

Equity Futures Analytics

A futures contract is an agreement between the two parties to buy or sell an asset at a certain time in the future for a certain price. Futures contracts are traded over the organized exchange. The futures' standardization helps to create liquidity in the marketplace enabling participants to close out positions before expiration

Let S_t be the spot price, σ the volatility and q the continuous dividend yield rate of an underlying stock. Let also T be the maturity and K the delivery price, and r the continuously compounded risk-free rate. The forward price at current time t is given by

$$F_t = S_t e^{(r-q)(T-t)}$$

and the value of a long forward contract, $f_t(S, T)$, is

$$f_t(S, T) = (F_t - K)e^{-r(T-t)} = S_t e^{-q(T-t)} - Ke^{-r(T-t)}$$

Similarly, the value of a short forward contract is $(K - F_t)e^{-r(T-t)}$.

The futures price is the expected value of the stock S at the maturity T , i.e. $F_t^*(S, T) = E_t[S_T]$,

and, thus, the terminal futures price is the stock price at time T , i.e. $F_T^*(S, T) = S_T$.

When the risk-free interest rate is constant and the same for all maturities, the forward price for a contract with a certain delivery date is the same as the futures price for a contract with that delivery date.

The theoretical Eurodollar future price at the value date is given by

$$P = 100 \cdot \left[1 - \frac{1}{dcf(T, T_u, DC)} \left(\frac{df(t, T)}{df_u(t, T_u)} - 1 \right) \right] + NB.$$

The Eurodollar future value at the maturity date of Eurodollar future is given by

$$V = \frac{P - K}{100} \cdot N \cdot dcf(T, T_u, DC).$$

Eurodollar futures are standard instrument and the formulae listed above are quite agreeable with market practitioners.

If F is the quoted price for a Eurodollar futures contract (EDF), the contract price is

$$P = 10,000 \cdot [100 - 0.25 \cdot (100 - F)] \quad (1)$$

The value of the EDF is given by

$$\begin{aligned} V &= 10,000 \cdot [100 - 0.25 \cdot (100 - F)] - 10,000 \cdot [100 - 0.25 \cdot (100 - K)] \\ &= \alpha \cdot 100 \cdot (F - K) \end{aligned} \quad (2)$$

where $\alpha = 25$ is the Value per Basis Point¹ and K is the strike price.

Reference:

<https://finpricing.com/lib/EqQuanto.html>

¹ It can be seen from equation (1) that a change of one basis point, or 0.01, in Eurodollar futures quote corresponds to a contract price change of \$25.