Public Defence of the Ph.D. in Applied Economics: Business Engineer by Gregory Rayée

The public defence of the Ph.D. in Applied Economics: Business Engineer for Gregory Rayée will take place on Thursday September 13th 2012 at 4pm in the Salle Solvay, Building NO - 5th floor, Campus Plaine, Université Libre de Bruxelles, Bld du Triomphe.

The Ph.D thesis is called "Essays on Pricing Derivatives by taking into account Volatility and Interest Rates Risks."
Promoters: Prof. dr. Steven Vanduffel (VUB) and Prof. dr. Griselda Deelstra (ULB)

Please confirm your attendance by Monday September 5th 2012 to Tom Matthijs

Abstract:
Essays on Pricing Derivatives by taking into account volatility and interest rates risks
In Chapter 1, we present a new approach to evaluate barrier type options based on a method known as the Vanna-Volga method. This new approach allows for a fast and easy calibration which is directly done on the barrier options market. It allows to price these options with a tool in accordance with the barrier options market. We also compare our results with those coming from the Dupire and Heston models. Furthermore, we study the sensitivity of the Vanna-Volga method with respect to the market data. We give a new theoretical justification for the Vanna-Volga method. More precisely, we show that the Vanna-Volga option's price can be seen as a first-order Taylor expansion of the Black-Scholes option price around the at-the-money volatility.
In Chapter 2, we study a model able to capture the market implied volatility effects and which also takes into account the market variability of the interest rates. This relaxes the assumption of constant interest rates present in the Black-Scholes model and solves a second main problem encountered in the latter, which can have large consequences in the valuation and hedging strategies especially for long maturity products. More precisely, we work in the foreign exchange (FX) market, with a local volatility model for the dynamics of the foreign exchange spot rates in which the domestic and foreign interest rates are also assumed stochastic. We derive the expression of the local volatility and various results particularly useful for the calibration of the model. Finally, we derive useful results for the calibration of hybrid volatility models where the volatility of the FX spot rate is a mix of a local volatility and a stochastic volatility and we develop a calibration method for this model.
In Chapter 3, we apply the local volatility model with stochastic interest rates developed in the previous chapter to the pricing of life insurance derivatives. Since the maturity of such options is the retirement age, they can be considered as long maturity products. For the calibration of the local volatility, we use a method developed in Chapter 2. Since we study exotic products, we also compare the prices obtained in different models, namely the local volatility, stochastic volatility and finally the constant volatility model all combined with stochastic interest rates.
Finally, in Chapter 4 we work with Lévy type models for the underlying dynamics. The idea underlying the Lévy model is the use of a more general stochastic process than the standard Brownian motion which allows to be in agreement with the observed market probability distribution at maturity. In a financial crisis period, this model is especially popular since it has the particularity to allow for jumps in the dynamics. In this chapter, we are interested specifically in the evaluation of discretely monitored arithmetic Asian type options whose payoff is based on the discrete arithmetic mean of the underlying during the life of the option. As for many exotic

options, it is not possible to derive an analytical pricing formula even in the simple case of the Black-Scholes model. In this case the only way to price such options is by using numerical methods. In Chapter 4, we develop a method based on Monte-Carlo simulations and we use two types of control variates to improve the convergence. We also develop a method based on a conditioning approach to obtain a lower bound for the Asian option price. The efficiency of this last method outperforms the efficiency of the other methods and the results are relatively close to the Monte-Carlo value of the corresponding Asian.