

CCFEA

Centre for Computational Finance
and Economic Agents

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Centre for
Computational Finance
and Economic Agents

CCFEA

Wivenhoe Park, Colchester CO4 3SQ, UK

Mapping Trader Behaviour

Presenter: **NORMAN, David James**

Through the current research I am looking to capture the realtime trading behaviour of high-frequency electronic traders through the realtime download of the trading system digital audit trail, and to understand more fully why traders make their decisions to trade. Using the trader's trading data and a range of metrics to record the changes in trader behaviour given various market conditions, the objective is to understand more fully how and why traders make decisions to trade, what market conditions lead them to make certain trading decisions and how time, peer group pressure, stress and other intangible influences affect their judgement and behaviour. The end result of the research is to be able to understand more fully human critical point activity at extremely short time intervals and how an understanding of this behaviour can be effectively applied to other time-critical human endeavours.

Keywords: High Frequency Trading, Trader Behaviour, Realtime, Decision-making, Judgement.

A Coevolutionary Grammatical Evolution Approach for High Frequency Trading Systems

Presenter: **ADAMU, Kamal**

Traders make trade decisions specifying entry, exit, and stop loss levels. The entry dictates when to enter a trade, the exit defines when to exit a trade, and the stop loss determines when to exit a losing trade. All three decisions are interdependent. An optimal trading system is one that takes the interdependencies into account and minimizes losses while producing a healthy profit. In this paper we present an approach based on coevolutionary grammatical evolution for developing entry, exit, and stop loss rules for trading in high frequency. We benchmark the rules developed against the popular Turtle Trading System.

Keywords: Coevolution, Grammatical Evolution (GE), Turtle Trading System (TTS), Trading Systems, High Frequency Trading.

A Fuzzy Logic Momentum Analysis System For High Frequency Trading

Presenter: **KABLAN, Abdalla**

The modelling of financial systems continues to hold great interest for not only researchers but also investors and policymakers. Many of the characteristics of these systems, however, cannot be adequately captured by traditional financial modelling approaches. Financial systems are complex, nonlinear, dynamically changing systems in which it is often difficult to identify interdependent variables and their values. Financial trading is concerned with executing orders of buying and selling of certain amounts of shares at the best possible price. Many mathematical and algorithmic systems have been developed for this task, however they cannot seem to overcome a standard volume based system. This paper proposes a framework for high frequency trading using an intelligent fuzzy logic based momentum analysis system. The system was applied to the trading of financial stocks, and tested against a standard volume based brokerage system. The Fuzzy Logic Momentum Analysis System has proven to outperform the traditional and standard systems that are used in the industry.

Keywords: Financial trading; fuzzy logic; high frequency trading.

Periodicities of FX Market Activities in Intrinsic Time

Presenter: **GIAMPAOLI, Iacopo**

This paper suggests the application of advanced methods from Fourier Analysis in order to describe ultra-high frequent data in limit order books. Using the Lomb-Scargle Fourier Transform to take into account the irregularity in spacing, the power spectra of different inhomogeneous time series processes can be easily and quickly estimated, without immense computational effort due to the large amount of observations, as compared to common econometric approaches in the finance literature. Investigating empirical foreign exchange (FX) market data set, the spectral analysis coupled with an event-based approach shows that the price process contains different periodic components, especially in the medium-long term, implying the existence of stylised facts of ultra-high frequency data in the frequency domain.

Keywords: Ultra-high Frequency Transaction Data, Limit Order Book, Irregularly-spaced Data, Lomb-Scargle Fourier Transforms, Spectral Density.

From Aggregate to Microscopic FOREX Behavioural Analysis: Evidence from OANDA Trading Platform

Presenter: **MASRY, Shaimaa**

Our study revisits the intraday FX market activity from a microscopic perspective, using detailed tick transactions of anonymized traders of the OANDA FX trading platform. We find that traders can be grouped and compared according to their trading frequencies and their sleeping hours during the day. Analyzing the behaviour of these groups of traders, our study reveals that the documented FX market intraday pattern is nothing but an aggregate behaviour of individual traders' intraday activities. Whereas the FX market aggregate behaviour violates the stock market intraday pattern, individual traders' intraday activity goes in line with the stock market intraday behaviour. FX traders exhibit intensive trading at the beginning and end of their trading days, regardless of their trading time zones. Furthermore, we find that the type of trade plays a role in defining the intraday activity. Closing trades account mainly for the trading intensity at the end of the day, whereas both opening and closing trades cause the intensity at the beginning of the day. The proportion of closing to opening trades varies however according to the traders' sleeping groups.

Keywords: FOREX Market, Traders' Behaviour, Intraday Seasonality, Stylized Facts, High Frequency Finance.

Modelling the real market, an agent-based approach

Presenter: **ALoud, Monira**

Nowadays, the limitations of traditional analytical models for analyzing and understanding high frequency financial markets represent a big challenge. Although many studies and research have greatly contributed to the field of high frequency finance, exploring the market and the forces that drive market behaviour still needs further precise elaborations. However, due to the complexity of the financial markets model, it is difficult to identify which features of this model are responsible for allowing it to statistically resemble a real market.

In this work, we used an agent-based approach to model market situations under which stylized facts are exhibited. We aim to observe the stylized facts of traders' behaviour in the foreign exchange market over a long time horizon in order to identify the minimal conditions under which the traders' behaviour statistically resembles the behaviour of real Foreign exchange market traders. Such conditions will be considered essential in modelling a realistic financial market.

The proposed model could encourage finance and economics researchers to address financial problems and issues using a more scientific approach leading to more efficient and stable financial markets.

Keywords Agent-based approach; Foreign exchange market; High frequency data; Stylized facts; Exchange rate dynamics.

Introduction to the Mexican Derivative market (MexDer) and two Mexican cases of hedging

Presenter: **CORDOBA GONZALEZ, Jose Manuel**

Mexico as an emerging market economy (EME) is one of the leading countries in Latin America and has a competitive derivative market. Since its first future contract in 1998, MexDer has been continuing growing in order to offer a wide variety of foreign exchange and interest rate contracts nowadays. I give an insight of the MexDer and a brief introduction to the hedging contracts "Non-Deliverable Forward (NDF)" to understand the dramatic fall in the price of Controladora Comercial Mexicana (Comerci) as a result of a sudden fall in the Mexican peso's value after the Lehman Brothers bankruptcy. On the contrast, I revise the case of oil hedging that the Mexican government bought which was awarded with the prize of the most innovative or creative use of derivatives by the prestigious British magazine Futures & Options World (FOW) in 2009.

Keywords: Hedging instruments, Corporate hedging, Option hedging, Derivatives, Risk Management

Estimation of Stochastic Volatility Models with Implied Volatility Indices and Pricing of Straddle Options

Presenter: **PENG, Yue**

In this paper, we assess the performance of three different stochastic volatility models across five different markets. We calibrate the different models five stock market indices (FTSE 100, S\&P 500, AEX, CAC 40, and BEL 20) and their respective implied volatility indices (VFTSE, VIX, VAEX, VCAC, and VBEL) using maximum-likelihood estimation. We find that there is a clear difference in goodness of fit for the different models, and that the estimated parameters differ significantly across these five markets. Next, we test whether the difference in statistical goodness-of-fit between the models is also economically significant by pricing at-the-money forward straddle options, a derivative which provides a good hedge against volatility risk. We find that the choice of dynamics for the stochastic volatility has indeed a clear impact on the price of such a derivative, suggesting that the choice between the different stochastic volatility models can make a significant impact in real-life pricing or risk-management applications.

Keywords: Stochastic volatility, Implied Volatility Index, maximum-likelihood, CEV model, GARCH model, Heston model, Straddle Option

17th Feb. 2010

Presenter

Title

Portfolio Optimisation (Chair: Jin Zhang)

10:00 - 10:30	Javed Iqbal	<i>International Portfolio Optimization using Regime Switching: Case of Subcontinent</i>
10:30 - 11:00	Anil Khuman	<i>A Neuroevolutionary Approach to Portfolio Insurance</i>
11:00 - 11:30	Jin Zhang	<i>Moment optimization for asset allocation with pair-copula decompositions</i>

11:30 - 12:00 **Break**

Financial Contagion (Chair: Ali Rais Shaghghi)

12:00 - 12:30	Mateusz Gatowski	<i>CDS Markets and Financial Contagion</i>
12:30 - 13:00	Ali Rais Shaghghi	<i>Large-scale Agent-based Model of Financial Systems (Financial Contagion)</i>

13:00 - 14:00 **Lunch Break**

CDS Pricing (Chair: John O'Hara)

14:00 - 14:30	Yuan-Sung Chu	<i>Analysis of the Determinants of the iTraxx CDS Spreads using the Skewed Student's t AR-GARCH Model</i>
14:30 - 15:00	Alex Guarin-Lopez	<i>Enhancing Credit Default Swaps Pricing with Meshfree Methods</i>
15:00 - 15:30	Azusa Takeyama	<i>The impact of the UK government bank bail out on the CDS of major UK banks</i>

15:30 - 16:00 **Break**

Invited Session (Chair: Edward Tsang)

16:00 - 17:00	Laurence Wormald	<i>tba</i>
17:00 - 17:30	Best Presentation Award	

International Portfolio Optimization using Regime Switching: Case of Subcontinent

Presenter: **IQBAL, Javed**

Hamilton (1989) gave idea to model regime shifts, and Ang, A. and G. Bekaert (2002) used it with CAPM for the returns and portfolio optimisation. I have tried to implement methodology used by both to model behaviour of international portfolios. The price data from three stock exchanges, Karachi Stock Exchange (KSE), Bombay Stock Exchange (BSE) and Dhaka Stock Exchange (DSE) to be evaluated against MSCI World Index was used. The idea was to invest 1 USD in this portfolio and to continuously rebalance the portfolio from the weights generated by the regime switching model and compare them with simple mean-variance portfolio and market value portfolio (Market capitalization weighted portfolio). Previously, we have been able to show that Regime Switching Strategy has been successful and this data also supports the same argument that Regime Switching strategy performs better against simple mean variance and market capitalisation strategies.

Keywords: Regime Switching, International Portfolio, Asian Stock markets, MSCI, Optimization etc.

A Neuroevolutionary Approach to Portfolio Insurance

Presenter: **KHUMAN, Anil**

Portfolio insurance in instances where there is no suitable derivative available to hedge the underlying, has traditionally been performed through Constant Proportion Portfolio Insurance (CPPI). CPPI has been widely adopted in industry, yet with a fixed multiplier the strategy is somewhat inflexible. This has given rise to modifications to the strategy whereby trading bounds, ratchets and even dynamic multipliers may be implemented. However, these changes introduce additional parameters that must be tuned and raise the question of how far from CPPI an effective portfolio insurance model may deviate.

This work models portfolio insurance as a dynamic portfolio optimisation problem. The goal is to generate a dynamic trading model which manages a portfolio of a single risky asset and a risk-free asset to maximise terminal utility. The utility function presented is formulated to adequately capture the gap risk. Neuroevolution is used to construct and adapt a neural network through reinforcement learning to decide on the optimal trading strategy. This approach is demonstrated using real data from the FTSE 100 as the risky underlying in the presence of transaction costs.

Keywords: portfolio insurance; CPPI; neuroevolution; reinforcement learning; dynamic portfolio optimization

Moment optimization for asset allocation with pair-copula decompositions

Presenter: **ZHANG, Jin**

This paper employs a pair-copula threshold-GARCH to model the joint return distributions of five S&P equities for asset allocation. The Joe-Clayton copula and the Student t copula are used as building blocks of the pair-copula systems for the nonlinear and asymmetric dependency construction. The asset allocation model distributes weights by maximizing a portfolio performance measure which is computed based on the information generated from the pair-copula-TGARCH model. Three measures, which are developed based on different return moments (i.e. the Omega ratio, the Sharpe ratio and the modified Sharpe ratio), are considered in selecting an optimization criterion for the asset allocation. We find that, the Joe-Clayton pair-copula system provides a better way to capture the joint return upwards than the Student t system after the recent U.S. credit crunch. Moreover, the modified Sharpe ratio is suggested to be appropriate for the proposed asset allocation model.

CDS MARKETS AND FINANCIAL CONTAGION

Presenter: **GATKOWSKI, Mateusz**

Credit default swaps (CDS) which constitute up to 98% of credit derivatives have had a unique, endemic and pernicious role to play in the current financial crisis. However, there are few in depth empirical studies of the financial network interconnections among banks and between banks and non-banks. In this paper we present development of an network model of Credit default swaps market. We use data on CDS quotes of different financial institutions and sovereigns to investigate statistically contagion effect in financial markets. Our results confirm the contagion started in financial markets and spread into a real economy. With use of EWMA correlations, and Granger-casualty tests we are able to confirm that contagion spread from US Banks to US economy and then to a global economy.

The result shows that in such a network financial contagion spreads fast and potential bank failures can be devastating to whole system, which seems to not be fit for a purpose of surviving major crisis.

Keywords: Credit Default Swaps; Financial Contagion; Financial Networks; Correlation in Default Risk; Causality

Large-scale Agent-based Model of Financial Systems (Financial Contagion)

Presenter: **RAIS SHAGHAGHI, ALI**

Evidence in global financial system, about dynamics and its complex and interconnected nature, seem to be not easily understood in the traditional financial and economics modelling paradigm. Lack of quantitative modelling tools and complex structure of the financial system with many entities and dynamics within the system will need a more dynamic model to capture various complex aspects of the system resulting in a macro analyses.

The current research focuses on building a multi-component data-driven agent-based simulation framework focusing on aspects of integrating several simulation scenarios within the financial system and building individual components which are dependent to a database system. The research will mainly focus on two aspects, the financial and economic framework of the model and also a new approach towards building agent-based computational economics models (ACE) with focus on multi-sector aspects of the origins of the financial contagion from the sub-prime crisis in the US that can be traced back to the development of financial products such as Residential Mortgage Backed Securities (RMBS), Collateralized Mortgage/Debt Obligations (CM/DOs) and Credit Default Swaps (CDS).

Keywords: Agent-based Computational Economics (ACE), ABS, CDS, Large-scale Simulation, Complex Systems

Analysis of the Determinants of the iTraxx CDS Spreads using the Skewed Student's t AR-GARCH Model

Presenter: **CHU, YUAN-SUNG**

In this study, we discuss the linear relationship between the iTraxx Europe CDS index with its theoretical determinants for the period between 2004 and 2009. Regression analysis is also used to test the explanatory power of the theoretical determinants for the pre-crisis (2004-2007) period and the crisis period (2007-2009). Our finding is that firm's value and equity volatility have statistically significant explanatory power on the iTraxx CDS index in different period tests. The risk-free rate has limited explanatory power on the iTraxx index while the iTraxx Europe CDS index is volatile. Moreover, financial time series are known to be conditionally heteroskedastic, fat-tailed, and often skewed. We adopt the skewed Student's t AR-GARCH model to capture volatility clustering features in the iTraxx CDS market, and find out the AR-GARCH model with the skewed Student's t marginal density function is much more flexible than the standard (symmetric) AR-GARCH model.

Keywords: iTraxx; CDS; Credit default swap; AR-GARCH; Skewed Student's t distribution

The impact of the UK government bank bail out on the CDS of major UK banks

Presenter: **TAKEYAMA, Azusa**

This paper discusses how the credit risk of major UK banks is reflected in their CDS spreads. In particular it focuses on the recent financial crisis and the effects of the Lehman Brothers bankruptcy and the subsequent bail out by the UK government of two of the major UK banks. The first key part of the analysis is to derive the probability of default (PD) from listed stock options using the asymptotic expansion approach by Bayraktar and Yang (2009). In the second stage, the implied PD is then employed to obtain, from the market CDS spreads, the implied loss given default (LGD). The results show that the implied LGD for banks bailed out by the UK government fell to around 10% whilst their implied PD spiked up-to between 30%-40% on announcement of their bail out. The CDS spread for all major UK banks during this period remained stable at around 100bp-200bp and similar to non-financial companies. This illustrates that debt investors expected limited losses in the event of default for those banks bailed out by the government, whilst for those same banks the equity market implied a substantial PD even after the bail out.

Key words: asymptotic expansion, option pricing under credit risk, CDS spread, loss given default, bank bail out by government

ENHANCING CREDIT DEFAULT SWAPS PRICING WITH MESHFREE METHODS

Presenter: **GUARIN LOPEZ, Alexander**

In this paper we apply radial basis function (RBF) interpolation to numerically approximate both the zero-coupon bond price and the survival probability in order to price credit default swap (CDS) contracts. We assume that the interest rate follows a Cox-Ingersoll-Ross process while the intensity rate is modeled by a Black-Karasinski process. We run several experiments to compare approximations by RBF interpolation and finite difference methods (FDM). The experiments are implemented for one-factor and two-factor models, also allowing for correlation between factors. Our findings show that the RBF approach is computationally efficient and achieves more accurate and stable results than FDM. Furthermore, we found that CDS spreads show considerable differences between both approaches for two-factor models, which are bigger for instruments with a long maturity. Moreover, our results show that the correlation between factors does not have decisive effects on the CDS spreads.

Keywords: Intensity Models, Black-Karasinski Model, Radial Basis Function Interpolation, Finite Difference Methods, Meshfree Methods.