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Taming the Wild and Wooly Stock Market

Jamaica Plain resident Ivan Bercovich, a senior electrical engineering major at the University of Massachusetts Amherst, is using the tricks of his own trade to work out a sound stock-market investment strategy that will make sharp downturns, such as the current recession, irrelevant in the long run. His premise is that investors have to make long-term commitments to their stocks, 20 years in this case, regardless of short-term volatility in the market. Bercovich's method is based on a scientifically proven engineering technique known as "signal processing," meaning the analysis, interpretation, and manipulation of signals. In Bercovich's research, the "frequency" of the signal is represented by the up and down graphing of closing stock-market prices over the last century.

Bercovich's research, which he is doing for his senior honors capstone thesis, was inspired by an article in *Money Magazine* written by Senior Editor Walter Updegrave. In his article, Updegrave posed a question that is much debated in the financial community.

"They are debating whether it is better to invest a sum all at once, or release it into the market in smaller slices to erode some of the risk," says Bercovich. "Although there are a lot of articles that choose either side, it is rare to find numerical support for these claims. My objective is to perform a series of statistical analyses and come up with a more quantitative reason to choose one strategy over the other."

With the help of his advisor, Professor Dennis Goeckel of the Electrical and Computer Engineering Department, the Argentinean-born Bercovich recognized that the ups and downs of the stock market are actually time-varying quantities that act like signals. They can therefore be analyzed and interpreted through signal processing, which quantitatively analyzes radio and telecommunication transmissions and many other kinds of signals, including sensor data such as electrocardiograms. With that idea in mind, Bercovich has gathered almost 100 years of figures from the Dow Jones Index and 50 years from the S&P 500 Index, all of which he is now analyzing as if it were an electrocardiogram of our stock market. In many ways it is.

"I'm using the same engineering technique that one would use to process a signal," says Bercovich. "So the signal will have a pattern, or frequency, and it will have noise. In my research, we look at the fluctuations in the market as frequency and the market volatility as the noise. So, when I am studying volatility I am really trying to determine how noisy the market is. It's much the same as trying to receive a radio signal when it is thunder-

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storming."

In order to compare the "one lump sum" strategy of investment with the "little bit at a time" strategy, which people in the financial community refer to as "dollar cost averaging," Bercovich is testing the two approaches against each other to see how they would perform over the past century of stock-market records.

"I will invest a lump sum on a random day and then keep the stock for 20 years," he explains, "and I repeat this experiment 10,000 times. Then I see how the distribution of my returns comes up. Next I do the corresponding experiment, which is the dollar cost averaging, and repeat the same experiment 10,000 times. The idea is to compare these two strategies."

After he completes this exhaustive analysis, he can determine quantitatively which approach is better. What Bercovich is using are equations that mathematicians and engineers have developed to predict signal fluctuations. His goal is to help people in the financial world translate theory to real-world decisions. He is combining his background in mathematics and electrical engineering, especially signal processing, and several courses in finance to connect these fields and interpret financial data from an engineering perspective.

One goal Bercovich hopes to reach is protecting investors from the so-called St. Petersburg Paradox, a classical economics problem in which a naïve decision criterion, based on unsound mathematics, suggests a course of action that no rational person would be willing to take because of false expectations and unforeseen results.

"After I analyze this particular problem," says Bercovich, "this research could then be extended to explore the systematic analysis of financial data in all circumstances for which expectation yields deceiving results." (February 2009)

Raytheon Makes Sparks Fly for Engineering Students

During a tour of the Raytheon Integrated Air Defense Center in Andover, Massachusetts, on February 13th, a group of our engineering students

saw how that company makes the sparks fly. The students, accompanied by Interim Director of Diversity Programs Shelly Perdomo, were visiting the transformer winding and high-voltage testing area, where Raytheon employee Joe Costa walked them through the facility. Test technician Billy Iseman "burned up the wires" and made sparks fly as he cranked up the voltage across a one-inch air gap separating two conductors until a spark jumped the gap. The breakdown occurred at 18,000 volts. Talk about an icebreaker! It was all part of the overview of the Raytheon Integrated Defense Systems culture, products, vision, and values given our students during a panel discussion, talk, lunch, and a two-hour tour accompanied by company escorts Monique Larose, Amy Wilkinson, and Chet Boncek.

The Raytheon Company, an early pioneer of defense technology since World War II, is the world's leading missile defense organization. Raytheon is an industry leader in defense and government electronics, space, information technology, technical services, and business aviation, and special mission aircraft with 80,000 employees worldwide. The Andover IADC facility, a 1.2-million-square-foot multi-disciplined center, is the operations headquarters for IDS and currently employs approximately 4,000 personnel. The facility is a low-volume/high-mix, multi-discipline manufacturing, engineering, and program support facility that provides