

# Internship Subject 2009-2010

## High-Frequency Trading: Microstructure theory and towards a better Description of the Price Process

Arbitragis Trading, Paris, France

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### Abstract

A new field in quantitative finance is emerging : high-frequency trading. This area of derivatives trading is very different from traditional trading (say volatility trading or convertible arbitrage) because of the massive amount of data that needs to be processed and because of a relative lack of academic work that has been done on the subject. There are two big issues that modern finance has not managed to solve yet:

-a real relevant description of the creation process of a price through microstructure theory. Currently, some models only work with zero-intelligence agents, and the resulting price process only mimicks a "real" price without really explaining it.

-the incorporation of a future expectation of the spot price embedded in a microstructure formation process of the price.

At this microscopic level of the price formation process, new analytical tools must be brought in because of issues such as *stochastic time* or the *bid-ask bounce*. A massive amount of computing power can be brought in to help solve problems, and a creative approach must be brought in because algorithms must be parallelized to run on *vector processors* or *parallel cores*. We propose a challenging internship research subject that aims at understanding how to handle microstructure noise.

*Keywords:* microstructure noise, stochastic time, tick data, high-frequency finance, jump diffusion process.

## 1 Who are we ?

*Arbitragis Trading* is a leader in quantitative trading. We build our own models and softwares in order to trade financial markets with a highly quantitative bias. Most of our trading is done by our computers that trade the markets without human intervention. Trading is done with our own capital, which allows us to be extremely creative in the Research and Development process.

We also like to maintain a close relationship with the academic world : we also teach computational finance at Ecole Centrale Paris [Click here for the schedule and the agenda.](#), and you will also take advantage of our research and vision.

## 2 Internship subject

You will try and understand how microstructure noise can be analyzed with stochastic calculus. Inspiration may come from the thesis report from Farmer & al. [1]. Even though some of our R&D

subjects are on par with PhD thesis, reaching tangible results can be done in 1/8th of the time thanks our internal methodologies and our mastering of computation power.

### **3 Research Steps**

You will do a thorough documentary research relying partly on our internal scientific library and on academic papers. A calibration of relevant models that you will implement and create will be done in order to try and measure the impact of microstructure noise.

### **4 Tools Given by Arbitragis**

Selected students will need to be proficient in Matlab or R and be very proficient in C++ before coming. You will have access to a tremendous database of data that will allow to lead a research subject and hopefully get innovative results.

### **5 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 developers of high-level financial applications. Your knowledge and understanding of derivatives will be extremely high. You will benefit from a very competent staff which will help you if you need so that you spend as little time possible.

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 develop a superb application within an extremely short period of time.

Our alumni work in trading rooms at JP Morgan, SocGen, Citibank or BNP. Some continue their studies at El Karoui's DEA or Harvard. [Click here for testimonies of our alumni.](#)

### **6 How to apply ?**

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

### **7 Who should apply ?**

Students from ENS Ulm, Polytechnique, Centrale Paris, Ecole des Ponts, Mines de Paris, Telecom Paris. Students from DEA of P6 and P7 may only apply if they graduated from one of the previous schools.

### **8 Internship dates**

Dates are flexible starting from January 2009 or later, for 6 months at least.

### **References**

- [1] A close look at market microstructure *Quantitative Finance*, Vol 3, No 2  
Marcus G. Daniels, J. Doyne Farmer, L. Gillemot  
*Quantitative Finance*, Vol 3, No 2.