazard rate follows a process

Generate N paths at points

Let be the values of the hazard rate and the stocks at the points on the paths. Let be the starting value.

Since the options are vanilla and American, we can create grids

We can use a PDE backward induction solution for each at The values are

On each path, at each time , we can interpolate vs to obtain Now we can compute

survival along path

discount factor

For PFE, just take the 95th percentile of the ’s,

For a slightly more difficult problem, suppose that a position consists of a payoff at T depending on and can be plus or minus, and it cannot be separated into 1-dimensional problems.

How do we compute CVA in this case?

We have to use Monte Carlo just to evaluate . So it seems as though we would have to Monte Carlo within Monte Carlo because we have to evaluate at every point on every path.

This is **PROHIBITIVE!!** So… how do we get around this?

First, we can clearly compute

Now suppose that we are at and suppose we have already computed and we also have the stock prices

Now over all such that we do a least-squares regression

Now let result of this regression on *all* paths, where is the forward discount factor between and Now let

Now do the same thing as before for PFE.