

Homework assignment #2

Andrew Lesniewski

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The enclosed data set contains market implied volatilities for swaptions of indicated maturities on 10 year swaps. The volatilities are quoted in terms of the lognormal model. The snapshot was taken on January 8, 2007, the day of the rates snapshot of the previous assignment. This is important as you are expected to use the results of your work on the first assignment in order to solve today's problems.

Problems

1. Implement the normal and lognormal swaption models.
2. Use Excel's Solver (or write your own Newton-Raphson routine) in order to convert the lognormal volatilities to normal volatilities. You may notice that your forward swap rates are somewhat different from those in the data set. This is due to the differences in the curve construction.
2. Implement the SABR implied normal volatility function. This function should take as arguments the model parameters (α, β, ρ) , the relevant market parameters (σ, F) and the contract terms (option maturity and strike).
3. Using the enclosed data sheet and Excel's Solver utility, calibrate the parameters of the SABR model. Fix the beta parameter to be $\beta = 0.5$.
4. Consider a 1Y into 10Y receiver swaption struck ATM. Use the results of your calibration to calculate the delta risk of this option under a parallel shift of the curve by -1 bp. Compare your delta with the classic Black-Scholes delta, and discuss the consequences for hedging.

This assignment is due in two weeks