 VIETNAM NATIONAL UNIVERSITY HCMC

**INTERNATIONAL UNIVERSITY**

**PROPOSAL**

**STUDENT RESEARCH PROJECT 2017**

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| **1. NAME OF RESEARCH PROJECT**  Pricing European barrier options with rebates  **Research area:** Financial mathematics | **2. CODE** |
| **3. RESEARCH PERIOD** 12 months *(maximum 12 months, including project acceptance and contract liquidation)* | |
| **4. PRINCIPAL INVESTIGATOR** *(research group leader)* | |
| Full name: *Ta Thi Phuong Dung* Student ID: MAMAIU13067  School/Department: Mathematics Department – International University, VNU-HCM  Quarter 6, Linh Trung Ward, Thu Duc District, HCMC  Home address: Phan Van Tri apartment, ward 2, district 5, room 207  Cell phone number: 0974174129 Email: ttpdung2303@gmail.com | |
| **5. ACADEMIC ADVISOR** | |
| Academic rank, title, full name: Dr. Le Nhat Tan Staff ID: 0443  School/Department: Mathematics Department – International University, VNU-HCM  Quarter 6, Linh Trung Ward, Thu Duc District, HCMC  Cell phone number: 0888926768 Email: lntan@hcmiu.edu.vn | |
| **6. HOSTING INSTITUTION** | |
| Name of institution: International University, VNU-HCM  Address: Quarter 6, Linh Trung Ward, Thu Duc District, HCMC  Head of institution: Dr. Hồ Nhựt Quang – Position: Vice Rector  Phone number: (028) 3724 4270 Website: http://www.hcmiu.edu.vn | |
| **7. MEMBERS OF RESEARCH PROJECT** *(if any)* | |
| **8. OVERVIEW OF RESEARCH SITUATION IN THE COUNTRY AND ABROAD** | |
| 1. OVERVIEW OF RESEARCH SITUATION IN THE COUNTRY   In Vietnam, derivatives market has just started officially very recently, in August, 2017, with futures contracts on VN30 index. It is a very new investment area for Vietnamese investors. This market is however expected to strongly develop soon and then enhance greatly Vietnamese economy. In fact, trading volume on futures contracts on VN30 index is increasing significantly over last few months, and is expected to increase with an even faster rate.  One important type of financial derivatives products is options. In Vietnam, covered call (a type of call options) will be traded soon, expected in December. Options will bring greater leverage to speculators and bring more risk management tools for hedgers. Options thus have great potential chance in Vietnamese financial markets. Understanding clearly the pricing formulas for these products is very urgent.   1. OVERVIEW OF RESEARCH SITUATION IN ABROAD   In the world, Valuation organizations are favored by countries as World Association of Valuation Organisations (WAVO), Asean Valuer Association (AVA), … with the objective of developing methods and technologies valuation. Specifically, the use of mathematical models for valuing derivative instruments is extremely common. In order to formulate of the European barrier option with rebates, the feasible method is the probability method. Alternatively, the partial differential equations can be used to solve this problem. | |
| **9. GOALS OF RESEARCH PROJECT** | |
| 1. Deriving the formula for European barrier option with rebates  2. Testing real data for normal distribution  3. Applying the approved formula for real data in Vietnam securities market | |
| **10. SUMMARY OF RESEARCH CONTENTS AND IMPLEMENTATION PLAN** | |
| 1. Summary of research contents 2. Introduction   On August 10, 2017, Vietnamese government has opened a derivatives market, with its first product: futures on VN30 index, to attract more capital investment to the economy. The market will introduce more financial derivatives products soon. In particular, option contracts will be operated in Vietnam in this December.  This research formulates a pricing formula to the barrier options. The special features here is that payoffs depend on whether or not the underlying asset price has reached or exceeded some barrier level during the option's life. The barrier options are popular and attractive thanks to benefits that they give investors more flexibility to express their view on the asset price movement in the option contract. There are some advantages of this option. Firstly, the barrier option offers more choices for the investors’ predictions on price of stocks in the future, so it is suitable to beliefs about the future behavior of the market. Secondly, it matches hedging needs more closely that it helps the investor reduce risk because of the fluctuation of prices. Lastly, European barrier call options are usually cheaper than its corresponding standard European call options. It allows investors not to pay a premium to cover scenarios he or she views as unlikely. In addition, European barrier call option with rebates even offers a compensation to option holder in the event that the knock-out condition is triggered. The investors still get back something when the worst event occurs. These advantages make barrier options very appealing to investors.    Up and Out option X<H  Down and Out option X>H   1. Methodology    1. The Black-Scholes-Merton model  * Continuous Random Variables * Normal Random Variables * Lognormal property of stock price * The distribution of the rate of return * Volatility * Risk neutral valuation * The Black-Scholes-Merton pricing formulas   Where  N(x) is the cumulative probability distribution function for a variable with a standard normal distribution  c is the European call price  is the stock price at time zero  K is the strike price  r is the continuously compounded risk-free rate  σ is the stock price volatility  T is the time to maturity of the option.   * 1. The probabilistic approach   We will start with the framework of continuous-time, Brownian Motion driven models, a basic introduction to Stochastic. It also has the Black-Scholes-Merton pricing model.  We may formulate the pricing models of barrier options using the probabilistic approach that includes the martingales pricing approach and derive the corresponding price formulas by computing the expectation of the discounted terminal payoff under the risk neutral measure Q. When the martingale approach is used, we obtain the transition density function using the reflection principle. To compute the expected present value of the rebate payment, we derive the density function of the first passage time to the barrier. The price of the European down-and-out call option with rebates is given by   1. Testing real data for normal distribution   The data is collected from historical data of stock’s price of a company in Vietnam. This data is used for testing whether normal distribution or not and calculating some variables.  The software is using for testing data is R – Studio.   1. Application   Using the final formula to calculate the option price of the underlying asset price of stocks in Vietnam. The stock is applied that must be satisfied given conditions by previous testing.   1. Implementation plan   Plan is divided into 3 periods of time:  - In first 4 months, finding out about the basic concept of the topic, classifying the  Black-Scholes-Merton model  - In 4 months in middle, deriving the final formula by the probabilistic approach and  find real data that suitably for testing normal distribution  - In last 4 months expecting to apply the final formula into Vietnam securities market  and complete the research report | |
| **11. OUTCOMES OF RESEARCH PROJECT** | |
| 1. The formula of European barrier option with rebates  2. Calculate the approved formula for real data in Vietnam securities market | |
| **12. BUDGET** | |
| Total budget: 7,000,000 VND (seven million Vietnamese dong)  Budget narratives:  - From International University: 7,000,000 VND (seven million Vietnamese dong)  - From another source: | |