**A Simple Wrong-Way Risk Example**

We consider a stock that starts off at 100 at and then at the stock can jump to 110 with probability 0.4, or down to 95 with probability 0.6. We have a risk-free rate of 0, and a survival probability of 0.98 for the interval [0,0.5] that will go to 0.96 for the interval [0.5,1] if the stock jumps to 110; otherwise it will go to 1.00 (no default risk) if the stock goes down to 95. Asssume also that between and that the stock grows at the risk-free rate, i.e. stays the same, regardless of where it wound up at Assume also that if default occurs, that it can only happen right before 0.5, say at or right before 1, say at where is extremely small.

Now suppose you have a position consisting of a single ATM call option struck at 100, and there are no dividends.

First note that if you are long this option and hedge with -2/3 share of the stock, then you are perfectly hedged. Let P the value of the option plus the hedge. Then

This means that this hedge position must grow at a rate of 0% per year on the interval , so that the call option value C can be valued thus:

Note also, that under the *risk-neutral* measure, the probability of the stock going to 110 at is actually 1/3, not 0.4. Next note that the CVA on just the option position (no hedge) is just

By contrast, if the risk-neutral probability of the default risk going to 0.96 in the last half is 1/3 independently of where the stock goes, then the payoff on the option will only average out to 10/3 regardless, and there will only be a CVA contribution before the end of the year if the default risk goes to 0.96, so we would get instead

This is, of course, lower, showing the effect of wrong-way risk.