Swaption Volatility Surface

An implied volatility is the volatility implied by the market price of an option based on the Black-Scholes option pricing model. An interest rate swaption volatility surface is a four-dimensional plot of the implied volatility of a swaption as a function of strike and expiry and tenor.

The term structures of implied volatilities which provide indications of the market's near- and long-term uncertainty about future short- and long-term swap rates. A crucial property of the implied volatility surface is the absence of arbitrage.

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To construct a reliable volatility surface, it is necessarily to apply robust interpolation methods to a set of discrete volatility data. Arbitrage free conditions may be implicitly or explicitly embedded in the procedure. Typical approaches are

Any volatility models must meet arbitrage free conditions. Static arbitrage free condition makes it impossible to invest nothing today and receive positive return tomorrow.

The option price is more sensitive to correlation than to volatility. The sensitivity appears to be the result of the fact that the option value is a relatively small difference between swap values. The swap values depend quite strongly on the internal rates of return, and small changes of the swap values may cause noticeable relative changes in the option price.

The relatively weak dependence of the option price on volatility suggests that the option price is dominated by its intrinsic value. This apparently is due to the facts that the length of period between the valuation date and the beginning of exercise interval, and especially the

option tenor are small compared to the swap's length., and that the internal rates of return for swaps starting at different dates are very strongly correlated

The volatility break points are related to the forward start times of the respective swaptions in the calibration portfolio.

Reference:

https://finpricing.com/curveVolList.html