A Relative Research of the Vasicek and the CIR Model

Christoforou, Nektaria

Business Administration Programm, School of Economic Sciences and Business, Neapolis University Pafos

http://hdl.handle.net/11728/10825

Downloaded from HEPHAESTUS Repository, Neapolis University institutional repository
A Relative Research of the Vasicek and the CIR Model

By
CHRISTOFOROU NEKTARIA
Master in Banking, Investment and Finance
Neapolis University Pafos
Pafos, Cyprus
2017

Submitted to the Faculty of School of Economics and Business
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE

Supervisor: Professor Kostas Giannopoulos
Statement of Authorship
I thereby anoint that I have authored this master thesis independently and without use
of others than the indicated resources. All texts, which are exactly or in generally
article taken out of publications or other resources, are marked as such.

Nektaria Christoforou

Limassol, 1/2/2018
Dedicated to my children Andriana and Nikolas.
Thanks to
This thesis held in Neapolis University Paphos and specifically in The School of Business specializing in the Master Program of Banking, Investment and Finance.

Overseeing the work was Professor and Head Masters in Banking and Finance, University of Neapolis Kostas Giannopoulos. I would like to express my sincere thanks for the very good cooperation we have had, trust, patience and guidance in the individual stages of work.

Finally, I would like to thank my family, notably my parents who are always by my side and with their support give me the opportunity to attend the above postgraduate studies, despite the stresses and anxiety of the times.
Table of Contents

Statement of Authorship ........................................................................................................ 2
Dedicated .................................................................................................................................. 3
Thanks to ................................................................................................................................... 4
Executive summary .................................................................................................................... 7
CHAPTER 1 ................................................................................................................................ 8
  1.1 Introduction ......................................................................................................................... 8
  1.2 Theories about the term structure of interest rates: ......................................................... 13
    1.2.1 Expectations theory ...................................................................................................... 13
    1.2.2 Segmented markets theory ........................................................................................ 15
    1.2.3 Liquidity premium theory .......................................................................................... 16
  1.3 Term structure of interest rates .......................................................................................... 18
    1.3.1 Yield curve ................................................................................................................ 19
  1.4 Bibliography ..................................................................................................................... 21

Chapter 2 .................................................................................................................................. 38
  2.1 Introduction ......................................................................................................................... 38
  2.2 Interest rate models ............................................................................................................ 39
  2.3 Compare the term structure of interest rate models.......................................................... 41
  2.3 Table: Description of models and parameter limitations .................................................. 44
  2.4 Single-factor interest rate models ...................................................................................... 45
  2.5 One factor time-invariant models ..................................................................................... 46
    2.5.1 The Merton’s model (1973) ..................................................................................... 46
    2.5.2 Vasicek’s model (1977) .......................................................................................... 47
    2.5.3 The Cox-Ingersoll-Ross’s model (1985) .................................................................... 48

CHAPTER 3 .................................................................................................................................. 49
  3.1 Empirical applications and results ..................................................................................... 49
    3.1.1 Empirical analysis ...................................................................................................... 50
    Table 1: Bond prices for Vasicek model .............................................................................. 54
    Table 2: Bond prices for CIR model .................................................................................. 54
    Table 3: Vasicek yield curve .............................................................................................. 56
    Figure 1: Vasicek yield curve ............................................................................................. 56
    Table 4: CIR yield curve ..................................................................................................... 56
    Figure 2: CIR yield curve ..................................................................................................... 57
    Figure 3: Vasicek yield curve vs CIR yield curve vs Observed yield curve ..................... 57
Table 5: Vasicek relationship ................................................................. 58
Table 6: CIR relationship ..................................................................... 60
4. Conclusions ...................................................................................... 64
5. Bibliography: .................................................................................... 66
BIOGRAPHY ......................................................................................... 73
Executive summary
Recent years have seen the development of theoretical models of the structure of interest rate models. The modeling and forecasting of interest rates is an especially prime and challenging. It is one of the most prime indicators for pricing potential claims, identifying capital costs and managing financial risk. As an effect, extensive research has been developed in this area.

The purpose of this thesis of the term structure of interest rates is to analyze and present the relationships between them. The last fifty years, financial economists have turned their interest especially in this field of research which is particularly important for the conduct of monetary policy.

In the first chapter of the survey we are investigating the structure of interest rates theoretically. In particular, general introductory elements of the interest rate structure are presented, basic definitions are provided, and the maturity theories accompanying these correlations are presented. At the same time, a detailed bibliographic review is made on the structure of interest rates and on their evolution and a brief review of the models to be followed.

In the second chapter I start with a brief description of the interest rate models. Then I compare the models to each other, quote how their differential equations come out, I present the single factor interest rate models in detail for these models.

In the third chapter of the research using the models of Vasicek and Cox- Ingersoll - Ross examined the empirical application whether specific rates covariate with the passage of time in the secondary market of US money. Also compare the two methods together.