Anatomy of Trading and Liquidity in the Credit Default Swaps Market

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Abstract

Trading in the multi-trillion dollar credit default swaps (CDS) market has remained a mystery to most due to lack of available data. We propose to demystify this market by employing a unique data set of all trades with anonymized counterparty information at daily level from January 2007 to date of North American single-name CDS. In particular, we seek to explain for the CDS market the extent and nature of trading (by whom – dealer or buy-side players and how concentrated) and its liquidity measured in different ways using number of trades, volume, price dispersion and price impact. Our primary economic inquiry is to document and understand the time-series variation in CDS market liquidity, especially the change from prior to the crisis (pre-August 2007) to during the crisis, with a focus on significant events of stress to the CDS markets such as 9th August 2007 (money market "freeze"), 14th March 2008 (the collapse of Bear Stearns) and 15th September 2008 (Lehman Brothers' failure), and employing equity and bond market liquidity changes as controls for trading stress unrelated to the CDS markets.

Research Objectives

We seek to explain for the CDS market

- the extent of trading:
    - how many trades
    - how much volume
- the nature of trading
    - by whom (dealers or buy-side players)
    - how concentrated (do a handful of dealers dominate most of trading across almost all names?)
    - what kind of trades (new trades or assignments of existing trades)
    - whether there are "hot potatoes" in the CDS market (are new trades done by dealers then passed around through assignments from dealer to dealer)
- liquidity
    - measured in a variety of ways such as #trades, volume (and type of volume depending on trading counterparties), price dispersion, and price impact (the Amihud 2002 *ILLIQ* measure applied to CDS)
    - cross-sectional and time-series nature of CDS liquidity
- trading and liquidity in "stressed" environment of the crisis of 2007-09
    - comparing liquidity before and during the crisis
    - event-study type analysis of liquidity in the CDS market around key announcements and failures during the crisis, especially relative to effects around the same events on equity and bond markets: are there differential

(and higher) liquidity dislocations for the CDS market, and for which names (riskier, correlated to failing institutions, those where failing institutions held significant CDS exposures with other counterparties)?

Literature Review

While credit derivatives have been rightly acclaimed as the most successful financial innovation since the interest-rate swaps in terms of volumes traded, they are also likely to be associated with several difficult issues. While the risk-sharing benefits were claimed during the recession of 2001-02, like all forms of insurance, credit derivatives are subject to moral hazard (as pointed out in an early contribution by Duffee and Zhou, 2001) and asymmetric information (Acharya and Johnson, 2007). Recently, it has become clear however that *opacity* in trading infrastructure might also be an important dimension that contributes to these agency issues (Acharya and Bisin, 2009 and Acharya and Engle, 2009), and has led to calls for centralized clearing of such derivatives and whether that would necessarily be beneficial for these markets (Duffie and Zhu, 2009). Stulz (2009) provides an excellent synthesis of the benefits of the CDS markets and the potential concerns arising due to specific issues about how they are traded.

Most studies of CDS to date have focused on information transmission issues using data prior to 2005. Blanco, Brennan and Marsh (2005) report that for a sample of high-grade credits there is greater price discovery in the CDS market than in the bond market, although the reverse occurs as well. Norden and Weber (2004) study the co-movement of CDS, bond, and stock markets during 2000 to 2002. By and large, they provide similar evidence as Blanco et al. Longstaff, Mithal, and Neis (2005) examine weekly lead-lag relationships between CDS spread changes, corporate bond spreads and stock returns of US firms and find that both stock and CDS markets lead the corporate bond market. Acharya and Johnson (2007) document evidence that is consistent with insider trading by relationship banks revealing more information in CDS markets ahead of significant credit events, but find no evidence of such information effects adversely affecting liquidity, measured as bid-ask spreads (available in CreditTrade data *only* up to 2004).

To date however there is little detailed analysis of CDS market liquidity, especially during the stressed environment of the crisis of 2007-09. This has of course been due to lack of available data. Our access to DTCC and Markit datasets has put us in a uniquely fortunate position to provide such analysis that can provide factual basis for important policy decisions currently under way for the CDS markets.

Data requested (and now provided by DTCC and Markit)

Initially we would like to try our methods on a sample data set of 5 names. We have obtained this pilot data from DTCC and the preliminary results seem extremely promising in shedding light on operations of the CDS market. Counterparties are anonymized, but we have unique identifiers to link counterparties over time; counterparties are also segregated by “dealers” (who generally provide liquidity and trade on both sides) and “buy-side” (other players such as large hedge funds, insurance companies, etc.); finally, we also know if trades are “new” trades, “assignments” (of existing trades to new counterparties), and “exits” or “terminations”. We will be receiving soon the entire available history (pre-dating the crisis by at least six months, if not more) of trade-level data for all North American single names and indices. The academic papers will be based on the larger dataset.

Research Methods

Since part of the project describing trading in the CDS markets is largely descriptive, we focus on research methods pertaining to measurement and analysis of CDS liquidity.

The first task is to construct measures of liquidity in the CDS market. Standard approaches from the equity market based on volume, bid ask spread and price impact will have to be adapted to the CDS market. The Amihud (2002) measure which is the ratio of price change over a period divided by the turnover seems like a sensible first approach. Because we know trade direction, measures related to the VNET of Engle and Lange(2001) or regression based measures originated by Hasbrouck(1991) can be used. Others can follow. Interesting inputs might be trade/quote counts and other inputs specifically related to the structure of this asset class.

The second step is to model how liquidity varies over reference names and over time. Presumably it will be time varying and may correlate with liquidity measures in other markets. It will be important to discover whether liquidity on all names moves together with a dominant factor or whether there are multiple factors involved.

The third step is to analyze how liquidity was affected during the crisis. Several comparisons are of interest: liquidity on specific names in the cross-section; liquidity risk or in other words the time-varying nature of liquidity for CDS market as a whole and on individual names; liquidity before and during the crisis and around “stress” events (9th August 2007, 14th March 2008, 15th September 2008), and whether certain single names (for example, those correlated with failed financial institutions, and if data are made available as requested by us, those who were counterparties to the failed firms) were more affected around these times. In all of these comparisons, equity and bond market liquidity measures, constructed in similar way as that for CDS markets, would be employed as controls to trace out effects on liquidity that are specific to the CDS market.

Expected Form of Results

The first half of the paper will be primarily a descriptive presentation of anatomy of trading in the CDS market and measures of its liquidity.

The second half of the paper will comprise regression- and event-based analysis of time-varying and cross-sectional nature of CDS market liquidity.

We expect to have a preliminary draft of results in Fall 2009, a complete paper draft in Spring 2010, available for presentations starting Summer 2010.

Additional Future Projects

The availability of trade- and exposure-level data opens up room for addressing a variety of other questions pertaining to CDS markets that could not be asked thus far. We have simply listed our first idea for an academic paper based on this data. Some other topics of great interest to academics, practitioners and policy makers alike:

(1) Measurement of counterparty risk and its pricing in CDS markets (which we can analyze using our unique data).

(2) Effect on the CDS markets (trading, pricing, liquidity) of the “big bang” protocol of April 2009 which provided a centralized clearinghouse arrangement for index trades, eventually to be phased in for single-name products. In particular, is there evidence of centralized clearinghouse having reduced the counterparty risk externality (see Acharya and Bisin, 2009 and Acharya and Engle, 2009), by rendering prices more sensitive to counterparty exposure information?

(3) “Tail dependence” (or extreme correlations) between the equity, bond and CDS markets, and their dynamic pattern (pre- and post-crisis). This will employ methods based in Engle (2008).

References

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- Acharya, Viral V and Robert Engle (2009), “Derivatives Trades Should All Be Transparent”, *Wall Street Journal*, 15 May 2009.
- Acharya, Viral V and Timothy C Johnson (2007), “Insider Trading in Credit Derivatives”, *Journal of Financial Economics*, 84(1), 110-141.
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- Duffee, G. and C. Zhou (2001), “Credit Derivatives in Banking: Useful Tools for Managing Risk?” *Journal of Monetary Economics*, 48, 25–54.
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- Engle, Robert and Joe Lange (2001), “Predicting VNET, A Model of the Dynamics of Market Depth”, *Journal of Financial Markets, 4, 113-142*
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- Longstaff, Francis A., Sanjay Mithal and Eric Neis (2005), “Corporate Yield Spreads: Default Risk or Liquidity?” *Journal of Finance*.
- Stulz, Rene (2009), “Credit Derivatives and the Credit Crisis”, *Journal of Economic Perspectives*, forthcoming.

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General Indian, Born on 1st March 1974, Married

Education

Ph.D. Finance, Stern School of Business, New York University, 1996 – 2001
- Dissertation - "Essays in Banking and Financial Institutions"

Ph.D. Computer Science (Incomplete), New York University, 1995 – 1996
B. Tech. in Computer Science and Engineering, IIT Bombay, 1991 – 1995
- President of India Gold Medallist for the highest GPA among 350 students.
- President of India Gold Medallist for the best academic and overall proficiency.
- Ranked 5th all over India at IIT Joint Entrance Exam, 1991.

Academic Appointments

Initiative on Global Markets (IGM) Visitor (May 2009), University of Chicago, Booth School
Professor of Finance (2007-2009), London Business School
Visiting Professor of Finance (Winter 2007), Graduate School of Business, Stanford University
Associate Professor of Finance (2005-2006), London Business School
Assistant Professor of Finance (2001-2004), London Business School

Other Positions

- Research Associate of National Bureau of Economic Research (NBER) in Corporate Finance
- Research Affiliate, Center for Economic Policy Research (CEPR)
- Research Associate, European Corporate Governance Institute (ECGI)
- Research Associate of the European Member of the Research Advisory Board of the British Private Equity and Venture Capital Association (Fall 2008-)
- Academic Director, the Coller Institute of Private Equity at London Business School, 2007-09
- Academic Advisor to the Federal Reserve Bank of New York and Member of the Liquidity Working Group (Jan 2009-), Philadelphia (Jan 2009-) and Cleveland (May 2009)
- Senior Houblon Norman Fellow at the Bank of England (July-August 2008)
- Academic Advisor to the Bank of England (Dec 2004-June 2008)
- Visiting Scholar, International Monetary Fund, August 2006
- Member – American Finance Association, Western Finance Association, European Finance Association, Financial Intermediation Research Society, European Corporate Governance Institute, Society of Financial Econometrics (SoFiE), Volatility Institute

Editorship

- Editor – Journal of Financial Intermediation (2009-)
- Associate Editor – Management Science (2009-), Review of Finance (2006-), Review of Financial Studies (2005-2008), Journal of Financial Intermediation (2005-2008), International Journal of Central Banking (2004-2006), Journal of Financial Stability (2004-), Journal of Financial Services Research (2007-)

Awards

- Distinguished Referee Award from the Review of Financial Studies, 2009
- III Jaime Fernandez de Araoz Corporate Finance Award, 2009 – "The Internal Governance of Firms"
- Best Paper on Corporate Governance awarded by the European Corporate Governance Institute, 2008 – "Corporate Governance Externalities"
- Journal of Financial Economics Best Paper in Capital Markets and Asset Pricing, Second (Fama/DFA) Prize, 2007 – "Does Industry-wide Distress Affect Defaulted Firms? – Evidence from Creditor Recoveries"

- The “Rising Star in Finance” Award at the Inaugural Rising Stars Conference in Albany organized by Rennslear Polytechnic Institute (RPI), 2008.
- Citibank Best Paper Award at the Summer Research Conference organized by the Center for Analytical Finance (CAF) at Indian Business School, 2007 – “Bankruptcy Codes and Innovation”
- Second Runner-up Award for the Best Paper at the 13th Mitsui Life Symposium on "Value Creation: Financing and Organizing the Firm" at the University of Michigan, 2007 – “Bankruptcy Codes and Innovation”
- Journal of Financial Economics Best Paper for Capital Markets and Asset Pricing, First (Fama/DFA) Prize, 2005 – “Asset Pricing with Liquidity Risk”
- First recipient of the Lawrence G. Goldberg Prize for the Best Ph.D. in Financial Intermediation, 2005
- Outstanding Referee Award for the Review of Financial Studies, 2003
- NYSE Award for Best Paper on Equity Trading, WFA Meetings, 2003 - “Asset Pricing with Liquidity Risk.”
- Best Student Paper Award at FMA European Conference, 2001 - “Is the International Convergence of Capital Adequacy Regulation Desirable?”
- Journal of Financial Economics Best Paper for Corporate Finance and Organizations, First (Jensen) Prize, 2000 - “On the Optimality of Resetting Executive Options.”
- Lehman Brothers Fellowship for Excellence in Finance Research - First Prize, 2000 (Awarded to a graduating student across MIT, Harvard, NYU, Columbia, Wharton, and Chicago) - “A Theory of Systemic Risk and Design of Prudential Bank Regulation.”
- L. Glucksman Institute Research Awards, NYU - First Prize (2002-2003, 1998-1999), Second Prize (2000-2001), and CDC Working Paper Awards, NYU - First Prize, 2003, 2000, 1999
- Harold W. MacDowell Award for Outstanding Achievement in Doctoral Program, Stern School of Business, NYU, 2001

Research

Areas of Interest

- Banking – Liquidity, Crises, Systemic Risk, Regulation, Diversification of Loan Portfolios.
- Corporate Finance – Cash Management, Incentive Compensation, Bankruptcy Systems, Private Equity and Corporate Governance.
- Asset Pricing – Causes and Effects of Liquidity Risk, Disclosure and Insider Trading.
- Valuation and Hedging of Corporate Debt and Credit Derivatives.
- International Finance – Law, Innovation, Growth and Crises.
- General Equilibrium – Agency and Default.

Publications

- “A Theory of Systemic Risk and Design of Prudential Bank Regulation”, *Journal of Financial Stability,* 5(3), 2009, 224-255.
- “Bankruptcy Codes and Innovation” with Krishnamurthy Subramanian, *forthcoming, Review of Financial Studies*.
    - “Bankruptcy Codes and Innovation: A Model” with Krishnamurthy Subramanian, theoretical appendix to the above paper, online at *Review of Financial Studies*.
- “Managerial Hedging, Equity Ownership, and Firm Value” with Alberto Bisin, *forthcoming, Rand Journal of Economics.*
- “Corporate Governance Externalities” with Paolo Volpin, *forthcoming, Review of Finance.*
- “Private Equity versus Plc Boards in the U.K.: A Comparison of Practices and Effectiveness” with Conor Kehoe and Michael Reyner, *Journal of Applied Corporate Finance,* 21(1), 2009, 45-56.
- “Cash-in-the-Market Pricing and Optimal Resolution of Bank Failures,” with Tanju Yorulmazer, *Review of Financial Studies*, 21, 2008, 2705-2742.
- “Information Contagion and Bank Herding” with Tanju Yorulmazer, *Journal of Money, Credit and Banking,* 40(1), 2008, 215-31.
- “Is Cash Negative Debt? – A Hedging Perspective on Corporate Financial Policies” with Heitor Almeida and Murillo Campello, *Journal of Financial Intermediation,* 16(4), 2007, 515-554.

- “Does Industry-wide Distress Affect Defaulted Firms? - Evidence from Creditor Recoveries,” with Sreedhar Bharath and Anand Srinivasan, *Journal of Financial Economics,* 85(3), 2007, 787-821.
- “Too-Many-To-Fail – An Analysis of Time-inconsistency in Bank Closure Policies,” with Tanju Yorulmazer, *Journal of Financial Intermediation*, 16(1), 2007, 1-31 (lead article).
- “Insider Trading in Credit Derivatives,” with Timothy Johnson, *Journal of Financial Economics,* 84(1), 2007, 110-141.
- “Private Equity: Boom and Bust?” with Julian Franks and Henri Servaes, *Journal of Applied Corporate Finance,* 19(4), Fall 2007, 44-53.
- “When Does Strategic Debt-Service Affect Debt Spreads?” with Jing-zhi Huang, Marti G. Subrahmanyam, and Rangarajan K. Sundaram, *Economic Theory,* Feb 2006, 1–16.
- “Should Banks Be Diversified? Evidence from Individual Bank Loan Portfolios," with Anthony Saunders and Iftekhar Hasan, *Journal of Business*, May 2006, 79(3), 1355-1412.
- “Optimal Financial-Market Integration and Security Design,” with Alberto Bisin, *Journal of Business*, 78(6), 2006, 2397-2433.
- “Asset Pricing with Liquidity Risk," with Lasse Pedersen, *Journal of Financial Economics*, 77(2), 2005, 375-410.
- “Is the International Convergence of Capital Adequacy Regulation Desirable?" *Journal of Finance*, 58(6), 2003, 2745-2781.
- “Corporate Bond Valuation and Hedging with Stochastic Interest Rates and Endogenous Bankruptcy,” *Review of Financial Studies,* 15(5), 2002, 1355-1383 with Jennifer N. Carpenter.
- “Pricing Credit Derivatives with Rating Transitions,” *Financial Analysts Journal*, 58(3), 2002, 28-44, with Sanjiv R. Das and Rangarajan K. Sundaram.
- “On the Optimality of Resetting Executive Stock Options,” *Journal of Financial Economics*, 57(1), 2000, 65-101, with Kose John and Rangarajan K. Sundaram.

Working Papers

- “Precautionary Hoarding of Liquidity and Inter-Bank Markets: Evidence from the Sub-prime Crisis” with Ouarda Merrouche.
- “The Internal Governance of Firms” with Stewart Myers and Raghuram Rajan.
- “Imperfect Competition in the Inter-Bank Market for Liquidity as a Rationale for Central Banking” with Denis Gromb and Tanju Yorulmazer.
- “Rollover Risk and Market Freezes” with Douglas Gale and Tanju Yorulmazer.
- “Limits to Arbitrage and Hedging: Evidence from Commodity Markets” with Lars Lochstoer and Tarun Ramadorai *(submitted)*.
- “A Theory of Slow-Moving Capital and Contagion” with Hyun-Song Shin and Tanju Yorulmazer *(submitted)*.
- “Corporate Governance and Value Creation: Evidence from Private Equity” with Moritz Hahn and Conor Kehoe *(submitted)*.
- “Labor Laws and Innovation” with Ramin Baghai-Wadji and Krishnamurthy Subramanian *(submitted).*
- “Cash Holdings and Credit Risk” with Sergei Davydenko and Ilya Strebulaev.
- “Leverage, Moral Hazard and Liquidity”, with S. (Vish) Viswanathan *(being revised for resubmission).*
- “Liquidity Risk and Correlation Risk: A Clinical Study of the General Motors and Ford Downgrade of 2005” with Stephen Schaefer and Yili Zhang.
- “Finance and Efficiency: Do Bank Branching Regulations Matter?” with Jean Imbs and Jason Sturgess *(submitted).*
- “Fire-sale FDI” with Hyun-Song Shin and Tanju Yorulmazer *(submitted).*
- “Endogenous Information Flows and the Clustering of Announcements” with Peter DeMarzo and Ilan Kremer *(being revised for resubmission).*
- “More Insiders, More Insider Trading: Evidence from Private Equity Buyouts” with Timothy Johnson *(resubmitted).*
- “Creditor Rights and Corporate Risk-taking” with Yakov Amihud and Lubomir Litov *(being revised for third resubmission).*

- "Crisis Resolution and Bank Liquidity" with Hyun-Song Shin and Tanju Yorulmazer *(resubmitted).*
- "Cross-country Variations in Capital Structure: The Effect of Bankruptcy Codes," with Kose John and Rangarajan K. Sundaram *(resubmitted).*

Work in Progress

- "Securitization *without* Risk Transfer" with Philipp Schnabl and Gustavo Suarez.
- "Regulating Systemic Risk" with Ashley Lester, Lasse Pedersen, Thomas Philippon and Matthew Richardson.
- "Dividends and Bank Capital in the Financial Crisis of 2007-09" with Irvind Gujral and Hyun-Song Shin.
- "Centralized versus Over-the-counter Markets" with Alberto Bisin.
- "Liquidity Risk of Corporate Bond Returns" with Yakov Amihud and Sreedhar Bharath.
- "Corporate Governance and Incentive Compensation" with Marc Gabarro and Paolo Volpin.
- "Seeking Alpha: Excess Risk Taking and Competition for Managerial Talent" with Marco Pagano and Paolo Volpin.
- "Seeds of a Crisis: A Theory of Bank Liquidity and Risk Taking over the Business Cycle" with Hassan Naqvi.
- "Is the Inter-Bank Market Special?" with Ouarda Merrouche and Lev Retnvoski.
- "Financial Innovation, Risk Transfer and Financial Stability" with Hyun-Song Shin.
- "Lines of Credit versus Cash: The Role of Systematic Risk" with Heitor Almeida and Murillo Campello.
- "Counterparty Risk, Collateral and Liquidity" with Erlend Nier and Robert Ritz.

Book and Short Articles on the Crisis of 2007-09

- *"Restoring Financial Stability: How to Repair a Failed System" – An Independent View from New York University Stern School of Business, Viral V. Acharya and Matthew Richardson, editors, New York University Stern School of Business, (c) John Wiley & Sons, March 2009.*
  My articles featured in the book:
  - "Prologue: A Bird's Eye View – The Financial Crisis of 2007-09: Causes and Remedies", with Thomas Philippon, Matthew Richardson and Nouriel Roubini.
  - "How Banks Played the Leverage *Game*" with Philipp Schnabl.
  - "Governance, Incentives and Fair Value Accounting – Overview", with Raghu Sundaram.
  - "Corporate Governance in the Modern Financial Sector" with Jennifer Carpenter, Xavier Gabaix, Kose John, Matthew Richardson, Marti Subrahmanyam, Rangarajan Sundaram and Eitan Zemel.
  - "Derivatives, Short-selling and Transparency – Overview".
  - "Derivatives – The Ultimate Financial Innovation" with Menachem Brenner, Robert Engle, Anthony Lynch and Matthew Richardson.
  - "Centralized Clearing for Credit Derivatives" with Robert Engle, Stephen Figlewski, Anthony Lynch and Marti Subrahmanyam.
  - "Regulating Systemic Risk" with Lasse Pedersen, Thomas Philippon and Matthew Richardson.
  - "Private Lessons for Public Banking: The Case for Conditionality in LOLR Facilities" with David Backus.
  - "The Financial Sector *Bailout*: Sowing the Seeds of the Next Crisis?" with Raghu Sundaram.
  - "International Alignment of Financial Sector Regulation" with Paul Wachtel and Ingo Walter.
- *"The Financial Crisis of 2007-09: Causes and Remedies", Viral V. Acharya and Matthew Richardson, editors, New York University Salomon Center Series on Financial Markets, Institutions and Instruments, (c) Blackwell, March 2009*
  - Overview and Executive Summaries of articles in the book *"Restoring Financial Stability: How to Repair a Failed System"*

- "Causes of the Financial Crisis" with Matthew Richardson, 2009, *Critical Review*, 21(2–3): 195–210.
- "Capital Budgeting at Banks: The Role of Government Guarantees", with Julian Franks, prepared as part of assignment with Knight Vinke Asset Management, published in various versions in *The Banker (February 2009), QFinance, voxeu.org, Agenda - Advancing Economics in Business, London Business School's Business Strategy Review and Alumni magazine.*

Invited Articles, Overviews and Presentations

- "Systemic Risk and Deposit Insurance Premium" with Joao Santos and Tanju Yorulmazer, *forthcoming, Economic Policy Review, Federal Reserve Bank of New York.*
- "How to Charge for Deposit Insurance", 2009, *Lombard Street*, 1(7), 18-23.
- "Dividends and Bank Capital in the Financial Crisis of 2007-2009", Presentation to Liquidity Working Group of the Federal Reserve Bank of New York, April 2009.
- "Restoring Financial Stability: How to Repair a Failed System", Presentations at Baruch College, NYU-Stern, Bank of England, Banque de France, International Monetary Fund, The Growth Commission Workshop at Harvard, World Bank, Journal of Financial Intermediation Conference on the Financial Crisis in Barcelona, the CFA Society of the UK, Bank of Finland, Helsinki School of Economics, Bank for International Settlements, London School of Economics, March-July 2009.
- "Credit Derivatives: Some Puzzling Facts", BNP Paribas Center, HEC Paris, March 2009.
- "The Voice of Experience: Public versus Private Equity", with Conor Kehoe and Michael Reyner, in *The McKinsey Quarterly*, Spring 2009.
- "Corporate Governance and Value Creation: Evidence from Private Equity", Presentation to the HM Treasury Group and Regulators for Pensions and Financial Reporting, November 2007, November 2008.
- "Private Equity and Hedge Funds: The Changing Face of Corporate Governance", Presentation to the HM Treasury Group and London Business School Governance Center, October 2006, to Freshfields Private Equity Group, December 2006.
- "Liquidity, Liquidity Risk and Credit Spreads: Some Open Questions," for The Third Annual Credit Risk Conference organized by Moody's and Stern School of Business, New York University, May 16-17, 2006.
- "Understanding and Managing Correlation Risk and Liquidity Risk," with Stephen Schaefer, *International Financial Risk Institute (IFRI) Roundtable*, 29-30 September 2005, *CREDIT Conference in Venice*, September 2006, *RISK Magazine's Credit Risk Summit (Europe)*, 2-3 October 2006.
- "Should Banks Be Diversified? Evidence from Individual Bank Loan Portfolios," *Proceedings of the Federal Reserve Bank of Chicago Conference on Bank Structure and Competition*, 2002, with Anthony Saunders and Iftekhar Hasan.
- "Competition amongst Banks, Capital Requirements, and International Spillovers," *Economic Notes*, 30(3), 2001, 337-358.

Teaching

- Credit Risk, Executive Education to S&P.
  Summer 2009 – Teaching rating:
- Credit Risk, Full-time MBA and Langone (Part-time MBA) elective, NYU Stern.
  Spring 2009 – Teaching rating: 6.0/7.0
- Credit Risk, MBA/Masters in Finance Elective, LBS (with Stephen Schaefer).
  Summer 2008 – Teaching rating: 4.66/5.00, Summer 2007 – Teaching rating: 4.39/5.00
- Corporate Finance and Valuation, Masters in Finance Core, LBS.
  Fall 2006, 2005, 2004, 2003, 2002, Average teaching rating: 4.20/5.00
  Summer 2004 [Indian School of Business], Teaching rating: 6.28/7.00
- Options and Futures, MBA/Masters in Finance Elective, LBS.
  Fall 2006, 2005, 2004, Spring 2004, 2003, 2002, Average teaching rating: 4.13/5.00
  Fall 2003 [Indian School of Business], Teaching rating: 6.65/7.00
  Fall 1999, Spring 1999 [NYU], Average teaching rating: 6.32/7.00

Teaching Awards

- Runner-up for Best Teacher in Masters in Finance programme at London Business School, 2006-07.

Grants

- Europlace de Finance, 2008.
- BSI Gamma Foundation, 2008.
- Global Association of Risk Professionals (GARP) grant, 2008.
- Senior Houblon Norman Fellowship at the Bank of England, July-August 2008.
- INQUIRE Europe grant, 2007-08.
- Leverhulme Trust Fellowship, 2007-08.
- Fondation Banque de France Grant, 2008, 2005, 2004.
- Research & Materials Development Grant, London Business School, 2008, 2007, 2006, 2005, 2003, 2001.
- INQUIRE, UK, 2002.

Refereeing

- Econometrica, American Economic Review, Journal of Political Economy, Review of Economic Studies, Rand Journal of Economics, Journal of Economic Theory, International Economic Review, Journal of Law, Economics and Organization, Journal of Finance, Journal of Financial Economics, Review of Financial Studies, Management Science, Journal of Financial and Quantitative Analysis, Journal of Banking and Finance, Journal of Financial Intermediation, Review of Finance, Journal of Money, Credit and Banking, International Journal of Central Banking, Journal of Financial Stability, Journal of International Economics, The B.E. Journals in Theoretical Economics, Review of Derivatives Research, Mathematical Finance, Journal of Derivatives, Journal of Financial Services Research, Bank of England Working Papers, Economic Theory, European Economic Review, Journal of the European Economic Association, Economic Notes.
- Expert Panelist for European Research Council (ERC)'s Advanced Grant Evaluation, 2008, 2009 (remote).
- Reviews of NSF, ESRC and Candian Research Council Grant Proposals.
- Book review of "Credit Risk – Pricing, Measurement, and Management" by Darrell Duffie and Kenneth J. Singleton, for Economica, 2004.
- Scientific Committee –Annual Credit Risk Conference organized by Moody's and London Business School, 2008, 2005, CREDIT Conference (Venice), 2009, 2008, 2006.
- Program Committee – AFA, 2008, WFA, 2006-2009, EFA, 2002-2008, Financial Intermediation Research Society – 2004-2009, Corporate Finance of Financial Intermediaries (Wharton) – 2006, FMA – 2008, Indian School of Business Summer Conference, 2007-09, UniCredit Conference on Risk Transfer.

Discussions

- Carnegie-Rochester Public Policy Conference, April 2009.
- Econometric Society – 2006, AFA – 2008, 2007, 2003, WFA – 2008, 2005, 1999-2002, EFA – 1999-2003.
- NBER Summer Institute for Corporate Finance, 2008, 2006, 2002; NBER Corporate Finance – 2002.
- NYU-Penn Conference on "Law and Finance", February 2006.
- Liquidity Conference at Federal Reserve Bank of New York, October 2005.
- Financial Intermediation Research Society Meetings – May 2004, Capri.
- Conference on "Liquidity Concepts and Financial Instabilities," June 2003, Eltville.

Presentations (Summer 2008-)

- Organizer and presenter at the "Short-term Debt and Asset Prices" session at Gerzensee (2009), NBER Market Institutions and Financial Market Risk, London School of Economics, Western Finance Association Meetings 2009, Bank for International Settlements (Basel), Bank of Finland, Helsinki School of Economics, Euronext Conference in Amsterdam, CFA Society of the UK, University of Binghamton, Tuck Business School, JFI Conference on the Financial Crisis, World Bank, Growth Commission Workshop, International Monetary Fund, Bank of England, Banque de France, Federal Reserve Bank of Philadelphia, NYU-Economics, Baruch College, NYU Law and Finance Symposium, Federal Reserve Bank of New York Conference on Liquidity, Carnegie Mellon, Cornell, NYU-Stern, World Bank, BSI Gamma Foundation, Oesterreichische Nationalbank, RISK Capital 2008, Western Finance Association Meetings 2008, Said Business School – Oxford, Credit and Financial Risk Management Conference (Florence), Toulouse, London Business School Private Equity Symposium, Lehman Brothers, Federal Reserve Bank of New York and Columbia GSB Conference on Money Markets, London School of Economics, Brunel University Conference on Financial Economics, Moody's/NYU Fifth Annual Conference on Advances in Credit Risk.

Press Coverage

- Sloan Management Review, 15 March 2009, coverage of *"Labor Laws and Innovation"*.
- Huffington Post, *Stress Tests: It Might Have Been Different if Fed had Restricted Dividends,* 8 May 2009, coverage of *"Dividends and Bank Capital in the Financial Crisis of 2007-2009"*
- Opeds and interviews: Newsweek, *Do Bankers Deserve Bonuses?* 17 July 2009; QFinance, *Regulation after the Crash* (with Julian Franks), May 2009; Wall Street Journal, *Derivatives Trades Should All Be Transparent* (with Robert Engle), 15 May 2009; CNBC.com, *What will the Stress Tests tell us?* (with Matt Richardson and Nouriel Roubini), 7 May 2009; FT, *Concorde's Fate Offers a Lesson for Finance,* 15 April 2009; www.voxeu.org, *Amidst Crisis, Banks Are Still Paying Dividends,* March 2009 (with Irvind Gujral and Hyun Shin); www.voxeu.org and US Exchequer, *Repairing a Failed System,* February-March 2009 (with Matt Richardson); Forbes.com, *Expect More Shadow Banking Losses,* 3 February 2009 (with Philipp Schnabl); The Banker, *Why Government Guarantees are a Double-edged Sword,* February 2009 (with Julian Franks); FT.com (The Economists' Forum), *Government money should have strings attached* (with Dave Backus and Raghu Sundaram), 6 January 2009; Forbes.com, *Time to lift the veil: A clearinghouse for credit derivatives trading* (with Marti Subrahmanyam), 12 November 2008; www.voxeu.org, *The other part of the bailout: Pricing and evaluating the US and the UK loan guarantees* (with Raghu Sundaram), 26 Oct 2008; FT.com (The Economists' Forum), *Getting healthy banks to acquire troubled ones,* 13 Oct 2008.
- Financial Week, *Is Obama Just Bluffing on Banks?,* 2 March 2009; Financial Week, *The Real Reason Investors Dislike TARP 2.0,* 12 February 2009; Finance Asia, *HSBC's woes mount,* 20 January 2009; Bloomberg, *Fed Pledges Exceed $7.4 Trillion to Ease Frozen Company Credit,* 24 November 2008.
- Spectator Business, 1 January 2009, *Capital Breakdown;* The Times, 28 October 2008, *Management Briefing: Private Equity;* Retail Banking Insider, August 2008, *Private Equity Poised to Swoop on Banks;* Harvard Political Review, Spring 2008, *Golden Geese: Sovereign Wealth Funds and Private Equity are here to stay*; Financial News, 23 June 2008, *Operating Partners Brought in to Boost Performance;* Private Equity News, 23 June 2008, *Operating Partners Earn Their Stripe.*
- London Business School's *Business Strategy Review,* Autumn 2008 – *Risky Business;* London Business School's *Insight* magazine, Spring 2008 – *The Sub-prime Smoke Shield*; Herald Tribune, 31 January 2008, *Changes for banks? U.K. overhaul aimed at curbing runs;* FEM Business on the current financial crisis which ran in August; Quoted in *"Rate cut calls miss the point after prolonged market change"* in Financial Times, 27 August 2007**.**
- Wall Street Journal, 22 January 2008, *The M&A Boom: The Biggest for Insider Trading?;* Washington Post, 17 January 2008, *Throw Out the Inside Traders;* CFA Society of the UK, June 2008, Interview with Bloomberg TV, featured in *Special on Insider Trading,* July 2007.
- Articles in International Herald Tribune and L'Agefi on default credit swaps which ran in May 2007, Bloomberg, 17 October 2006, *Credit-Default Swaps Raise Insider Trading Concerns,*

Wall Street Journal, 31 August 2006, *Can anyone police the swaps?*, FT.com, 29 May 2005, *Banks scrutinised in credit default swaps market*, Financial Times, Front Page – First Section, 30 May 2005, *Insider trade fears in swaps market*, and in IDD, IFR, Dow Jones UK Wire.

- Financial Times – Mastering Financial Management, June 2006, *Managing the Risks of Liquidity and Correlation* (with Stephen Schaefer), Economic and Political Weekly, India, January 2006, *Liquidity Risk: Causes, Consequences and Implications for Risk Management.*

Consulting

- Pershing Square Capital Management, 2009.
- Knight Vinke Asset Management, 2008-09.
- International Financial Risk Institute – Research paper on “Changing Correlations and Liquidity: Causes and Implications for Financial Institutions”, September 2005.
- Industrial Credit and Investment Corporation of India (ICICI Bank) - Credit Risk, 2002-3.
- Institute for Financial Management and Research/Academy for Management Excellence (IFMR/ACME), India - Design of Post-Graduate Program in Quantitative Finance, 2003-4.
- J. P. Morgan Equity Derivatives Research, New York, Summer 1997 - Developed a Monte Carlo valuation of complex derivative products, based on quasi-random sequences and Brownian Bridge technique, documented in technical mimeo “Hybrid Quasi-Monte Carlo Methods for Valuation,” with Julia Chislenko, Jonathan Goodman and Arnon Levy.

Hobbies

- Singing and composing (Indian semi-classical), Poetry, Cricket, Tennis, Running, Traveling.
- Founding Member and Chairman (2003-2007) of PrathamUK, the UK chapter of Pratham, an Indian NGO providing pre-primary and primary education to underprivileged children in India (www.pratham.org), 2003-. Chapters have to date raised over £2mln.
- Founding Member and President of PrathamUSA, the NY/NJ chapter of Pratham, 1998-2001.
- Boardmember, GIVE (Giving Impetus to Voluntary Effort) – UK, 2003-Current.

Non-academic Awards

- Asian Achievers’ Award for Community Service, 2006, awarded by Asian Voice and Gujarat Samachar in UK.
- Short-listed in the final seven for the “Young Philanthropist” Award of Beacon Fellowships in the UK, 2004-05, 2005-06.

References

• Professor Franklin Allen	(1) 215 898-3629	allenf@wharton.upenn.edu
• Professor Peter DeMarzo	(1) 650 736-1082	pdemarzo@stanford.edu
• Professor Darrell J Duffie	(1) 650 723-1976	duffie@stanford.edu
• Professor Raghuram G. Rajan	(1) 202 623-8977	raghuram.rajan@chicagogsb.edu

ROBERT F. ENGLE
CURRICULUM VITAE

NOBEL PRIZE FOR ECONOMICS 2003

January 28, 2008

BRIEF BIOGRAPHY

Robert Engle, the Michael Armellino Professor of Finance at New York University Stern School of Business, was awarded the 2003 Nobel Prize in Economics for his research on the concept of autoregressive conditional heteroskedasticity (ARCH). He developed this method for statistical modeling of time-varying volatility and demonstrated that these techniques accurately capture the properties of many time series. Professor Engle shared the prize with Clive W. J. Granger of the University of California at San Diego.

Professor Engle is an expert in time series analysis with a long-standing interest in the analysis of financial markets. His ARCH model and its generalizations have become indispensable tools not only for researchers, but also for analysts of financial markets, who use them in asset pricing and in evaluating portfolio risk. His research has also produced such innovative statistical methods as cointegration, common features, autoregressive conditional duration (ACD), CAViaR and now dynamic conditional correlation (DCC) models.

Before joining NYU Stern in 2000, Professor Engle was Chancellor's Associates Professor and Economics Department Chair at the University of California, San Diego, and Associate Professor of Economics at the Massachusetts Institute of Technology.

He received his bachelor of science in physics from Williams College and his master of science in physics and doctor of philosophy in economics from Cornell University. Born in Syracuse, NY ,he grew up in Media, Pennsylvania, spent 25 years in San Diego, and now lives in New York.

BUSINESS ADDRESS

New York University
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Tel: 212-998-0710, Asst: -0702
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http://www.stern.nyu.edu/~rengle
Email: rengle@stern.nyu.edu

EDUCATION

Ph.D., Economics, Cornell University, 1969
M.S., Physics, Cornell University, 1966
B.S., Williams College, 1964, with Highest Honors in Physics

ACADEMIC POSITIONS

Michael Armellino Professor in the Management of Financial Services, NYU Stern School of Business, 2000-
Professor, Department of Finance, Stern School of Business, New York University, 1999.
Emeritus Professor and Distinguished Research Professor, University of California, San Diego, 2003
Chair, University of California, San Diego, 1990 - 1994.
Chancellors' Associates Chair in Economics, 1993 -
Professor, University of California, San Diego, 1977
Associate Professor, University of California, San Diego, 1975-1977.
Associate Professor, Massachusetts Institute of Technology, 1975.
Assistant Professor, Massachusetts Institute of Technology, 1969-1974.

HONORS and AWARDS

Member, World Economic Forum, 2007
Member, National Academy of Sciences, 2006
Fellow of the Institute for Quantitative Research in Finance, 2006
Doctorate Honoris Causis, HEC, Paris, France, 2005
Doctorate Honoris Causis, Université de Savoie, France, 2005
Nobel Prize for Economics, 2003
Doctorate Honoris Causis, University of Southern Switzerland, 2003
Fellow, American Finance Association, 2004
Fellow, American Academy of Arts and Sciences, 1995
Fellow, American Statistical Association, 2000
Fellow, the Econometric Society, 1981

HONORARY LECTURES

- Pareto Lecture, Annual Meeting of ASSET, Istanbul, 1995
- Frank Paish Lecture, Annual Meeting of the Royal Economic Society, Swansea 1996
- Fisher Schultz Lecture, European Meeting of the Econometric Society, Istanbul 1996
- A.W. Phillips Lecture, Australasian Meetings of the Econometric Society, Melbourne, 1997
- Lecture Series, Academica Sinica, Taiwan, 2000
- Journal of Applied Econometrics Lecture Series, Cambridge, England, 2001.
- Lecture Series, Finnish Statistical Association Meeting, Vassa, Finland, 2001
- Conference Honoree and Keynote Address, "International Conference on Modeling and Forecasting Financial Volatility", Perth, Australia, 2001
- Fields Lecture, University of Toronto, 2001
- Nobel Lecture, Stockholm, 2003
- Econometric Institute/Princeton University Press lecture series at Erasmus University, 2003.
- Joint lunch of the AEA/AFA Annual Meeting, Philadelphia, 2004
- "Cutting Edge Innovations and Derivatives", *Credit Suisse First Boston First Annual Meeting*, March 2005

- Lecture: "A Simple GARCH Approach to Default Correlations", *International Association of Financial Engineers*. New York, NY: March 2, 2005
- Lecture on "Downside Risk: Implications for Financial Management", *the Czech National Bank, Czech Economic Society and CERGE-EI*. March 17, 2005.
- Public Lecture: Budapest Collegiums, "Downside Risk: Implications for Financial Management", *European Cultural Foundation*. March 23, 2005.
- Presentation on "Testing and Valuing Dynamic Correlations for Asset Allocation", *Research Conference for Corporate Associates*. Stern School of Business – NYU. April 2005
- "Dean's Roundtable Luncheon", *Stern Executive Board*, Stern School of Business - NYU. April 5th, 2005
- Lecture: *Citigroup Conference*, April 6th, 2005
- Federal Reserve System's Fourth Annual Community Affairs Research: *Federal Reserve Bank of New York*, April 8th, 2005
- "Statistics Day", *University of Maryland Conference on Statistics*. April 15th, 2005
- "Stern Scholar in the Parlor", Hosted by Leonard Stern, Stern School of Business. April 20th, 2005
- Paper presentation on Microstructure, *National Bureau of Economic*. Cambridge, MA – May 6, 2005.
- Keynote Speaker, *Morgan Stanley Equity Market Microstructure Research Conference*. May 12th-13th, 2005
- Induction Ceremony Key Note Speaker, *Penncrest High school*, May 18th, 2005
- *Financial Econometrics Conference*, University of Montreal, May 19th, 2005
- Lecture on "Frontiers in Time Series Analysis", *Journal of Applied Econometrics Annual Conference*, Sardinia, Italy. May 29-31, 2005.
- Lecture: *Changing Structures in International and Financial Market ant the Effects on Financial Decision Making*, Venice, Italy. June 2nd and 3rd, 2005.
- "MBS and Credit Derivatives – The Recent Development", *13th annual PBFAE Conference* - Rutgers University, New Brunswick. June 10, 2006.
- Chair Speaker, *Econometrics Society World Congress*, London, England. August 2005.
- Key Note Speaker, *International Conference on Finance*, University of Copenhagen, Denmark. September 2005
- "Downside Risk – Econometric Models and Financial Implications", *ASTIN – AFIR Conference*, Zurich, Switzerland. September 2005
- Opening Address: "The Spline GARCH Model for Unconditional Volatility and its Global Macroeconomic Causes", *Statistical and Applied Mathematical Sciences Institute Conference*. Duke University, North Carolina. September 2005
- *Stern Honors Society Lecture*, Stern School of Business – New York University. November 3, 2005.
- Hedge Fund Lecture Principal Speaker on "Measuring Downside Risk": *IXIS - NYU Banking Conference Series on Hedge Funds*. September 2005.
- Keynote Speaker: "Underlying Dynamics of Credit Correlations", *Risk Magazine Quant Congress*, New York, NY. November 8, 2005.
- "A Brief History of Time", *Economics Roundtable for University of California, San Diego*. August 2005.
- Public Lectures at *Chongquing University, Wuhan University, Huanzang University, National Taiwan University, TABF Inauguration, NBER Trio Conference, Tokyo University.* December 2005
- Keynote speaker "Allied Social Science Associations Annual Convention, KUU Conference, *American Economic Association*. Boston, MA. January 6-8, 2006.
- Host, *Monday Quantitative Finance & Econometrics Seminars*: Stern School of Business – NYU. On-going
- Lecture and Workshop on "Execution Risk", *University of Toronto.* Feb. 17-19, 2006.
- Will Mann Richardson Lectureship, *Austin College.* March 3-5, 2006.
- Speaker: "Financial Volatility – Causes, Consequences, and Global Patterns", *Midwest Economics Association, Chicago.* March 24-25, 2006.

- Speaker: "Downside Risk and its Implications for Financial Management", *Q-Group Conference – Institute for Quantitative Research in Finance, West Palm Beach, Florida.* March 31-April 3, 2006.
- Edmund R. Mechalik Distinguished Lecture in the Mathematical Sciences, "Global Volatility: It's Measurement, Interpretation, and Causes", *University of Pittsburgh.* April 7-9, 2006.
- Bloomberg TV Interview, "Downside Risk". May 31, 2006
- Lecture on "Execution Risk", Paris Microstructure. June 6, 2006
- Lecture, Hautes Etudes Commerciales, Universite de Lausanne. June 8, 2006
- Speaker, INSEAD - Paris, France. June 9, 2006
- Speaker, International Symposium on Forecasting – Santander, Spain. June 12, 2006
- Lecture on "Global Financial Volatility", Lindau Foundation – Germany. Aug. 16, 2006
- Lecture, University of Florence. Sept. 15, 2006
- Lecture on "Measuring and Modeling Execution Cost and Risk", Time Series Conference – Montreal, Quebec. Sept. 29, 2006
- "History of Finance" Internet Interview for American Finance Association. Oct. 2006
- Keynote speech, Ukrainian National University – Kiev, Ukraine. Oct. 13, 2006
- Lecture, Econometrics Conference – Yale University, New Haven, Connecticut. Dec. 2, 2006
- Panel Presenter, World Economic Forum – Davos, Switzerland. January 2007
- Lecture on "Execution Risk", Morgan Stanley Conference – London School of Economics, London. Jan. 30, 2007
- Lecture on "Anticipating Correlations", Manchester Business School – Manchester, UK. Jan. 31, 2007
- Speaker, "Global Financial Volatility", Swiss National Bank – Zurich. Feb. 2, 2007
- Speaker, "Global Financial Volatility", European Central Bank – Frankfurt. Feb. 5, 2007
- Public Lecture at University of Technology Sydney, Australia. April 12, 2007
- Speaker, Inaugural Rady School Finance Conference. May 2007
- Lecture on "Global Financial Volatility" Chancellor's Distinguished Lecture Series at University of California-Riverside. May 2007
- Speaker, "Volatility, Downside Risk, Portfolio Models, and VAR" - Distinguished Lecture Series at KAIST Graduate School of Finance-Seoul, South Korea
- Keynote Speaker for the Conference 2007 International Symposium on Financial Engineering and Risk Management (FERM2007), Beijing 11-12 June 2007
- Invited talk "DECO: Dynamic Equicorrelation Models for Large Correlation Matrices" at the 2007 European meeting of the Econometric Society at Budapest, Hungary. August 2007
- Keynote Speaker, Journal of Investment Management Conference Series - Boston, MA. September 2007
- Lecture, "Vector Multiplicative Error Models: Representation and Inference" Princeton Conference on Likelihood Methods – Princeton, NJ. October 2007
- Keynote Address and Official Opening Remarks for the FMA 2007 Annual Meeting - Orlando, FLA. October 17, 2007
- Keynote Speaker at the Multivariate Volatility Models Conference in Faro, Portugal. October 26, 2007
- Master Lecture at Foundation Rafael Del Pino – Madrid, Spain. October 29, 2007
- Public Lecture at Universidad Carlos III in Madrid, Spain. October 30, 2007
- Panel Discussant on VolatilityTOPIC: The Fed's role & the impact of financial turmoil on the real economy with Tom Cooley and Mickey Levy, Chief Economist of Bank of America. November 2007
- Interview for Street.com, November 2007
- Keynote speaker at ISEO European Colloquia and Pioneer Investment in Vienna
- Lecture on "High Dimension Dynamic Correlations" at HIS joint with OeNB in Vienna, December 2007
- Speaker/Participant at Nobels Colloquia in Trieste, December 2007

BUSINESS AFFILIATIONS

Director, Volatility Institute

Director, Society for Financial Econometrics (SoFiE)

Principle, *Robert F. Engle, Econometric Services*

A personal consulting company specializing in the application of econometric methods to financial and other business needs. Current work focuses on liquidity and trading in financial markets, risk measurement and management, derivatives pricing and hedging and a variety of volatility and correlation related research tasks.

In addition, presents many lectures every year to financial practitioners around the world on topics of current interest.

Business Address: 8 Frederick St. , Mahopac, NY. 10541. Ph. 845-208-2028. email: englearch@netscape.net

Director and Founder of the Center for Financial Econometrics at New York University.

The center runs a seminar series, Quantitative Finance and Econometrics (QFE) sponsored by Morgan Stanley, a series of lunch research meetings, a public web site under the Salomon Center and a venue for visitors, post-docs and reaserch fellows.

Chairman of the Academic Advisory Board of Morgan Stanley's Equity Microstructure Grants.

This board administers an academic grant program giving approximately 10 grants per year to faculty and students studying market microstructure. The winning grants are invited to present their work at a conference in the following year that is run by the AAB.

NBER, Faculty Research Associate

MEDIA

Video and Television

- BBC Nobel Laureates 2003
- Swedish Television Nobel Ceremony 2003
- BBC Nobel Minds, 2003
- CNBC October, 2003
- Kudlow and Cramer, November 2003
- CNBC Power Lunch, 2004
- BBC Asia, 2004
- Nobel e-museum, 2003
- Bloomberg Radio and Bloomberg TV 2006

Bloomberg TV 2006
"History of Finance" Internet series, American Finance Association, 2006
BBC Radio and BBC TV 2007
World Economic Forum, Davos Switzerland, 2007
Financial Times "Global Financial Volatility" Online Series Lecture, 2007
Street.com, 2007
TV Globo: Brazil 2008

RESEARCH PUBLICATIONS

Overview:

Engle has published well over 100 academic research papers, four books and many other scholarly works. These are mostly in the broad area of time series econometrics with the most important applications to financial markets. However over the years there are influential papers analyzing macro economics, energy markets, urban economies, emerging markets as well as the main financial asset classes: equities, currencies, fixed income and derivatives. Two of his papers have reached milestones in citations: the paper introducing the *ARCH* model in 1982 and the paper coauthored with Clive Granger introducing *Cointegration* in 1986. These two papers were honored in "Citation Classics" as two of the most cited of all papers in economics. They were also the two papers forming the basis for the 2003 Nobel Prize.

Several other papers have achieved widespread recognition and have been reprinted widely. The most heavily cited papers are listed below.

12 FREQUENTLY CITED PAPERS

1. "Autoregressive Conditional Heteroskedasticity With Estimates of the Variance of U.K. Inflation," *Econometrica* 50 (1982): 987-1008.
2. "Co-integration and Error Correction: Representation, Estimation and Testing," (with C.W.J. Granger), *Econometrica* 55 (1987): 251-276.
3. "Estimation of Time Varying Risk Premia in the Term Structure: the ARCH-M Model," (with David Lilien and Russell Robins), *Econometrica* 55 (1987): 391-407.
4. "Asset Pricing with a Factor ARCH Covariance Structure: Empirical Estimates for Treasury Bills," (with V. Ng, and M. Rothschild) *Journal of Econometrics* 45 (1990): 213-237.
5. "ARCH Models," (with D. Nelson and T. Bollerslev) in *Handbook of Econometrics, Volume IV,* ed. R. Engle and D. McFadden (Amsterdam: North Holland, 1994), 2959-3038
6. "Forecasting and Testing in Co-integrated Systems," (with Sam Yoo), Journal of Econometrics 35 (1987): 143-159.
7. "Semi-parametric estimates of the relation between weather and electricity demand," (with C.W.J. Granger, J. Rice and A. Weiss), *Journal of American*

Statistical Association 81 (1986): 310-320.

8. "Exogeneity," (with David F. Hendry and Jean-Francois Richard), *Econometrica* 51 (1983): 277-304.
9. "Testing for Common Features," (with S. Kozicki), *Journal of Business and Economic Statistics* 11 (1993): 369 - 380.
10. "Autoregressive Conditional Duration: A New Model for Irregularly Spaced Transaction Data," Econometrica (1998) 66: 1127-1162.
11. "The Econometrics of Ultra High Frequency Data," Econometrica (2000) 68: 1-22.
12. "Dynamic Conditional Correlation - A Simple Class of Multivariate GARCH Models, *Journal of Business and Economic Statistics,* ", (July 2002)*,* V20N3

EXPOSITORY PAPERS

1. "The ET Interview: Robert F. Engle," (interviewed by Francis X. Diebold), *Econometric Theory* (January 2003) v19 n6
2. "Robert F. Engle III, autobiography (2004) Les Prix Nobel 2003, Nobel Foundation, pp. 309-325
3. "Risk and Volatility: Econometric Models and Financial Practice," Nobel Lecture,(2004) *American Economic Review,* V94M3 pp 405-420
4. "Grappling with GARCH," (with Joseph Mezrich), *RISK* (1995): 112-117
5. "GARCH for Groups," (with Joseph Mezrich), *RISK* (1996): 36-40
6. "GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics", *Journal of Economic Perspectives* (Fall 2001), V15N4
7. "What Good is a Volatility Model?" (with Andrew Patton), *Quantitative Finance,* (March 2001) V1N2 pp 237-245
8. "Financial Econometrics – A New Discipline with New Methoods," *Journal of Econometrics* (Jan. 2001), V100 pp53-56

RECENT PAPERS

1. "Time-Varying Arrival Rates of Informed and Uninformed Trades" with David Easley, Maureen O'Hara, Liuren Wu. *Journal of Financial Econometrics,* Forthcoming 2008

2. "Priced Risk and Asymmetric Volatility in the Cross Section of Skewness," with Abhishek Mistry.

3. "The Underlying Dynamics of Credit Correlations" (with Arthur Berd and Artem Voronov), *Journal of Credit Risk* (2007), Vol. 3, N2: 27-62

4. "Execution Risk", (with Robert Ferstenberg) *Journal of Portfolio Management,* Winter (2007), V33, I2, pp.34-45

5. “Measuring and Modeling Execution Cost and Risk” (with Jeffrey Russell and Robert Ferstenberg) Working paper, pp.1-54 (2007)

6. "Are Exchange Traded Funds Fairly Priced?" (with Debojyoti Sarkar) Institutional Investor, Fifth Anniversary Issue, (2006)

7. "High Frequency Multiplicative Component GARCH," (with Magdalena E. Sokalska and Ananda Chanda), (August 2005), Working Paper No. SC-CFE-05-05

8. “The Spline-GARCH Model for Unconditional Volatility and its Global Macroeconomic Causes,” (with J. Gonzalo Rangel), (November 2004). Working Paper No. SC-CFE-04-05, forthcoming *Review of Financial Studies*

9. “Vector Multiplicative Error Models: Representation and Inference” (With Fabrizio Cipollini, and Giampiero M. Gallo) Working Paper No. 0331

10. “A GARCH Option Pricing Model with Filtered Historical Simulation”, (with Giovanni Barone-Adesi and Loriano Mancini), *forthcoming Review of Financial Studies*

PAPERS IN PROCESS

a “Investigating ICAPM with Dynamic Conditional Correlations” (with Bali, Turan),(2007) manuscript

b "High Dimension Dynamic Correlations," Prepared for a Festschrift for David Hendry, Oxford University, (2007)

c “When Is Noise Not Noise – A Microstructure Estimate of Realized Volatility” (with Zheng Sun) (2007)

d “Fitting and Testing Vast Dimensional Time-Varying Covariance Models,” (with Kevin Sheppard and Neil Sheppard). (2007)

e “Measuring and Modeling Execution Cost and Risk,” (with Jeffrey Russell). (2007)

f "Vector Multiplicative Error Models: Representation and Inference," (with Fabrizio Cipollini and Giampiero M. Gallo)

g “Priced Risk and Asymmetric Volatility in the Cross-Section of Skewness,” (with Abhishek Mistry). (2007)

h "High Frequency Multiplicative Component GARCH," (with Magdalena E. Sokalska and Ananda Chanda)

i "Forecasting Variance of Variance: The Square-root, the Affine and the CEV GARCH Models," with

Isao Ishida - under revision

j “Theoretical Properties of Dynamic Conditional Correlation Multivariate GARCH” (with Kevin Sheppard), (2005)

k “Evaluating the Specificiation of Covariance Models for Large Portfolios (with Kevin Sheppard), (2005).

l “Time-Varying Betas and Asymmetric Effects of News: Empirical Analysis of Blue Chip Stocks,” (with Young-Hye Cho).-under revision

m “Modeling the Impacts of Market Activity on Bid-Ask Spreads in the Option Market,” (with Young-Hye Cho). under revision

n “Macroeconomic Announcements and Volatility of Treasury Futures,” (with Li Li).-under revision

o “Conditional Volatility of Exchange Rates Under a Target Zone (with Yin-Feng Gau). -under revision

BOOKS

Long Run Economic Relations: Readings in Cointegration, (eds. R. Engle and C.W.J. Granger) Oxford, Oxford University Press, 1991

Handbook of Econometrics, Volume IV, (ed. with Dan McFadden), Amsterdam: North Holland, 1994

ARCH: Selected Readings, Oxford University Press, 1995

Cointegration, Causality, and Forecasting: A Festschrift in Honor of Clive W. J. Granger, (ed. with Halbert White) Oxford University Press, 1999

Econometric Analysis of Financial and Economic Time Series, “Good Ideas” (Dedicated to R. Engle and C.W.J. Granger, Vol. 20, Parts A/B) Elsevier, Ltd, 2006

Anticipating Correlations. Princeton University Press 2008

COMPLETE CHRONOLOGICAL LIST OF PUBLICATIONS

1. "Effects of aggregation over time on dynamic characteristics of an economic model," (with T.C. Liu) in Burt G. Hickman, ed., *Econometric Models of Cyclical Behavior, Studies in Income and Wealth*, v. 2, no. 36, National Bureau of Economic Research, New York, 1972.

2. "An Econometric Simulation Model of Intra-Metropolitan Housing Location: Housing, Business, Transportation and Local Government," (with Franklin M. Fisher, John R. Harris and Jerome Rothenberg) *The American Economic Review* 62 (1972): 87-97.

3. "Issues in the Specification of an Econometric Model of Metropolitan Growth," *Journal of Urban Economics* 1 (1974): 250-267.

4. "Specification of the Disturbance for Efficient Estimation," *Econometrica* 42 (974): 135-146.

5. "Band Spectrum Regression," *International Economic Review* 15 (1973): 1-11.

6. "A Disequilibrium Model of Regional Investment," *Journal of Regional Science* 14 (1974): 367-376.

7. "De Facto Discrimination in Residential Assessments: Boston," *National Tax Journal* 28 (1975): 445-451.

8. "An Asset Price Model of Aggregate Investment," (with Duncan Foley), *International Economic Review* 16 (1975): 625-647.

9. "Equilibrium in Regional Investment: A Reply," *Journal of Regional Science* 15 (1975): 235-238.

10. "Some Finite Sample Properties of Spectral Estimators of a Linear Regression," (with Roy Gardner), *Econometrica* 44 (1976): 149-165.

11. "Interpreting Spectral Analysis in Terms of Time Domain Models," *Annals of Economic and Social Measurement* 5 (1976): 89-109.

12. "Simultaneous Estimation of the Supply and Demand for Household Location in a Multizoned Metropolitan Area," (with Katharine Bradbury, Owen Irvine, and Jerome Rothenberg), in *Residential Location and Housing Markets* (Gregory K. Ingram, ed.), (Ballinger 1977): 51-86.

13. "Policy Pills for a Metropolitan Economy," *Papers and Proceedings of the Regional Science Association* 35 (1976): 191-205.

14. "Constraints Often Overlooked in Analysis of Simultaneous Equation Models: Comment," *Econometrica* 44 (1976): 617-819.

15. "Estimating structural models of seasonality," in *Seasonal Analysis Of Economic Time Series*, ed. A. Zellner (U.S. Department of Commerce, Bureau of Census, 1978).

16. "Hypothesis Testing in Spectral Regression; The Lagrange Multiplier Test as a Regression Diagnostic," in *Evaluation of Econometric Models*, ed. Jan Kmenta and James Ramsey, (Academic Press, 1980).

17. "Testing Price Equations for Stability Across Frequency Bands," *Econometrica* 46 (1978): 869-881.

18. "Long Term Residential Load Forecasting," (with C.W.J. Granger, Allan Andersen, and Ramu Ramanathan) in *Forecasting and Modeling Time of Day and Seasonal Electricity Demands* (Electric Power Research Institute, Aspen, Colorado, 1977).

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