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THE FRACTAL MARKET HYPOTHESIS

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The current world economic crisis, that started with the 'Credit Crunch' in the Summer of 2007, appears to be spiralling out of control irrespective of government intervention. With the recent collapse and effective bankruptcy of major banks and financial organisations such as Northern Rock and Lehman Brothers, there is clearly something going on in the world economy that is more than just a technical hitch. Given all the financial modelling systems, checks and balances and sophisticated macroeconomic forecasting techniques that pervade the financial sector, why was the current economic situation not predicted? It was, using among other methods, the approach discussed in this lecture which is based on the paper: *Application of the Fractal Market Hypothesis for Macroeconomic Time Series Analysis*, J M Blackledge, International Society for Advanced Science and Technology, Transactions on Electronics and Signal processing, No. 1, Vol. 2, 78-101, 2008.

Financial time series modelling is a well established practice. This includes the use of certain partial differential equations for describing financial systems such as the Black-Scholes equation for options pricing. Attempts to develop accurate stochastic models for financial time series, which are essentially digital signals composed of 'tick data' (data that provides traders with daily tick-by-tick data - time and sales – of trade price, trade time, and volume traded, for example, at different sampling rates as required), can be traced back to the late Nineteenth Century when Louis Bachelier, in his PhD Thesis, *The Theory of Speculation,* proposed that fluctuations in the prices of stocks and shares (which appeared to be yesterday's price plus some random change) could be viewed in terms of random walks in which price changes were entirely independent of each other. This idea underpins what is now known in economics as the 'Efficient Market Hypothesis'. It is based on a number of questionable assumptions, one of the most important being, that economic time series are normally or Gaussian distributed, an assumption, upon which, models such as the Black-Scholes equation are ultimately based.

It has long been known that economic time series are non-Gaussian and, moreover, that they contain similar features, in a statistical sense, over different time scales – 'Elliot waves'. However, these observations are rarely included in the economic models that can end up affecting us all. In this lecture, an approach to macroeconomic modelling is considered that is based on a process known as fractional diffusion, incorporates the fact that the statistics of economic times series are non-Gaussian, non-stationary and self-affine or 'fractal', and is thus based on a 'Fractal Market Hypothesis'. It is demonstrated how this approach can provide an accurate and robust 'gauge' for economic forecasting.