

Internship Research Subject 2009-2010

Arbitrage of Futures on Volatility

Tuan Nguyen
Arbitragis Trading, Paris, France

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Abstract

A new asset class within the world of financial derivatives has recently emerged a decade ago: volatility itself [1] and futures on volatility[2]. Pricing such esoteric instruments requires a knowledge of the kurtosis of the distribution curve, which is a difficult information to obtain. It also requires the advent of models which take into account jumps in the distribution of asset prices such as variance-gamma or Heston models.

We propose an internship research subject that aims at understanding the behaviour of futures on volatility and the implementation of arbitrage strategies based on algorithms and trading robots that will make transactions in the market. The robots are going to be built in-house, leveraging on a lot of tools that we have developed. Among the different mathematics subjects that will be handled : volatility of volatility, skewness, gamma hedging, real-time pricing, log contracts.

Keywords: derivatives pricing, futures on volatility, log contracts, skewness, Heston model, stochastic volatility, kurtosis, Monte Carlo simulation, jump diffusion process, variance swaps.

1 Research Steps

The preliminary research will require an in-depth study of the dynamics of volatility and the understanding of the way the VIX index (the index on volatility) is computed. Talks with staff from the CBOE in Chicago (Chicago Board of Options Exchange) will be a must.

Then, first pricing models will be run with Monte Carlo and C++. The trading robot will also be built at the same time. A research will be done to see which pricing model would be the most suitable for our purposes.

Eventually, calibration with real market data will be done.

If the study is successful, a final step would be to find relevant trading strategies that exploit potential market inefficiencies.

2 Tools Given by Arbitragis

Selected students will need to be extremely proficient in C++ and for Monte Carlo simulations. A computing power similar to the computing power as Meteo France will be provided to students. They will benefit from our internal tools that will help them generate tangible results quickly. Market data across european and US markets will be readily available for number crunching.

3 What you will gain from this experience

You will gain a massive expertise in C++ and in quantitative finance that will be useful for your career as future Traders or Quants. Your knowledge and understanding of derivatives will be extremely high.

We will help you study and develop calibration methodologies in order to try and design real-life trading strategies. You will benefit from a very competent staff which will help you if you need and which will help you so that you spend as much time as possible doing research rather than be stuck in pure IT issues.

Eventually, you will benefit from our trading methodologies, know-how, and vision. You will benefit from the expertise of a competent and available staff that will help you whenever you need. Our development methodologies based on agile programming and our expertise in financial markets will allow you to create trading robots within an extremely short period of time. We also teach computational finance in Ecole Centrale Paris, and you will also take advantage of our research and vision.

4 Example of previous work with ECP academics and students

Arbitragis has already cooperated with ECP on numerous subjects related to computational finance and derivatives pricing. Here is a non-exhaustive list:

4.0.1 Teaching of *Computational Finance with Graphics Processing Units*, Applied Mathematics class, January 2009 with Ioane Muni Toke

Click here for the schedule and the agenda.

4.0.2 Study of Earthquake Predictions Applied to Financial Crashes. Michael Martos, ECP 2008

4.0.3 Lookback Options Pricing and Trend Following Strategies. Francois Bouscarle & Fabien Charbonnel, ECP 2008

4.0.4 Levy Laws used in Derivatives Pricing, Geoffrey Gascq, ECP 2008

4.0.5 Massively Parallel Quasi Monte Carlo, Grégoire Jauvion, ECP 2009

4.0.6 Visualization of High Frequency Market Data, Raphael Megzari & Hugo Delaborde, ECP 2010

5 How to apply ?

Please send a resume in PDF form to stages@arbitragis.com. This document can also be found on <http://www.arbitragis-research.com>.

6 Who should apply ?

Students from Polytechnique, Telecom Paris, Mines de Paris, and Centrale Paris. DEA from P6 and P7 are also admitted only if they graduated from one of the previous schools.

7 Internship dates

Dates are flexible, starting from February 2010 or later, for a length of 4 to 6 months.

References

- [1] Demeterfi, Derman, Kamal, Zou, 1999, More Than You Ever Wanted To Know About Volatility Swaps
Goldman Sachs Equity Derivatives Research, 1999

[2] Chicago Board of Options Exchange
<http://www.cboe.com/VIX/>

[3] Peter Carr: Realised volatility and variance: options via swaps
Risk.net.