ADI Application in Solution of Problem Option Pricing under the HHW Model

Zahra Sokoot*
Allameh Tabatabae'i University of Tehran

Abdolsadeh Neisy
Allameh Tabatabae'i University of Tehran

Abstract

we introduce a very important application of PDE in financial markets.for this purpose a european option pricing under underling asset with volatility and interest rate is stochastic. for estimating the option pricing of the european model.here we obtained approximation PDE and affine PDE, we solution this approximation PDE with Alternatig Directio Implicit (ADI) time Discretization scheme then the estimate eropean call and put option under HHW model.

Keywords: HHW model, ADI scheme,T- forward

1 Introduction

we describe the triple Heston-Hull-White (HHW) Model .In section 2 the HHW model is combined Heston model with stochastic volatility and hull-White for a stochastic interest rates process,as described by Grzelak and oosterlee (2009,2011),wich is three factor model.these dynamic are formed by three correlated standard Brownian motions.in this paper we briefly describe how to model PDE HHW with construct a portfolio of assets .By applying Ito's formula on the dynamics of the portfolio we will reach to the PDE HHW. unfortunately ,the HHW model and that's PDE are not affine ,not even apply to the log transform .so in section 3 PDE approximation is obtained by removal of non affine PDE HHW with this change.It has been possible to accept numerical model will be affine.In section 4 we using a ADI scheme to solve PDE and we will get to a solution wich is highly efficient

2 Heston-Hull-White Model

Consider the following system of the stochastic diffrential equation subject to the filtered probability space $(\Omega, \mathcal{F}, \mathbb{Q})$ and finite time $[0, t]$ .the model is defined ,under the risk natural measure $\mathbb{Q}$,the dynamics of these are presented as follow:

$$\begin{cases} dS(t)/S(t) = r(t)dt + \sqrt{v(t)}dW_x^Q(t) & S(0) > 0 \\ dv(t) = \kappa(\bar{v} - v)dt + \gamma\sqrt{v(t)}dW_v^Q(t) & S(0) > 0 \\ dr(t) = \lambda(\theta(t) - r(t))dt + \eta dW_v^Q(t) & S(0) > 0 \end{cases} \tag{1}$$

*Speaker