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Navin Rajkumar, Trader 2 (Bonds) **navin.rajkumar@mycmmb.com**

A Mathematics- Friend or Foe?

I must profess that during my primary and secondary school days, my love for mathematics was akin to the love that a cat has for an early morning shower, perhaps not so much out of fear but more because of my lack of understanding of the use of mathematics i.e. algebra, matrices, geometry, calculus, etc. However, with age comes wisdom (in most cases), and I began to understand that mathematics plays an important role in our everyday lives. I realised that all those mundane and enigmatic mathematical formulae actually served a purpose and can be applied to everyday life. I must confess that I am a born-again lover of mathematics and now live on the technical side of life.

My inspiration for this article stemmed from two separate events, both coincidentally occurring in the same week. Event 1 was a motivational / human resource session, where the speaker during his discourse asked how has Pythagoras' theorem (in a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the two other sides) affected his life; his answer was somewhat to the effect that mathematics aside, Pythagoras gave him the 'gift of rationality'. At Event 2, I went back to my alma mater, Naparima College, to participate in a 'Career Day' for Form three students as a representative of the finance industry. What surprised me at this event was the notion that most students who were furthering their studies of Maths at the A-level or university level was to enhance their ability to pursue a career in engineering or another similar technically related field. To their surprise however, I explained that a good understanding of Maths may also give them an advantage in the finance industry.

Pondering upon these two events, in relation to the finance industry I wondered how many people / students have an appreciation for the use of mathematics in the finance industry, for after all, the end results would invariably have an impact of some form on their lives (e.g. the current financial crisis). In this light, I decided to focus the remainder of this article towards highlighting the use of mathematics in the finance industry.

Probability Theory

Probability theory is the branch of mathematics that deals with the analysis of random events. This branch of mathematics is used extensively in the field of finance and economics with the aim of analyzing and understanding complex scenarios and stochastic processes. Probability theory sets the foundation for statistics and deals with concepts such as: probability distributions (discrete: binominal, geometric, continuous: normal etc.), joint probability, central limit theorem, conditional probability, random walk/Markov chains, etc.

Probability concepts are used by economist, investment / quantitative analyst, risk managers etc for forecasting, scenario

building, algorithm development etc.

Statistics

Statistics is the branch of mathematics that deals with the collection, analysis and interpretation of data. Statistics is widely used in the finance industry with its output meant to enhance decision making. It is used to provide information relating to data description: standard deviation, variance, mean, mode, median etc. It is also used to infer certain relationships for the given data or sample: hypothesis testing, regression / time series analysis, extrapolation, interpolation etc. Presently there are numerous statistical software that are able to conduct statistical analysis e.g. Minitab and SPSS.

Econometrics

Econometrics combines economic theory with statistics; economic theory is tested or 'modeled' using robust statistical concepts. An econometric model helps policy makers / managers to understand the relationship and to test hypothesis between economic variables and thus facilitates better decision making.

Econometricians usually apply regression analysis to time series data, cross sectional data and panel data with the aim of developing a plausible relationship between the independent and dependent variables. Robust statistical testing for significance of the estimated parameter and interference is conducted, such as: F-test, t-test, R-square, test for heteroskedasticity and autocorrelation etc. Econometricians frequently employ the following models (but not limited to): OLS, GARCH, ARCH, AR etc, in their analysis.

Game Theory

Game theory is a branch of applied mathematics that aims to capture behaviour in strategic situations, in which an individual's success in making choices depends on the choices of others. Game theory is used to analyse the behaviour of firms (duopolies, oligopolies, cartels etc), markets (bargaining, auctions etc) and consumers. The application of game theory to these economic situations aims to find an equilibrium such that each player of the game has adopted a strategy that is unlikely to change; one of the most famous of these equilibrium concepts is the Nash equilibrium.

Linear Algebra

Investment and economic analysis, usually involve a huge number of factors, but by using linear algebra (use of matrices) the complexity of the analysis may be reduced. A matrix can be used to solve a large number of linear equations simultaneously (matrices can also be used to solve combinations of non-linear equations).

Mathematical Finance and Stochastic Calculus

Mathematical Finance and Stochastic calculus are both branches of applied mathematics with the former concerned with financial markets and the latter, used to model systems that behave randomly e.g. stock and bond prices. Individuals with extensive knowledge of these branches of mathematics are employed in the financial industry as quantitative analyst /

financial engineers.

Quantitative analyst are primarily involved in derivative pricing, portfolio optimisation, creation / pricing of structured (tailored) securities, financial / Monte Carlo market modeling and financial risk modeling.

In conclusion mathematics can be intimidating, for both students and practitioners. Although mathematics brings the gift of rationality, an understanding and application of the underlying mathematical concepts can yield a sense of accomplishment.

FINANCIAL & ECONOMIC INDICATORS

As at 11 June, 2009

Exchange Rate/US$	Closing Value	Previous Week
Yen	97.63	96.58
Euro	1.39	1.40
Jamaica	88.73	89.09
Guyana	203.20	204.70

Commodity Prices	Closing Value	Previous Week
Crude oil (US$/bbl)	72.68	68.81
Natural Gas (US$/mmbtu)	3.51	3.58
Gold (US$/Troy Ounce)	953.95	980.25

Eurobond Indices (As at 11-June-09)

Lehman Brothers Global Aggregate Index (Return % YTD)	-0.12
JP Morgan EMBI+ (Basis points)	412
JP Morgan Central America and Caribbean Index (CACI) (YTD return %)	18.90

Policy Interest Rates (%)	Closing Value	Previous Week
United States	0-0.25	0-0.25
Euro Zone	1.00	1.00
Japan	0.10	0.10
Brazil	9.25	10.25
Trinidad	8.00	8.00
Jamaica	17.00	17.00
Barbados	3.00	3.00

Market Interest Rates (%)	Closing Value	Previous Week
US 90-day T-Bill	0.17	0.14
US 10-Yr Treasury	3.86	3.71
3-month UK Libor	1.25	1.27
Japan 90-day T-Bill	0.33	0.33
Brazil 90-day T-Bill	9.68	9.15
TT 90-day T-Bill	2.60	2.62
Jamaica 90-day T-Bill	19.21	19.21
Barbados 90-day T-Bill	3.96	3.93

Sources: Bloomberg, CMMB, Central Bank of Trinidad and Tobago, Bank of Jamaica, Central Bank of Barbados, www.lehman.com