CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

METHODS TO SOLVE ASSET BUBBLE IN FINANCE

A thesis submitted in partial fulfillment of the requirements
For the degree of Master of Science in
Applied Mathematics

by

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Dedication

Jas' dedication

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Table of Contents

ABSTRACT

METHODS TO SOLVE ASSET BUBBLE IN FINANCE

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Financial Market is very attracting topic in finance and mathematics world. Recently we have heard lot about Gold Prices inflations. It is the the hot topic in today's finance market. So how will be combine mathematics with today's asset changes? How can we determine the tale of asset's volatility for future? These are the questions which we will consider in this thesis. We will study non parametric estimator Floren Zmirou in local real time on compact domain with stochastic differential equation which has unknown drift and diffusion coeificents. Once we will have volatility from floren zmirou then we will able to use RKHS to estimates function which will extrapolate the tale of function.

0.0.1 Outline

As for the outline, i think you should have four chapters:

(1) Introduction:
(1.1) What problem are you trying to solve? Why is it important? What is your goal?
(1.2) Challenges
(1.3) Summary of how youÕve addressed those challenges, what have you found/built?
(1.4) Overview of following chapters

(2) Theoretical Background Ñ The Math:
(2.1) Where does your problem come from? (youÕll have to talk about stochastic PDEs, volatility, assets price modeling, martingales, etc.)
(2.2) Describe the math problem: parametric estimation, interpolation, extrapolation, minimization
(2.3) What is your solution? Based on all this theory connecting math and finance and assets and asset bubbles, how can you get an answer to your (math) problem as you described in chapter (1).

(3) Algorithm and Implementation Ñ The Software Tool:
Ñ We can discuss later, but you may want to consider different format options: do you want to have a section for each sub problem (acquiring data, fitting data, extrapolation, etc.) or you may want to group some of those and have a separate section talking about software tools that you have downloaded/modified, and tools you have developed
Ñ Also a section describing the Algorithm step by step.

(4) Numerical Examples Ñ Once your code works, run some experiments on real data, some that you know the answer, some that you donÕt know

You may want to have a final chapter with conclusions. future work, etc

0.1 Introduction

Chapter 1

Today's economy, financial asset bubbles are exciting and hot topic. In most recent market news, we have read or seen big changes in Gold prices. Everyone is interested to know what will happen in the future. How we can able to detect or estimate the future changes of any asset (stock, gold, housing, commodity)? How quickly asset price will jump? These are the question which we will consider in this study. We will study how to determine whether any asset is experiencing a price bubble in real time. How we will detect asset bubbles in real time?

Our problem will be deciding if an asset price is experiencing a price bubble in finite and infinite time period.

We will able to determine the volatility of asset price.Using some helpful techniques to determine asset bubble in real time will help finanial corporations, banks,and money marrkets.
They can lower their money damaging risks by using our methodology. According to " There is a bubble" paper paragraph 2, "indeed 2009 the federal reserve chairman Ben bernanke said in congress testimony[1]
"It is extraordinary difficult in real time to know if an asset price is appropriate or not".

Our goal is to estimate stock price volatility by Floren Zmirou estimator and then we will extrapolate the volatility tale in order to check the integral. wheather the integral is finite or infinite. The process for bubble detection depends on a mathematical analysis that determines when an asset is undergoing speculative pricing
i.e its market price is greater than its fundamental price. The difference between market and fundamential price, is a price bubble

As stated above, we will use a nonparametric estimator Floren -Zmirou which is based on local time of the diffusion process. The biggest challenge we have forced that using non parametric estimator, we can only estimate $\sigma(x)$ volatility function on the points which are visisted by the process. Only finite number of data points are used which is a compact subset of R+.Therefore we can not able to estimate the tail of the volatility. But by determining the tail of volatility, we can see if the integral if finite or infinite. We don't know the asympotice behavior of the volatility.In order to check the tail of the volatility, we need to use extrapolation method.

After estimation of volatility function $\sigma(x)$, we will interpolate the function using cubic splines and Reproducing Kernal Hilbert Spaces. . Once we have interpolated function then we will focus on extending the function to infinity which is our extrapolation method. Using Reproducing Kernal Hilbert Spaces combined with optimization we can get best possible extension of the interpolation function.

Our work is orginized as follow: in chapter 2 we present an overview of previos work, background of the problem, how the problem is connected to finance and mathematics, the methods to solve the problem, and our best possible solution to the problem. In chapter 3 we will discuss the details of our algorithm and it's implementation and in chapter 4 we present several numberical examples, conclusion and future work.