

財務演算法期中作業

Black-Scholes Model Calculation

台大財金所財工組碩二

R10723058

陳韋勳

Class架構介紹

Classes:

1. `class OptionCalculator`
提供以下兩個class會用到的計算工具
2. `class CallOptionCalculator : public OptionCalculator`
計算Black-Scholes call option 相關資訊
3. `class PutOptionCalculator : public OptionCalculator`
計算Black-Scholes put option 相關資訊

class CallOptionCalculator 功能介紹

繼承class OptionCalculator的工具，計算B-S model **call option** 相關數值

Functions:

1. double calculate_call_price()
計算call option的價格
2. void calculate_all_greeks()
計算call option的各式greeks
3. double calculate_implied_volatility(const double& option_price)
給定此Option的市場Premium，計算Implied Volatility

class PutOptionCalculator功能介紹

繼承class OptionCalculator的工具，計算B-S model **put option**相關數值

functions:

1. double calculate_put_price()
計算put option的價格
2. void calculate_all_greeks()
計算put option的各式greeks

結果展示

```
int main() {  
    cout << "=====  
    // Calculate black-Scholes call option price, greeks and implied volatility given market premium.  
    // Inputs: stock_price, strike_price, time_to_expiry, risk_free_rate, volatility  
    CallOptionCalculator callOptionCalculator(50, 50, 0.5, 0.1, 0.1);  
    cout << "Call Price: " << callOptionCalculator.calculate_call_price() << endl;  
    callOptionCalculator.calculate_all_greeks();  
    callOptionCalculator.calculate_implied_volatility(2.5); // Inputs: Premium  
  
    cout << "=====  
    // Calculate black-Scholes call option price and greeks.  
    // Inputs: stock_price, strike_price, time_to_expiry, risk_free_rate, volatility  
    PutOptionCalculator putOptionCalculator(100, 100, 1, 0.1, 0.1);  
    cout << "Put Price: " << putOptionCalculator.calculate_put_price() << endl;  
    putOptionCalculator.calculate_all_greeks();  
    cout << "=====  
  
    return 0;  
}
```

```
=====  
Call Price: 2.92514  
Delta: 0.771096  
Gamma: 0.085655  
Vega: 10.7069  
Theta: -4.63366  
Rho: 17.8148  
Implied Volatility:0.0500427  
=====  
Put Price: 0.791893  
Delta: -0.146859  
Gamma: 0.0229882  
Vega: 22.9882  
Theta: 0.398369  
Rho: -15.4778  
=====
```