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by

You Wang

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You Wang, Candidate

ADVISORY COMMITTEE

Zhenyu Cui, Advisor Date

Ionut Florescu, Reader Date

STEVENS INSTITUTE OF TECHNOLOGY
Castle Point on Hudson
Hoboken, NJ 07030
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ABSTRACT

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Author: You Wang

Advisor: Zhenyu Cui

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Degree: Master of Science - Financial Engineering

This thesis is dedicated to all Stevens students. Dedication is optional.

Acknowledgments

The acknowledgements section recognizes anyone that provided significant help in producing your thesis or dissertation. Frequently acknowledged people are your advisor, colleagues, and family. Sometimes companies or outside groups have contributed to the research done for a dissertation, and they can be thanked her as well. The Acknowledgements page is optional.

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Chapter 1

Introduction

Intro to be added

Chapter 2
Method Description

In this section, the origin DOI method, JDOI method and approximation method based on DOI method are introduced. In section 2.1,, we describe the origin DOI method. In section 2.2, we illustrate the approximation method proposed by Kristensen and Mele (2011). In section 2.3, we discuss our estimator to price American options based on JDOI method.

2.1 The DOI Variance Reduction Method

Consider a multi-factor model in which a d-dimensional vector of state variables $X(t)$ on a filtered probability space$(\Omega, \mathcal{F}, \mathbb{Q})$, which satisfies the following Stochastic Differential Equations(SDEs)

$$dX(t) = \mu(t, X(t))dt + \sigma(t, X(t))dW(t) \tag{2.1.1}$$

where $\mu(t, X(t))$ and $\sigma(t, X(t))$ are drift and diffusion functions under the risk-neutral measure $\mathbb{Q}$, which also satisfies appropriate growth and Lipschiz conditions such that equation(2.1.1) admits a unique strong solution and is Markovian; $W(t)$ is a d-dimensional standard Brownian Motion and $t \in [0, T]$.

Besides, we also need to consider the stopping time formulation such that we can apply DOI method to path-dependent options, we shall discuss it later in section 2.3 when pricing American options.

Let $G(t, X(t))$ be the price of derivative written on $X(t)$. Suppose it's sufficiently smooth and current state $X(t) = x$, we define the infinitesimal generator $\mathcal{L}$

associated with equation(2.1.1)to be

$$(\mathcal{L}G)(t, X(t)) = \frac{\partial V}{\partial t} + \sum_{i=1}^{d} \mu(t, x) \frac{\partial V}{\partial x} + \frac{1}{2} \sum_{i,j=1}^{d} \sigma_{ij}^2(t, x) \frac{\partial^2 V}{\partial x_i x_j} \tag{2.1.2}$$

2.2 Approximation Method based on DOI method

2.3 JDOI method

Appendix A

Appendix A Title

Appendices at the end of a dissertation are optional, and depend on the content of the dissertation. There can be one or more appendicies, however they should retain the page numbering requirements for dissertations. Any concerns about the formatting of an appendix should be brought to Doris Oliver, who can direct you how to format your appendix if you have questions.

Theoretical Dissertation Timeline		
Taskt	Time to Finish	Notes
Problem statement	10 hours	Initially very upbeat.
Research	3 days	Literature search to very previous studies.
Reformulation	4 hours	Presented and accepted by advisor
Research	20 days	Literature search to very previous studies.
Experiments	14 days	Do some experiments and get results.
Format	1 day	Understand format guidelines for paper.
Write	years	Write the paper.
Revise	not too long	Proof read, etc.
Format	1-3 days	Verify correct report format is used.
See Library	1 hour	Meet with Doris to verify formatting.
Defend	1 day	Defend your research.
Revise	0 hours	It was perfect the first time.
Submit	1 day	Submit final dissertation to the library.

Bibliography

Kristensen, D. and A. Mele (2011, November). Adding and subtracting Black-Scholes: A new approach to approximating derivative prices in continuous-time models. *Journal of Financial Economics 102*(2), 390–415.