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

Acknowledgements

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ABSTRACT

METHODS TO SOLVE ASSET BUBBLE IN FINANCE

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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. We will obtain volatility funtion then we will interpolate with cubic spline to see the behavior of the function.

Chapter 1

Numerical Solution, Conclusion and Future Work

Since we have done lot of good work, now it is the time to check the implementation. We will provide examples which will give better understanding for our problem. Numberical Solutions using implementation

1.1 Examples

1.1.1 EXAMPLE 1

- Ticker: **MWI Veterinary Supply Inc**
- D : 05/16/2014
- T : 60 seconds

Stock Class
We are using NASD. We download information from following website. Figure 1.1 shows stock prices vs. time in seconds.

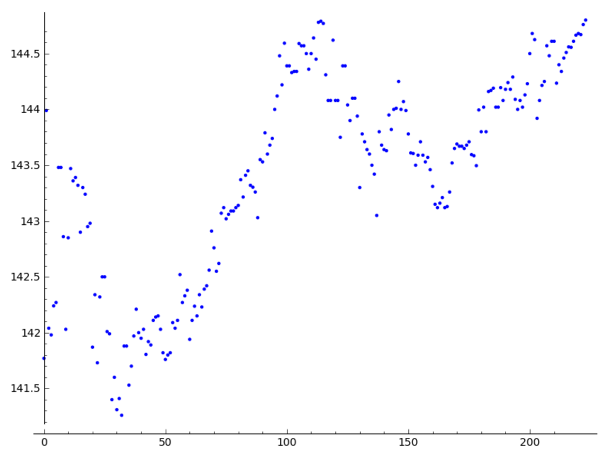


Figure 1.1: Stock Prices vs. Time

Now we have stock prices for MWI Veterinary. We will use Floren Zmirou estimator to see the volatility of stock prices.

Floren Zmirou Class

$$S_n(x) = \frac{\Sigma_{i=1}^{n} 1_{\{|S_{t_i} - x| < h_n\}} n (S_{t_i+1} - S_{t_i})^2}{\Sigma_{i=1}^{n} 1_{\{|S_{t_i} - x| < h_n\}}} \tag{1.1}$$

Usable Grid Points	Estimated Sigma Zmirou	Number of Points
141.842890874	1897.69862662	50
144.17445437	290.806107556	108
143.008672622	464.127160557	60

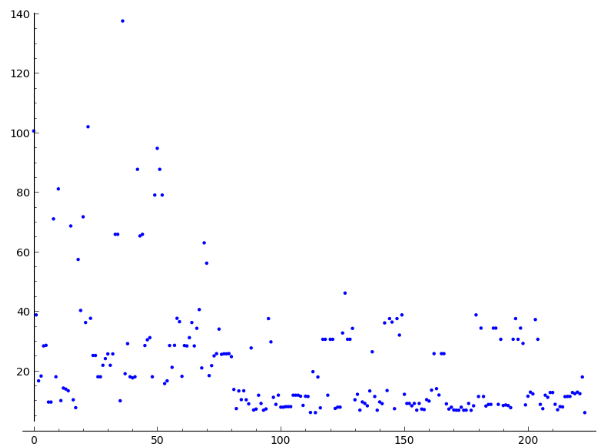


Figure 1.2: Stock Prices vs.Floren Zmirou Standard Deviation Estimation

Figure 1.2 shows volatility vs. stock prices. There are Floren Zmirou's estimated sigma values for usable grid points and number of points in each usable grid point. Next we used Cubic spline to connect Floren Zmirou's sigma points.

Cublic Spline

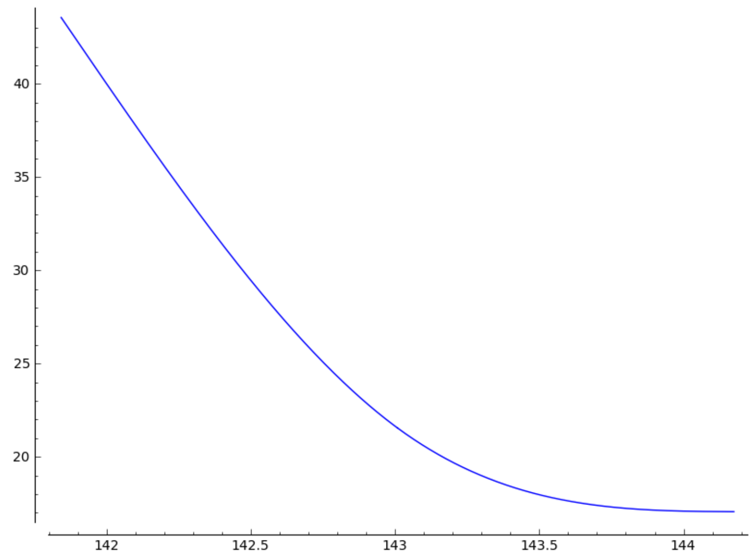


Figure 1.3: Floren Zmirou Standard Deviation Estimation vs. Variance Cubic Spline

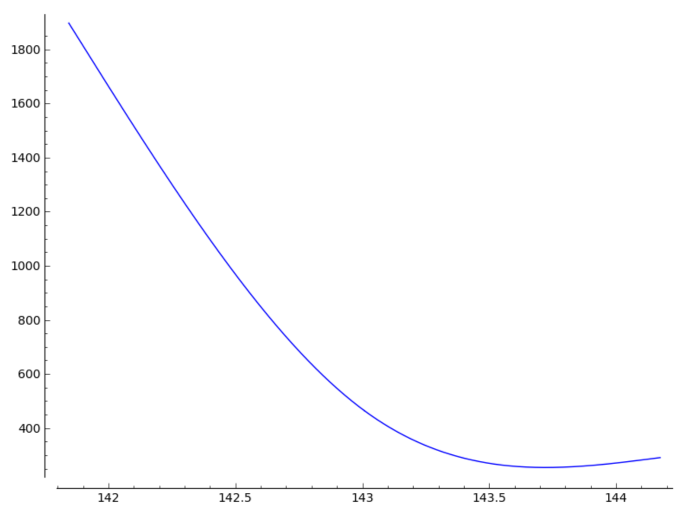


Figure 1.4: Floren Zmirou Standard Deviation Estimation vs.Standard Deviation Cubic Spline

In above example,

1.1.2 EXAMPLE 2

- Ticker: **GOOGLE Inc.**
- D : 05/16/2014
- T : 60 seconds

Stock Class:

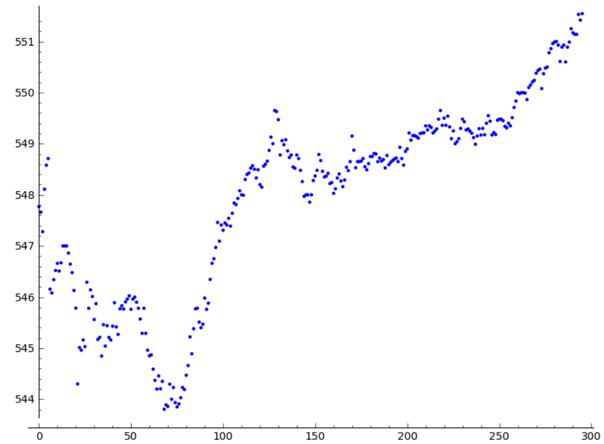


Figure 1.5: Stock Prices vs. Time

Floren Zmirou Class

Usable Grid Points	Estimated Sigma Zmirou	Number of Points
547.289611925	267.623605573	64
549.612686541	517.868135963	143
551.935761158	76.0733825073	17
544.966537308	1890.46832	72

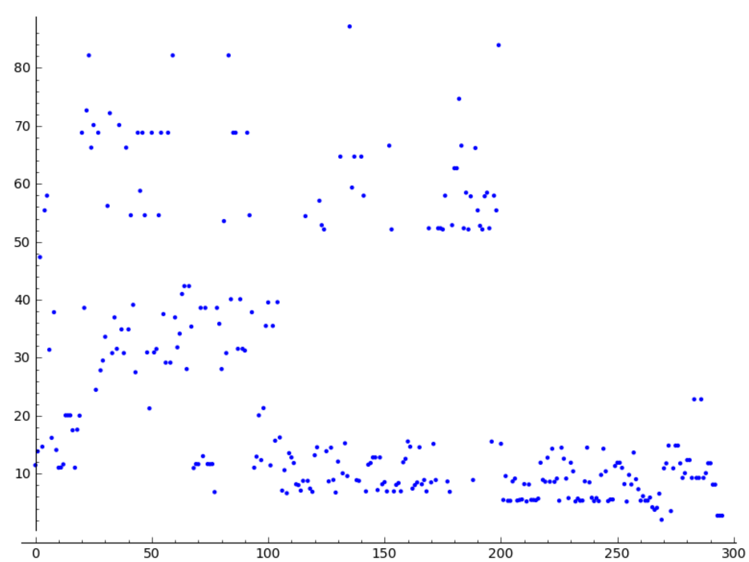


Figure 1.6: Floren Zmirou Standard Deviation Estimation vs. Stock Prices

Cublic Spline

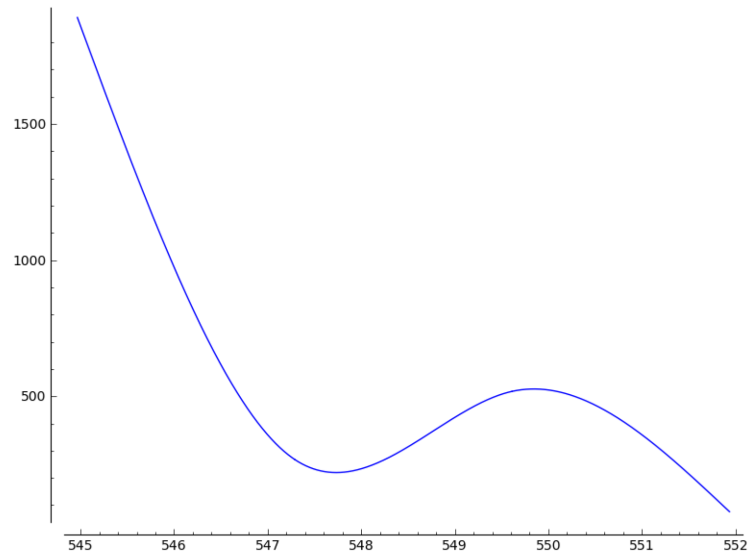


Figure 1.7: Floren Zmirou Standard Deviation Estimation vs. Variance Cubic Spline

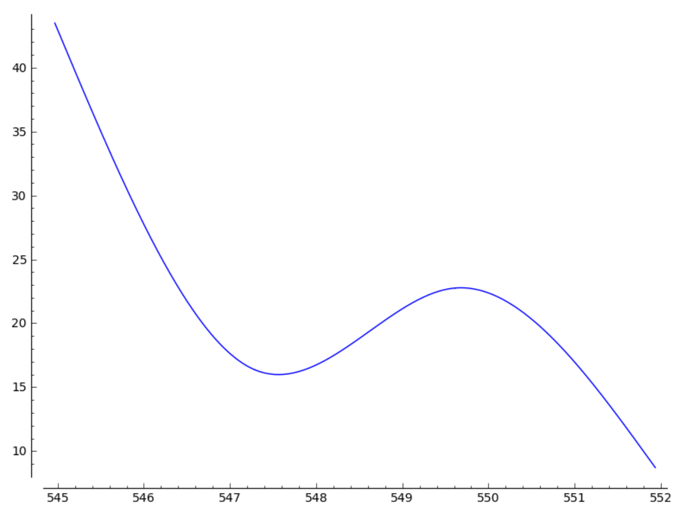


Figure 1.8: Floren Zmirou Standard Deviation Estimation vs.Standard Deviation Cubic Spline

In above example,

1.1.3 EXAMPLE 3

- Ticker: **APPLE Inc.**
- D : 05/21/2014
- T : 60 seconds

Stock Class

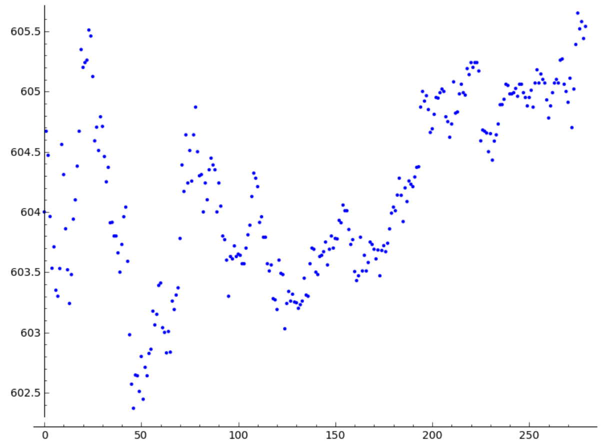


Figure 1.9: Stock Prices vs. Time

Floren Zmirou Estimation

$$S_n(x) = \frac{\Sigma_{i=1}^{n} 1_{\{|S_{t_i}-x|<h_n\}} n(S_{t_i+1} - S_{t_i})^2}{\Sigma_{i=1}^{n} 1_{\{|S_{t_i}-x|<h_n\}}} \tag{1.2}$$

Usable Grid Points	Estimated Sigma Zmirou	Number of Points
602.871457276	138.351149247	42
603.874371827	245.251175157	125
604.877286378	102.97102087	104

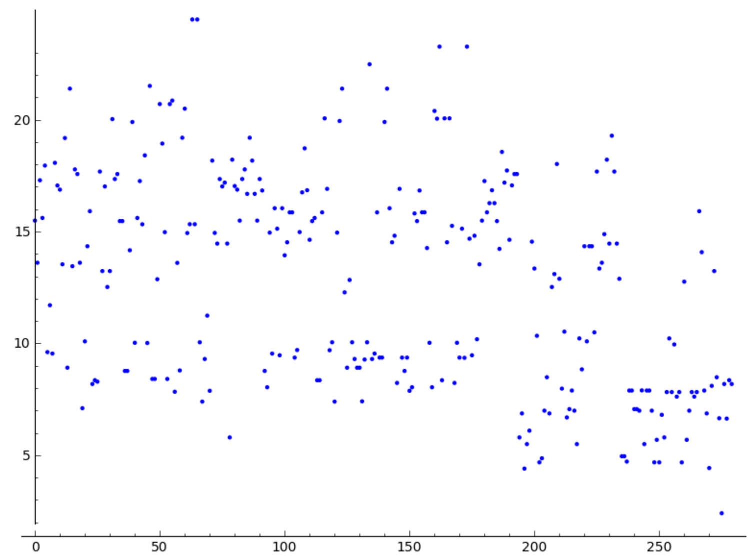
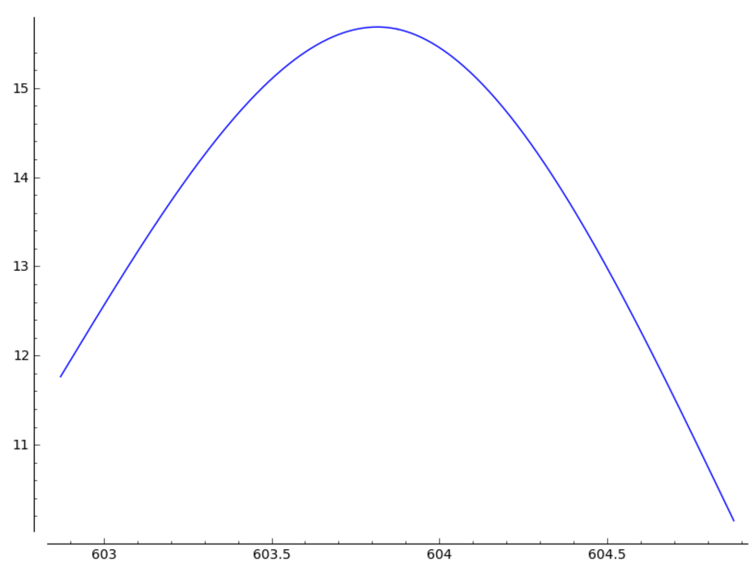
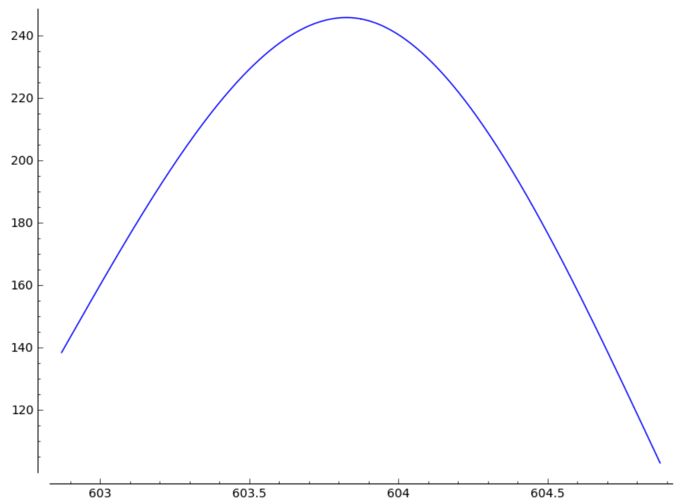


Figure 1.10: Floren Zmirou Standard Deviation Estimation vs. Stock Prices

Cublic Spline



Floren Zmirou Standard Deviation Estimation vs. Variance Cubic Spline



Floren Zmirou Standard Deviation Estimation vs.Standard Deviation Cubic Spline
In above example,

1.1.4 EXAMPLE 4

- Ticker: **GROUPON Inc.**
- D : 05/21/2014
- T : 60 seconds

Stock Class

Figure 1.11: Stock Prices vs. Time

Floren Zmirou Estimation

$$S_n(x) = \frac{\Sigma_{i=1}^{n} 1_{\{|S_{t_i}-x|<h_n\}} n(S_{t_i+1} - S_{t_i})^2}{\Sigma_{i=1}^{n} 1_{\{|S_{t_i}-x|<h_n\}}} \tag{1.3}$$

Usable Grid Points	Estimated Sigma Zmirou	Number of Points
6.01159662403	0.0106001479673	25
6.0947898721	0.00331796023881	38
6.17798312017	0.000229293586847	155
6.26117636824	7.51642424675e-05	86

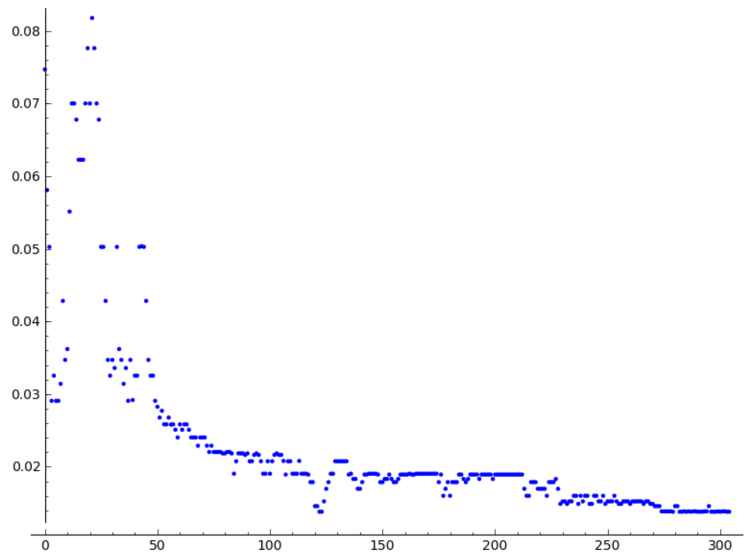


Figure 1.12: Floren Zmirou Standard Deviation Estimation vs. Stock Prices

Cublic Spline

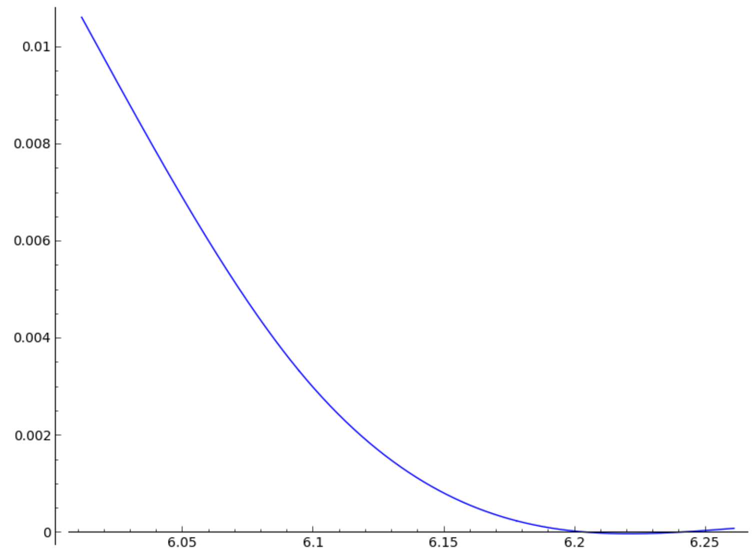


Figure 1.13: Floren Zmirou Standard Deviation Estimation vs. Variance Cubic Spline

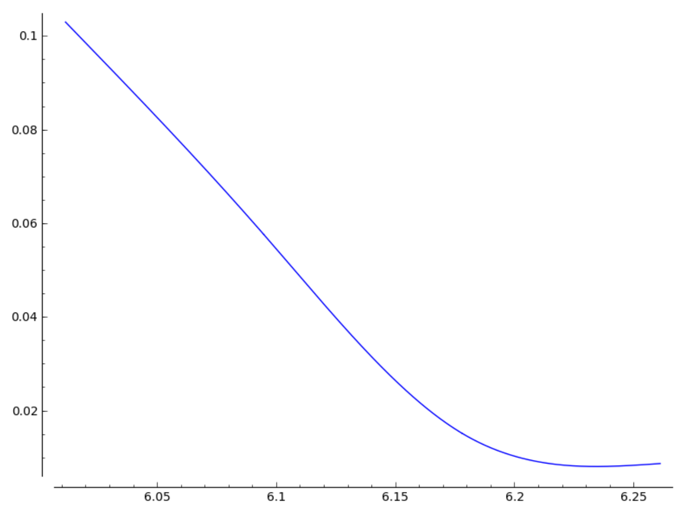


Figure 1.14: Floren Zmirou Standard Deviation Estimation vs.Standard Deviation Cubic Spline

1.2 Future Work

- Still need to know tail of the volatility function.
- Need to extrapolate the volatility with either Comparison Theorem Method or Reproducing Kernal Hilbert Spaces.
- Need to know themorem 0.1.12 equation(3)

$$\int_{\alpha}^{\infty} \frac{x}{\sigma^2(x)} dx < \infty \tag{1.4}$$

  for all $\alpha > 0$ is finite or infinite.

- Determine from intergral if there is bubble or not.