

Me and My Machine: The Automated Trader Interview



Larry Levy

Stephane Coquillard is a relative newcomer to live trading with a long background in exotic option trading and risk management. He algo-trades G5 Forex currencies for Toronto Dominion Bank Securities (TD Securities), using a market-model concept and artificial intelligence techniques. In this time of heightened anxiety about market and wider risk, not to mention regulation, how does Stephane Coquillard navigate the complexities of the currency markets, and what technology does he use to do it? Larry Levy, Automated Trader's globetrotting Head of Photography, went to meet him at TD Securities' very new London headquarters, at Number Sixty Threadneedle Street, to find out.



Larry Levy: Would you tell us a little about your background, Stephane?

Stephane Coquillard: My family originates from the Charentes, where it was based for generations - much of that time in the Cognac business. Until the age of seven we lived in the Loire valley. When I was aged seven, the family moved to Damascus in Syria. We stayed there a little over four years and I have fantastic memories of this time. Actually, my father worked for Alcatel.

We came back to France and settled in Versailles for a couple years before moving this time to Tunis, where we stayed another four years. Aged 17, I came back to Paris in order to prepare for my Baccalaureate. In 1992 I entered the ESSEC Business School (École Supérieure des Sciences Économiques et Commerciales) - a renowned Paris based Grande École with a strong focus in economic sciences. Simultaneously, I became a member of the French Institute of Actuaries after qualifying at the Institute of Statistics Pierre and Marie Curie. A few years later, I completed my curriculum with a Masters of Sciences in Computational Finance from Carnegie Mellon in Pittsburgh.

Larry Levy: When did you become interested, first, in computers, and secondly, in financial markets?

Stephane Coquillard: In Tunis, I remember very clearly my dad returning one day from a business trip with a brand new Apple II C, which at the time was really the ultimate in home computing. I spent countless hours on it and really became addicted to machines in this way.

My interest in finance was gradual though. I specialised more and more in mathematical topics. During the course of my studies, I discovered the field of applied financial mathematics and in particular the stochastic calculus used in the valuation of derivatives products. From this point, I became passionate about all aspects relating to derivatives pricing and risk management and it became clear to me that I wanted to make it my profession.

Larry Levy: Tell us briefly about your history in the markets please?

Stephane Coquillard: I first started in 1996 at Aurel Leven, a French investment company, where I wrote my actuarial thesis on the valuation of convertible bonds using hybrid models.

Then I started trading at Banque CPR where I was responsible for market-making and risk-managing convertible bonds and exotic equity derivatives for a couple years. However in '99 I moved to London and held senior positions in market risk management, firstly at Dresdner Kleinwort Wasserstein, heading the team dedicated to FX, emerging markets, commodities and short rates trading. Subsequently in 2005 I moved to Barclays Capital where I was in charge of overseeing the rates and inflation derivatives business with a strong focus on their most exotic and longer term risk. Later, in 2006, I joined Calyon and came back to trading in charge of running the FX exotic options and complex products business which was flourishing in those pre-credit crunch days. Today, I work at TD securities, where I have been since late 2008.

Larry Levy: How did your six years at Dresdner Kleinwort Wasserstein in the risk-management role alter your trading perspective?

Stephane Coquillard: On the surface the job descriptions of market risk manager and trader are very distinct. In practice however, I found that the skills required to perform a decent job in both positions were more similar than different. A trader is in essence a risk manager who needs to constantly optimise his risk return on a daily basis whilst keeping an eye on the bigger picture and monitor the tail events which might impact his aggregated risk exposure.

Similarly, a risk manager, to be able to communicate with the business on an equal footing, must understand in great detail the products traded, the risk factors, dynamics and the P&L drivers, as traders do.

Larry Levy: What made you want to become a "quant" trader? Was there a sudden moment?

Stephane Coquillard: Well, I had this desire for quite a while without finding time or opportunity to really get started. With the credit crunch, the landscape of the FX derivatives market drastically changed almost overnight.

Gone were the large volumes in snowballing ratchets, tarns and other quanto spread options allowing for high leverages and large upfront premium payments



hitting the balance sheet on Day One. Complex options can be very illiquid, highly credit risk intensive, not always easily understood or used appropriately and subject to vast modelling assumptions for their fair valuation. These products, in which I was specialising, fell into disgrace in the aftermath of the Lehman crisis. The market deleveraged quickly to come back to simpler, more linear types of exotic derivatives. For example, to illustrate this, transacted (i.e. listed) vanilla FX options volumes on the CME surged exponentially post Lehman.

While I am currently facing a great challenge in my new position at TD Securities, mandated to deploy a range of FX derivatives products appropriate to support our franchise growth, I also thought that it was a good time to add another string to my bow and decided to go down the automated trading route - with the funding and support of management.

Larry Levy: Before making the move to algo trading you specialised in exotic options. How and why did you change from one to the other? Are they related?

Stephane Coquillaud: The current framework used for the valuation of financial derivatives is in most cases driven by underlying Markovian assumptions that the market is memory-less. In other terms that the past history of market prices cannot be used to predict the future price action.

However, this is exactly what one attempts to do when designing alpha trading algorithms. So in this respect it is quite different indeed! Such basic assumptions used for exotic options trading are simply challenged by the existence of working alpha trading algorithms. In practice however, exposure to exotic option pricing and risk management can provide one with



a large toolkit of concepts which can be reused for algo design purposes. Generations of quants have introduced enhanced stochastic processes in their valuation models, attempting to better reflect the actual observed market dynamics. A great deal of this literature can be recycled as a valuable source of inspiration when designing alpha trading models.

Larry Levy: Since you are not a fund, how do you quantify your risk reward in terms of relative returns?

Stephane Coquillaud: Pure trading performance is evaluated in a classic fashion by looking at the revenue generated in comparison to the risk generated. In

other terms, Sharpe ratio and similar metrics are being used. We will look also into tail event risk by stress testing the market action as well as systemic risk of drawdowns due to prolonged adverse market regimes. To give you an example, one indicator I am using quite extensively for instance is the Stirling Ratio, which looks at the return over the drawdown. I am also using my own variations around this theme. As a business however, the perception of the risk reward goes beyond the quality of earnings and pure P&L considerations. TD Securities is a highly entrepreneurial environment and keeping the cost base under control, making steady and consistent improvements on the R&D and infrastructure side as well as designing the platform in such a way that it can then be leveraged by other areas in the bank are equally important factors which I attempt to optimise. For instance, I am currently looking at automatising the gamma trading of the options group, and developing a specific algorithm for this purpose.

Larry Levy: Tell me about the technology, the “machine” itself.

Stephane Coquillaud: I am running Deltix - an out of house package. It is written in a combination of C# and Java. Deltix runs under the MS.NET framework on Windows 64 bit. The data is processed by Deltix’s own proprietary event-oriented polymorphic database engine. I am running two servers with two quad core Xeon processors with a 3 GHz speed and 8 GB of RAM on each one. One is dedicated to live trading and the other to research and development as well as live data recording. In addition, we are currently deploying a cluster of multiple computing nodes each equipped with six dual core AMD Opteron processors and 32GB of RAM in order to distribute the calculations and therefore speed up our backtesting as this has become a bottleneck in the last few months. To give you an idea, with the new set up, I expect to be able to run 500 strategies each on 10 currency pairs, over 10 years of 1 minutes bar data just under a minute!

Larry Levy: What attracts you to Deltix as opposed to other packages available in the market to test and trade your ideas?

Stephane Coquillaud: I made a reasonably thorough analysis of the software vendor market before making up my mind. I found that the better known mainstream retail software was basically not flexible and open enough to allow me to fully implement my modelling ideas.



At the other end of the spectrum, the most advanced professional business event driven processing platforms were not only too expensive up front, but also their toolkit design would have required a major investment in internal resources.

In other words, one was good enough for general use but just not capable enough, and the other was too expensive and unwieldy to prove practical.

The Deltix package made a lot of sense in my particular situation. It’s of a very high professional standard both in terms of its data processing capabilities and in terms of stability. It has proved quick to deploy and supports the entire life cycle of “research-deploy-manage” and in particular providing very precise and advanced backtesting functionality. In addition, the Deltix business model is attractive to the extent that they allow you to outsource all the coding and IT development effort to their support team. With about 45 engineers MSc and PhD level in this team this represents a lot of intellectual horsepower!

Larry Levy: Can you please tell us about your approach to alpha driven models?

Stephane Coquillaud: I started my research with a top down approach, trying to fit explicitly high level deterministic rules to capture the market dynamics and specific patterns in the data, be it trend following, mean reversion, breakout, pivot points and other technical patterns. This did not yield the results I was expecting, both in terms of relative risk return in sample but also, and more importantly, in terms of robustness in the out of sample performance. I also couldn’t help thinking that I was probably a bit naive to believe that my ex abrupto perception of the price action, necessarily oversimplifying, could lead me to



discover longer term deterministic rules. I needed something more generic and more powerful to have a chance to come up with stable and robust alpha driven models in a reasonable amount of time.

I decided to reverse the problem and started to try a more empirical bottom up approach instead. I spent 12 months building a genetic programming framework allowing me to generate a very large number of possible strategies and to evolve them in a computational framework attempting in a sense to replicate classical Darwinian evolution. The outcome of this evolutionary process brings me a set of strategies which best answers my modelling constraints. This set is then submitted to an extensive validation procedure on large out of sample data sets to make sure that the dynamics prescribed by the strategies hold well over time.

Larry Levy: You have stated that your analysis is not pairs based but currency based. Please explain this.

Stephane Coquillaud: A well known drawback of evolutionary techniques is their tendency to over fit the in sample data set. In other terms, whilst trading strategies generated this way will exhibit very good looking equity curves on the in sample data set, they will unfortunately most of the time bring very poor out of sample performance if not used carefully. This is why a large part of my research time is spent on how to efficiently discriminate at inception the set of possible outcomes in order to retain as much explanatory power as possible.

For this purpose, I think that looking altogether at the simultaneous variations of several currencies relative to

each other, rather than attempting to model the marginal behavior of single currency pairs is very beneficial in this respect.

Larry Levy: You have talked about your Pentahedron approach to trading G5 currencies. Please expand.

Stephane Coquillaud: In my opinion, a key aspect in the building of robust FX alpha models is the way one chooses to formulate the problem with the data set. Obviously, the more complex the data set, the more information it contains.

In contradistinction, the simpler the data set, the more likely is the

occurrence of exogenous information going to distort negatively your live trading performance. So while I have decided to focus on the G5 currencies, I have also spent time at formulating my data problem by representing these five currencies as a pentahedron. In this way I am not looking at the relative value of two currencies at the same time any more but rather five simultaneously, each one independently relative to the four others, which gives a far more informed view.

Larry Levy: How long does your average trade last, how often do you trade and what are your shortest and longest time periods for a trade?

Stephane Coquillaud: The average trade lasts just under one day. The shortest will be a few minutes and the longest a week. I am trading on the average 200 times a day, on a 24 hour basis. About 45 % of the trades are winners. Absolute P&L on the winning trades is on average twice that of the losing trades.

Currently there are 40 strategies in total running - all of them across the G5 to ensure optimal liquidity and transaction costs in all time frames.

Larry Levy: How often do you get a new idea? And what happens then?

Stephane Coquillaud: A new idea? This will happen at least once a day but mostly a good idea only once a month at best! There are many more ways to lose money than to make money and this is reflected quite well in my good to

bad ideas ratio.... When a new idea is generated, the first priority is to establish its statistical significance in terms of alpha generation.

So we will generally perform a quick and light on the fly implementation in our development environment as a first step and run a battery of standardised tests. We will be looking at consistent statistical bias on three to five years in sample and one to three years out of sample, depending on the trading horizon. If the back testing results look promising, the idea is then integrated in the generic research framework where it will then interact freely with the all the other genetic components. If it is then promoted to production status, a new executor software is then implemented and released for live trading once fully certified on our UAT (User Acceptance Testing) environment.

Larry Levy: Please expand on your UAT environment?

Stephane Coquillaud: A healthy dose of paranoia is always required in trading and this is even more true of algorithmic trading!

We have a specific environment where most of the liquidity providers we are using stream simulated but realistic prices, which can be used for paper trading, replicating the live trading conditions. We use this set up to acid test all of our algorithms before they make it to production. We stress pretty much all the execution parameters and risk limits on a large number of different strategies, hence uncovering quickly in principle any issue which would have escaped the initial certification of the code.

Larry Levy: What kind of logistics do you use for trade execution?

Stephane Coquillaud: We have an in house FX aggregator which pulls real time streaming from a dozen banks as well as the main ECNs, thus providing us with the tight markets we need in pretty much all liquid pairs. Deltix is hooked up to this aggregator using a dedicated API interface. Deltix generates orders which are handled in the aggregator. Once the trade is executed, Deltix will receive a confirmation which is processed and incorporated in the algorithm's logic. In parallel, the trades are routed to our official book of records layer from which they will undergo the standard back office procedures and other downstream procedures, such as market risk limits checks, et cetera.

Larry Levy: Do you work essentially alone or as part of a team? Who works with you, and how?

Stephane Coquillaud: I am driving the FX algo research and trading single-handedly from within TD Securities. However this is made possible only with the great support of Deltix which provides me with first class support in all aspects of the deployment, from IT infrastructure design, development of the algorithms, ►



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performance optimisation, model validation, etc. So in reality, I interact with many engineers at Deltix on a daily basis who are supporting my project at various levels.

Larry Levy: Is latency a factor in your trade execution?

Stephane Coquillaud: No, it is not a critical factor. When I started the implementation of my models, I knew that very low latency trading, as it is now practiced by the top firms, was not going to be an area where I would be able to gain a competitive advantage in the short term, for various reasons. Therefore the design of the models has factored this in from inception.

Larry Levy: How do you place a value on your work?

Stephane Coquillaud: In terms of the financial value of the systems and models which I am building, forward looking rather than backward looking. I started live trading in January 2010, after spending 2009 in research and development.

Therefore I am not in a position to be able to exhibit multi year track records yet. As I was expecting, the first six months of trading have been very much in line with the in sample and out of sample performance of the selected trading strategies, both in terms of risk and return. However, this really is the prospective revenue stream which can now be reasonably and confidently anticipated from this operation and which places a value on my work - I believe.

On a more personal level, I place a lot of value in the freedom I benefit from by being involved in the design and trading of alpha driven models, which actually best fits my natural inclination. Not only is the research work extremely creative and challenging with virtually no set boundaries to my imagination but also the full automation of the execution frees up a considerable amount of time compared to more traditional trading activities, like options, which are far more manually intensive.

Larry Levy: This can be a difficult business, can't it?

Stephane Coquillaud: You bet... when I switched on my models for the very first time in live trading, I immediately went through a three week (almost) uninterrupted drawdown! Although this type of scenario was perfectly accounted for in the all the backtesting work which was carried out beforehand and the amplitude of the loss was well within the possible outcomes, it cast a doubt in a lot of people's minds, including my own of course. This was not the easiest start by all means. I held on tight, resisting the temptation to start fiddling with the parameters and what was supposed to happen did happen - the models made it all back in about a month and started to produce consistently thereafter.

I think it is key in drawdown times to keep the faith and to remind yourself of all these days and nights spent building and testing your strategy. It is equally important to stay humble with the markets and accept the possibility of losing a battle by having a clear idea beforehand of what it will take for you to admit your defeat.

Larry Levy: What is your view on Very High Frequency Trading?

Stephane Coquillaud: Not being directly involved in it means I have no expert insider view and my knowledge in this area is limited to what I have read and heard about it. However, I feel that when used for the purpose of generating alpha based revenues, arbitrage, market making or managing order flows these techniques are perfectly legitimate and are simply the modern extension of classic investment banking activities, leveraging the latest technological improvements.

I am much more sceptical about its ethical dimension when it comes to trading predatory algorithms aimed primarily at front running flows or collecting rebates from the exchanges. I am also unsure about the sustainability of such business models in the changing regulatory landscape.

Larry Levy: What is your view on the development of automated trading and what are its future prospects?

Stephane Coquillaud: I think a lot is happening at the moment on the investment banking side with the increased automation of electronic market making and automated risk management of the client flows. Quite a few players took their time to enter this market, mainly due to the hefty entry costs, and are now catching up quickly, building unified e-commerce platforms across multiple asset classes. The race is on to offer differentiating services to capture increased market shares and the next few months should offer interesting developments for the seasoned observers. It is likely that we see increased regulatory pressure as well, given the always growing proportion of traded volumes initiated by algorithms. There is a palpable fear of algorithm generated market distortions which could go out of control, as illustrated and amplified for instance by the Flash Crash recently in May 2010, with the Dow falling 1000 points in a few minutes. [See page XXX.]

The red hot debate on the feasibility of implementation of global or regional financial transaction taxes is also very interesting. Here we have the confluence of several recurring themes since the financial meltdown: For example, the idea of protecting taxpayers against the recurrence of such crises, finding new means to fund long term ethical growth, and moralising certain financial practices. Ultimately, all this could change the landscape on the higher end of the high frequency trading spectrum in my opinion if decisions were made in this direction.

Larry Levy: How do you see the future ?



Stephane Coquillaud: I am trying not to think about it too much and prefer to live in the present. I know for a fact that in investment banking it takes an instant to see your life turned upside down and I stopped a long time ago building long term plans. As long as I am in a challenging working environment and excited to go to work in the morning, I am very happy. I am an anxious character and attempting to project myself in the future generates me unnecessary angst. Carpe Diem!

Larry Levy: Outside of financial markets, what makes you buzz?

Stephane Coquillaud: Above and beyond everything else my three lovely kids of course, nothing compares. I am also crazy about tennis, playing as much as I can, as long as I can, which is never enough. My idol in the game is Jimmy Connors and I can still get stupidly very excited watching him for the nth time winning against Ivan Lendl at the '83 US Open final I am afraid ! I am also fond of vintage Rock music and big game fishing. Lastly, I have kept a sweet nostalgia of all the years spent in Arab countries and Arabic arts and music really thrill me.

Larry Levy: Stephane Coquillaud, thank you very much. 