

## Trading & Exchanges

### **Survival of the Fittest Trading Models -- A hedge fund run by Harvard Ph.D.s is building trading models drawing on evolutionary concepts, like survival of the fittest.**

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1 March 2004

[Wall Street + Technology](#)

Charles Darwin probably never thought his theory of evolution and natural selection would be used to build trading models for a hedge fund. That is the case in Cambridge, Mass. where Financial Labs, an investment-management company launching a hedge fund, has developed a directional-trading strategy known as Darwin-FX. The strategy - created and maintained by the computer - seeks to extract profits from small inefficiencies in domestic and global-financial markets.

Rather than program the software using conventional methods, the team of five researchers with Ph.D.s in physics and astrophysics from Harvard University, are using the scientific method known as genetic programming.

"That practice is really the cutting edge of the industry at this point," says Clarkson Jones, owner of Monarch Capital Management, a commodity-trading adviser in Charlotte, N.C. Jones uses neural networks for genetic modeling of data - which is similar to genetic programming - to create predictive models for future returns. The same genetic-modeling techniques are used in weather forecasting, economic nation building and war planning by the U.S. Government. "I will say in the next few years most of the trading systems will be automated," says Jones, who notes that it allows traders to remove the human element of discretion and to program in a more detached, disciplined way.

The conventional approach is to sit down with a bunch of smart people and build one model, but that may only work for a month. "The problem is that these inefficiencies are very dynamic and change in time in an unknown manner," says Aaron Sokasian, partner, chief executive officer and research manager at Financial Labs. Whereas models built with genetic programming and neural networks are capable of learning and adapting to changing market conditions.

The genetic process involves creating around 200 models, training the models on historical data and measuring their performances to ensure that only the fittest models survive.

Founded in July, Financial Labs received seed funding from principals at FX Solutions, a futures commission merchant based in Ridgewood, N.J. Because the entire process of building, training and testing the models on historical data is so computationally intensive, they purchased a

supercomputer. "What would normally take 50 programmers to do or 100, we can do with five," says Thomas Plaut, co-founder.

Last fall, the firm purchased a custom-built supercomputer - a Beowulf Cluster with 16 processors running Linux. Beowulf refers to a bunch of Linux computers linked to parallel process a job. "You have to write the program in a parallel manner so that the computer can utilize multiple processors on the same job," he explains.

Plaut notes, "This is not something that a discretionary trader would have sitting on his desk. This is more of (what a) scientist would use to analyze massive sets of data," he adds.

### Beware of The Pitfalls

Though genetic programming has been around for a decade or more, it's notoriously hard to set up. It takes months and months of analysis and a lot of people who attempt it, give up on it, says Sokasian.

One of the barriers to entry has been the lack of computer-processing power, but that has just caught up, says Sokasian.

Another challenge is finding "high-frequency" data --minute-by-minute data for hundreds of instruments. Though the firm has obtained data for equities, FX-currency pairs (going back eight years) and futures from various sources, "it doesn't come cheap," Sokasian says. And there are only a handful of reputable sources, he adds. One reliable source is Switzerland's Olsen Group, a provider for FX. Others are FT Interactive Data and TickData.com for equities and futures.

However, genetic programming is not for the novice. "It's an incredibly powerful tool. It's like dynamite. Used properly, you can move mountains and used improperly, it can blow your legs off," says David Leinweber, a visiting faculty member at the California Institute of Technology, and principal of Leinweber & Co., a financial-research firm in Pasadena, Calif. Leinweber has over six years of experience with genetic algorithms managing \$6 billion at First Quadrant L.P.

In his article "The Perils and Promise of Evolutionary Computation on Wall Street," Leinweber warns, "Data mining is a constant risk in financial forecasting. If you look hard enough, you will always find something that looks great statistically but makes no sense."

But Leinweber says there are ways to overcome the danger of data mining with genetic programming. "It lets you do a lot of anti-data mining statistical adjustments. You'll always find something. But if it's done with skill it can be very innovative. If it's done without skill, it can be a good way to fool yourself."

## How it Works

Given this complexity, Sokasian and his team spent several months creating a language that would ask the computer to think very abstractly about coming up with a viable trading model. The computer creates a population of some 200 or so models. "You've taught the computer how to generate a model on its own," says Sokasian. It applies certain criteria to the models and trains them on historical data.

Models that performed well during the training period are allowed to go forward into the next gene pool of models. "You assess the performance of each one of the components of the model, then you either allow them to propagate or die off," says Sokasian. Then begins a process called breeding and mutation.

"It's kind of like a population of animals in the wild. You change the environment in which this population of animals live, some will adapt, but only the most successful ones will survive," he adds. Before the hedge fund is ready to trade, the last step is to develop a real-time model that is separate from the model built to do the historical analysis. The firm runs the historical model through a simulator that looks at real-time data (purchased from ComStock) and enters and exits trades, using the Financial Information Exchange (FIX) protocol.

## Model Trades via Fix

In December, the firm began trading with \$5 million in real-time using FX-currency pairs, and plans to expand into equities and derivatives on the underlying instruments.

The trading signals are sent out via FIX messaging to Barclays Capital, which clears the trades. Financial Labs connects to Barclays through a FIX engine-API via a T1 line.

Because the approach to trading is very systematic and devoid of human discretion, the FIX signals are sent to electronic markets such as Nasdaq, or the Chicago Mercantile Exchange's Globex or the Chicago Board Of Trade's LiffeConnect.

However, there are exceptions. When a FIX signal is routed to the NYSE, a trader takes care of it on the floor. In the case of FX, the trades are sent to FX Solutions, where a human liaison hunts for the best bid and offer via multiple platforms. "We use Reuters, automated systems from banks, and consolidated systems like **FXall**," says Plaut.

Beyond directional models, the firm is developing trading models for two other approaches: statistical and risk arbitrage. Here they are not using genetic programming; they are relying on the supercomputer to search the markets tick-by-tick around the world, and whenever there is a pricing discrepancy, they execute automatically based on transaction costs.

## The Results?

Because the hedge fund just began to trade in real-time, Sokasian says it's early to talk about results. But he's hoping to earn 20 percent returns with four percent draw-downs - which is the maximum amount lost after an account reaches a new high. In order to be successful, it will need to use 50 to 70 strategies across all three models.

The fund has \$20 million in commitments. However, it expects to grow immensely once it goes live, Sokasian says. Though the firm doesn't have a real-time track record or any formal training in finance, it hasn't had a lot of problems raising money because it's unique in its approach.

With a supercomputer cranking in its offices, its headquarters impresses potential investors. "They're intrigued enough to give us a shot," says Sokasian.