

S. Mark Barnes

Statistics, Probability Theory and Business Related Mathematics Credentials

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I am an attorney for the Office of Chief Counsel, IRS. I became heavily involved in statistics and mathematics professionally, when I was assigned to the Son of Boss Market Linked Deposits Litigation Team in early 2005. The Son of Boss tax shelters were heavily promoted for the taxable years 1999 through 2001, and involved the use of offsetting option position to generate fictitious tax losses. In order to attack this shelter, the Service had to present evidence that the option positions were not taken for a business purpose and had no real economic substance. In order to prove this point, we hired expert witnesses who could explain the technical aspects of options from both a market perspective and a theoretical perspective. Thus, we hired an expert who trades foreign currency options and an expert who is a finance professor and well known for this theoretical expertise with options. My responsibilities with the team have primarily centered on the technical and theoretical aspects of options, including option pricing theory. I also took the lead in preparing our experts to testify, and in cross examining experts testifying on behalf of taxpayers. In order to effectively deal with expert witnesses, an attorney must also gain expertise in the area. As a result, I have spent a great deal of time studying the ins and outs of options, with a particular emphasis on option pricing theory, which includes the Black-Scholes option pricing model and the use of Monte Carlo simulations, such as the bootstrap method, for pricing options.

In order to understand option pricing, a person must have a good grasp of probability theory, statistics (normal distribution, standard deviation, randomness, etc.), as well as simulation techniques for numerically solving pricing problems. As an attorney, who also must be prepared to cross examine opposing experts, it is important to be familiar with critiques of option pricing theory, such as the arguments advanced by Benoit Mandelbrot and Nassim Nicholas Taleb.

In 2007, I was also assigned to work on an estate tax case, which included the valuation of 2,500 acres at the south end of Lake Tahoe. Specifically, I was assigned to cross examine an economist called by the taxpayers as an expert witness to support their valuation of the property. I cross examined the expert concerning sampling problems (i.e., the fact that comparables used by the expert were not similar to the subject property in time, space or kind.) Also, I was required to cross examine the expert concerning the methodology he used to calculate the discount rate, which he applied in his valuation analysis. As stated above, in order to effectively cross examine an expert, I was required to research these issues and develop my own expertise in the areas of sampling and methodologies for calculating discount rates.

Based on the expertise, which I have developed over the last five years, I was asked to present at the IRS Office of Chief Counsel (SBSE) Continuing Legal Education Seminar held in Chicago during the week of August 9, 2010. This CLE seminar was attended by several hundred IRS attorneys from across the nation. Because approximately 95% of

the expert witnesses we employ deal with valuation issues, I was asked to teach a seminar on valuation concepts. I have attached the slides which I prepared in connection with this presentation. It is designed as a quick reference for valuation related issues. As you can see, it deals specifically with mathematical concepts, which underlie asset valuation. In addition to the concepts in the slides, I also included a discussion of Bayesian probability theory in my presentation, which I illustrated through a discussion of the well known Monty Hall problem made famous in the movie "21."

## Educational Background

Statistics, probability theory and mathematics are a significant part of economics and finance. As demonstrated by the attached presentation, any valuation analysis from the valuing of real property to derivatives requires the use of data and the application of statistical/mathematical concepts. I graduated Magna Cum Laude from the University of Utah with a BA in Economics. In recent years, I have taken seven graduate level classes in economics and finance, which required me to demonstrate my ability to understand and use statistics. In 2002, I enrolled in three graduate economics classes, Microeconomics, Macroeconomics and International Economics (9 credit hours) . I earned an A in each class. In 2007-2008, I successfully completed four graduate level classes in finance (12 credit hours), which required me to demonstrate my ability use statistics to analyze markets and to value various types of assets, including various financial instruments. The Office of Chief Counsel, IRS has created a program with NYU, whereby attorneys can take specific NYU classes using a satellite link. In 2007, I enrolled in an NYU class in Corporate Finance. I followed with two additional graduate finance classes at the University of Phoenix in 2008, and received an A in each class. In December of 2008, I completed a second NYU finance class in the taxation of financial instruments. This class was particularly challenging, and required a detailed understanding of stock, bonds, options, futures/forwards, and other derivative instruments. Obviously, the valuation of such instruments is critical to the proper taxation of such instruments. I received an award for superior academic performance from the Office of Chief Counsel, IRS for my work in this class. Specific information about these classes is located in My Academic Credentials.

## Teaching Experience

I have been teaching economics at the University of Phoenix since 2002, and finance since 2008. The use of statistics and statistical analysis are an important part of the classes, which I teach. Many of the materials which I have created or use for these classes can be found on my personal website: <http://markbarnes.us>. Please look at the materials under Economics, Finance and Statistics. You will see that I have experience teaching many statistics and business math related topics in my current classes.

<http://markbarnes.us/Economics-thoughts.htm>

<http://markbarnes.us/Finance-Materials.htm>

<http://markbarnes.us/fpmaterials.html>

<http://markbarnes.us/Statistics-Materials.html>

## Reading List

The following are books related to business mathematics, which I read in recent years.

1. Bookstaber, R. (2007). *A Demon of our own design: markets, hedge funds, and the perils of financial innovation*. Hoboken, NJ: John Wiley & Sons, Inc.
2. Barabasi, A. (2010). *Bursts: the hidden pattern behind everything we do*. New York, NY: Dutton Adult.
3. Barabasi, A. (2003). *Linked: how everything is connected to everything else and what it means*. New York, NY: Penguin.
4. Berlinski, D. (1995). *A Tour of the calculus*. New York, NY: Random House.
5. Bernstein, P. (1998). *Against the Gods: the remarkable story of risk*. Hoboken, NJ: John Wiley & Sons, Inc.
6. Bernstein, P. (2007). *Capital ideas evolving*. Hoboken, NJ: John Wiley & Sons, Inc.
7. Gleick, J. (2008). *Chaos: making a new science*. New York, NY: Penguin.
8. Lindley, D. (2002). *Euclid's window : the story of geometry from parallel lines to hyperspace*. New York, NY: Free Press.
9. Mandelbrot, B. (2004). *The Misbehavior of markets: a fractal view of financial turbulence*. New York, NY: Basic Books.
10. Mazur, B. (2003). *Imagining numbers: (particularly the square root of minus fifteen)*. New York, NY: Picador.
11. Nahin, P. (1998). *An Imaginary tale: the story of "i" [the square root of minus one]*. Princeton, NJ: Princeton University Press.
12. Neftci, S. (2000). *An Introduction to the mathematics of financial derivatives, second edition (academic press advanced finance)*. New York, NY: Academic Press.
13. Patterson, S. (2010). *The Quants: how a new breed of math whizzes conquered Wall Street and nearly destroyed it*. New York, NY: Crown Publishing Group.
14. Peters, E. (1999). *Patterns in the dark: understanding risk and financial crisis with complexity theory*. Hoboken, NJ: John Wiley & Sons, Inc.
15. Savage, S. (2009). *The Flaw of averages: why we underestimate risk in the face of uncertainty*. Hoboken, NJ: John Wiley & Sons, Inc.

16. Taleb, N. (2007). *The Black swan: the impact of the highly improbable*. New York, NY: Random House.
17. Taleb, N. (2004). *Fooled by randomness: the hidden role of chance in life and in the markets*. New York, NY: Random House.
18. Triana, P. (2009). *Lecturing birds on flying: can mathematical theories destroy the financial markets?* Hoboken, NJ: John Wiley & Sons, Inc.
19. Wilmott, P. (2009). *Frequently asked questions in quantitative finance*. Hoboken, NJ: John Wiley & Sons, Inc.
20. Wilmott, P. (2001). *Paul Wilmott introduces quantitative finance*. Hoboken, NJ: John Wiley & Sons, Inc.