

Dr. Fabrizio LILLO
CURRICULUM VITAE ¹

LILLO Fabrizio,

Born in Palermo, Italy, date of birth: 9 June 1970

Present position

- Associate Professor in Mathematical Finance (SECS-S/06) at the Scuola Normale Superiore di Pisa .
Leader of the group in Quantitative Finance at the Scuola Normale Superiore di Pisa
(<http://www.sns.it/ricerca/scienze/matematica/finanzaquantitativa/>).
- External Faculty Member, Santa Fe Institute, Santa Fe, NM, USA (from 2012)

Addresses

- Business: Scuola Normale Superiore di Pisa, Piazza dei Cavalieri 7, I-56126, Pisa, Italy
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Degrees

- National scientific qualification to function as Full and Associate professor in Italian Universities in the sector 13/D4 Metodi Matematici dell'Economia e delle Scienze Attuariali e Finanziarie (Mathematical Methods of Economics, Actuarial Science and Finance), February 5, 2014.
- National scientific qualification to function as Associate professor in Italian Universities in the sector 02/B3 Fisica Applicata (Applied Physics), December 27, 2013.
- PhD in Physics at Palermo University (1999). PhD thesis on “*Fundamental aspects of interferometry with one and two photons*”.
- Degree in Physics (110/110 Cum Laude) at Palermo University (1994). Thesis: “*Internal coherence and quantum visibility*”.

Occupations

- From 1 Nov 1998 to 31 Jan 1999 research fellowship from the Comitato Regionale di Ricerche Nucleari e di Struttura della Materia (CRRNSM) for a reasearch project about “Sum rules in interferometry and Majorana representation”.
- From 1 Apr 1999 to 4 Feb 2001 INFM two-year Post-Doc fellowship for research on the project: “Modeling of financial dynamics with advanced techniques of statistical mechanics”. Tutor: Prof. R. N. Mantegna.
- From 5 Feb 2001 to 4 Feb 2003 INFM Research Associate for research on the project: “*Statistical modeling of non-coding DNA*” at the INFM unit of Palermo.
- From 17 Feb 2003 to 17 Dec 2003 Postdoctoral Fellow at the Santa Fe Institute, Santa Fe NM, USA.
- From 5 Jan 2004 to 31 October 2014, Assistant Professor of Physics (Ricercatore) at the Palermo University.
- From 1 Jul 2005 to 16 March 2009, External Faculty Member at the Santa Fe Institute (USA)
- From 17 March 2009 to 16 March 2012, Professor at the Santa Fe Institute (USA)
- From 1 January 2011 to 31 December 2013 full time Junior Research Professor in Mathematical Finance at the Scuola Normale Superiore di Pisa, Italy

¹updated March 2015

Long visiting periods

- From 1 Jun 2000 to 31 Jul 2000 guest scientist at the Max Planck Institute for the Physics of Complex Systems in Dresden, Germany.
- From 1 September to 31 October 2000 visiting scientist at the R&D section of the Risk Management Group of Banca Intesa in Milan, Italy
- From 10 January 2002 to 9 March 2002 visit at the Santa Fe Institute (USA)
- From 15 September to 23 September 2004 visit at the Departament de Física Fonamental Universitat de Barcelona, Spain
- From 17 March 2009 to 15 September 2009 visit at the Santa Fe Institute (USA)
- From 18 March 2009 to 11 September 2010 visit at the Santa Fe Institute (USA)
- From 13 October 2013 to 13 November 2013, visiting professor at Ecole Centrale Paris (France)

Editorial activity

- Member of the Editorial Board of Journal of Statistical Mechanics (JSTAT, IoP)
- Member of the Editorial Board of Fluctuation and Noise Letters (World Scientific)
- Associate Editor of Market Microstructure and Liquidity (World Scientific)
- Member of the Editorial Board of Complex Adaptive Systems Modeling (Springer)
- Member of the Editorial Advisory Board of Cogent Physics
- Guest Editor of a special issue of European Journal of Physics - Special Topics on “Spatially Embedded Complex Networks” (2013)
- Guest Editor of a special issue of Quantitative Finance on “Interlinkages and systemic risk” (2015)
- Editor of a Springer volume on “Financial Econometrics and Empirical Market Microstructure” (with A. Bera and S. Ivliev) (2015)
- Peer review activity for Proceedings of the National Academy of Sciences USA, Nature (Scientific Reports), PlosONE, Physical Review Letters, Physical Review E, Physica A, Physics Letters A, Europhysics Letters, European Journal of Physics B, JSTAT, International Symposia in Economic Theory and Econometrics, Fluctuation and Noise Letters, International Journal of Theoretical and Applied Finance, Quantitative Finance, Journal of Economic Dynamics and Control, Annals of Finance, Central European Journal of Physics, Complex Systems, Eastern Economic Journal, Complexity, Journal of Economic Behavior and Organization, Applied Mathematical Finance, Mathematical Reviews, New Journal of Physics, Methodology and Computing in Applied Probability, Economics, Advances in Data Analysis and Classification, Modern Physics Letters B, Chaos, International Journal of Bifurcation and Chaos, Advances in Complex Systems, Entropy, Economics, ICST e-Scripts, Revista Brasileira de Finanças, Journal of the Operation Research Society, Algorithmic Finance, Journal of Complex Networks, Wilmott Magazine, Journal of Empirical Finance, Transportmetrica A, Complex Adaptive System Modeling, International Review of Financial Analysis, Market Microstructure and Liquidity.
- Book and journal review activity for Oxford University Press, John Wiley and Sons, CRC-Chapman Hall, Springer, and Cambridge University Press.
- Article and book review for Mathematical Reviews
- Grant review activity for Academy of Finland, FWO-Vlaanderen (Belgium), Netherlands Organisation for Scientific Research, Austrian Science Fund, Romanian National Research Council, Polish Narodowe Centrum Nauki, Czech Science Foundation, Swiss National Supercomputer Center, Social Sciences and Humanities Research Council of Canada (SSHRC).

Awards

- 1995 Award “Guggino”, Palermo University, Italy.
- 2008 Young Scientist Award for Socio-and Econophysics, AKSOE, German Physical Society
- 2008 Medal for scientific achievements of the University of Palermo

Organization of Conferences

- Market Design and Structure, Santa Fe (USA), September 10-12, 2009
- Systemic Risk Initiative, New York (USA), October 15-16, 2009
- Director of the Econophysics Colloquium, 13th Course of the International School of Complexity, Erice (Italy) October 25-31, 2009
- Complexity and the Future of Transportation Systems, Satellite of European Conference on Complex Systems 2011, Wien (Austria), September 2011.
- Complexity paradigms for Smart, Green and Integrated Transport, Satellite of European Conference on Complex Systems 2012, Bruxelles (Belgium), September 2012.
- Instabilities in financial markets, Scuola Normale Superiore di Pisa (Italy), 18-19 October 2012
- Interlinkages and systemic risk, Ancona (Italy), July 2013
- Complexity Science and Transportation Systems 13, Satellite of European Conference on Complex Systems 2013, Barcelona (Spain), September 18, 2013
- Deterministic and Stochastic Dynamics in Economics and Finance, Centro De Giorgi Pisa (Italy) December 2-6, 2013
- Complexity Science and Transportation Systems 13, Satellite of European Conference on Complex Systems 2014, Lucca (Italy), September 24, 2014
- Member of the Scientific Committee of
 - Econophysics Colloquium 2010
 - Econophysics Colloquium 2011
 - Workshop on Economic Heterogeneous Interacting Agents 2010
 - International Conference on Complex Systems 2011
 - Social Systems, Economics and Finance, 2012
 - Econophysics Colloquium 2013
 - 2013 Asia Pacific Econophysics Conference, Pohang (Korea)
 - European Conference on Complex Systems 2013, Barcelona (Spain)
 - Workshop on Economic Heterogeneous Interacting Agents 2014
 - Econophysics Colloquium 2015, Prague

Mentoring and supervision

- 6 Master students: Gabriele La Spada (Rome La Sapienza, 2007), Enzo Busseti (Pisa, 2011), Damian Taranto (Pisa, 2012), Marcello Rambaldi (Pisa 2013), Piero Mazzarisi (Pisa 2014), Domenico Di Gangi (Pisa 2015 expected).

- 5 PhD students: Gabriella Vaglica (Palermo, 2005-2008), Gianbiagio Curato (Pisa SNS, 2010-2013), Damian Taranto (Pisa, 2012-2015), Marcello Rambaldi (Pisa SNS 2013-2016), Michael Schneider (Pisa SNS 2013-2016).
- 10 postdocs: Gabriella Vaglica (Palermo, 2008-2013), Gerald Gurtner (Pisa SNS, 2012-2014), Fulvio Corsi (Pisa SNS, 2012-2014), Lucio Calcagnile (Pisa SNS, 2012-2013) Guido Germano (Pisa SNS, 2012-2013), Luca Valori (Pisa SNS, 2012-2013), Leonardo Bargigli (Pisa SNS, 2012-2013), Davide Pirino (Pisa SNS, 2013-2015), Gianbiagio Curato (Pisa SNS 2014-2015), Paolo Barucca (Pisa SNS 2014-2015).
- Member of the evaluation committee of the PhD programs: Physics at Siena University, Italy (2011), Physics at Pavia University, Italy (2012), Mathematical Finance at Ecole Polytechnique Paris, France (2012), Economics at Venezia University, Italy (2012), Mathematical Finance, Ecole Centrale Paris, France (2012), Mathematical Finance, Université Marne-la-Vallée (2014), Computer Science, Pisa (2014), Mathematics for Economics and Finance, Roma La Sapienza (2015).
- Reviewer for Habilitation á diriger des recherches in Mathématique, Université Pierre and Marie Curie, Paris, France

Grants managed as Unit Principal Investigator

The total amount managed as Principal Investigator is 677 kEur.

- ComplexWorld Network: Mastering Complex Systems Safely, Eurocontrol (European Project), 74 kEur, 7/2010-7/2014
- Price formation, agent's heterogeneity, and market efficiency, Scuola Normale Superiore, 39 kEur, 8/2011-7/2013
- Complexity Research Initiative for Systemic Instabilities (CRISIS), European Commission FP7, 180 kEur, 11/2011-11/2014
- Empirically grounded agent based models for the future ATM scenario (ELSA), Eurocontrol (European Project), 125 kEur, 5/2011-1/2014
- New tools in the credit network modeling with agents' heterogeneity, Institute for New Economic Thinking (INET), 17 kEur, 9/2011-8/2013
- Metrics of market stability, LIST (company), 174 kEur, 1/2012-12/2014
- Internal grant for inviting Prof. Jim Gatheral, Scuola Normale Superiore, 3.5 kEur, 7/2012
- Research agreement between Scuola Normale Superiore di Pisa (Italy) and HSBC London (UK, 40kEur, 1/2013-12/2016
- Internal grant for inviting Prof. Emmanuel Bacry, Scuola Normale Superiore, 3.5 kEur, 7/2013
- Systemic risk in financial markets across time scales, Scuola Normale Superiore, 41kEur 7/2013-7/2015

Publications of
Dr. Fabrizio LILLO:

According to Google Scholar, at March 2015 publications of Fabrizio Lillo received 4,000 citations and the h-index is 32.

Review articles

R7) S. Battiston, J.B. Glattfelder, D. Garlaschelli, F. Lillo, and G. Caldarelli, *The Structure of Financial Networks*. In E. Estrada, M. Fox, D.J. Higham, and G.L. Oppo (a cura di), *Network Science - Complexity in Nature and Technology*. Springer (2010).

R6) F. Lillo, “Networks in Finance”, in *Encyclopedia of Life Support Systems*, UNESCO, (2010).

R5) J.P. Bouchaud, J. D. Farmer, and F. Lillo, “How markets slowly digest changes in supply and demand”, in T. Hens and K.R. Schenk-Hoppé (editors), *Handbook of Financial Markets: Dynamics and Evolution*, Handbook of Finance, 57-160 (2009).

R4) F. Lillo, Entry “Statistics of order flow” for the *Encyclopedia of Quantitative Finance*, R. Cont (Editor), John Wiley & Sons, (2010).

R3) F. Lillo, S. Micciché, Entry “High frequency data entry: statistical findings at high frequency” for the *Encyclopedia of Quantitative Finance*, R. Cont (Editor), John Wiley & Sons, (2010).

R2) F.Lillo, S. Micciché and R.N. Mantegna, “Econofisica: il contributo dei fisici allo studio dei sistemi economici”, *Il Nuovo Saggiatore* **21**, 68-81 (2005), (in Italian) .

R1) Giovanni Bonanno, Fabrizio Lillo and Rosario N. Mantegna, “Econophysical modeling of financial markets”, *Mètode* **35** 63-66 (2002), (in Catalan).

Publications in journals with impact factor (IS

P76) Elia Zarinelli, Michele Treccani, J. Doyne Farmer, Fabrizio Lillo, Beyond the square root: Evidence for logarithmic dependence of market impact on size and participation rate, *Market Microstructure and Liquidity* (accepted 2015).

P75) Giacomo Bormetti, Lucio Calcagnile, Michele Treccani, Fulvio Corsi, Stefano Marmi, and Fabrizio Lillo, Modelling systemic cojumps with Hawkes factor models, *Quantitative Finance* doi:10.1080/14697688.2014.996586 (in press 2015).

P74) Fabrizio Lillo and Davide Pirino, The Impact of Systemic and Illiquidity Risk on Financing with Risky Collateral, *Journal of Economic Dynamics and Control* **50** 180202 (2015).

P73) Andrew Cook, Henk A.P. Blom, Fabrizio Lillo, Rosario Nunzio Mantegna, Salvatore Micciche, Damian Rivas, Rafael Vazquez, Massimiliano Zanin, Applying complexity science to air traffic management, *Journal of Air Transport Management* **42**, 149-158 (2015).

P72). Marcello Rambaldi, Paris Pennesi, and Fabrizio Lillo, Modeling FX market activity around macroeconomic news: a Hawkes process approach, *Physical Review E* **91**, 012819 (2015).

P71) Gianbiagio Curato and Fabrizio Lillo, Modeling the coupled return-spread high frequency dynamics of large tick assets. *Journal of Statistical Mechanics* P01028 doi:10.1088/1742-5468/2015/01/P01028 (2015).

P70) Bence Toth, Imon Palit, Fabrizio Lillo, J. Doyne Farmer, Why is equity order flow so persistent?, *Journal of Economic Dynamics and Control* **51**, 218239 (2015).

P69) Giovanni di Iasio, Mauro Gallegati, Fabrizio Lillo, Rosario N. Mantegna, Special issue of Quantitative Finance on Interlinkages and Systemic Risk, *Quantitative Finance* **15**, 587-588 (2015)

- P68)** Leonardo Bargigli, Giovanni di Iasio, Luigi Infante, Fabrizio Lillo, Federico Pierobon, The multiplex structure of interbank networks. *Quantitative Finance* **15**, 673-691 (2015).
- P67)** Fabrizio Lillo, Salvatore Miccichè, Michele Tumminello, Jyrki Piilo, Rosario Nunzio Mantegna, How news affect the trading behavior of different categories of investors in a financial market, *Quantitative Finance* **15**, 213-229 (2015).
- P66)** Damian Eduardo Taranto, Giacomo Bormetti and Fabrizio Lillo, The adaptive nature of liquidity taking in limit order books. *Journal of Statistical Mechanics* P06002 doi:10.1088/1742-5468/2014/06/P06002 (2014).
- P65)** G  rald Gurtner, Stefania Vitali, Marco Cipolla, Fabrizio Lillo, Rosario Nunzio Mantegna, Salvatore Miccich  , Simone Pozzi, Multi-scale analysis of the European airspace using network community detection, *PLoS ONE* **9** (5): e94414. doi:10.1371/journal.pone.0094414 (2014)
- P64)** Gianbiagio Curato and Fabrizio Lillo, Multiscale model selection for high-frequency financial data of a large tick stock by means of the Jensen-Shannon metric *Entropy* **16**, 567-581 (2014).
- P63)** Jos   T. Lunardi, Salvatore Miccich  , Fabrizio Lillo, Rosario N. Mantegna, Mauro Gallegati, Do firms share the same functional form of their growth rate distribution? A new statistical test, *Journal of Economic Dynamics and Control* **39**, 140-164 (2014)
- P62)** J. Doyne Farmer, Austin Gerig, Fabrizio Lillo, Henri Waelbroeck, How efficiency shapes market impact *Quantitative Finance* **13**, 1743-1758 (2013).
- P61)** Gabriele La Spada and Fabrizio Lillo, The effect of round-off error on long memory processes, *Studies in Nonlinear Dynamics and Econometrics*, **18**(4) 445482, ISSN (Online) 1558-3708, ISSN (Print) 1081-1826, DOI: 10.1515/snde-2013-0011, (2013)
- P60)** S. Miccich  , F. Lillo, R.N. Mantegna, The role of unbounded time-scales in generating long-range memory in additive Markovian processes, *Fluctuation and Noise Letters* **12**, No. 2 1340002, (2013).
- P59)** S. Miccich  , A. Buchleitner, F. Lillo, R.N. Mantegna, T. Paul and Sandro Wimberger, Scale-free relaxation of a wave packet in a quantum well with power-law tails, *New Journal of Physics* **15** 033033 (2013).
- P58)** E. Strano, M. Zanin, E. Estrada, and F. Lillo, Editorial: Spatially Embedded Complex Networks, *European Journal of Physics - Special Topics*, **215** 1-4 (2013).
- P57)** M. Zanin and F. Lillo, Air Transport Network: a short review, *European Journal of Physics - Special Topics*, **215** 5-21 (2013).
- P56)** E. Busseti and F. Lillo, Calibration of optimal execution of financial transactions in the presence of transient market impact, *Journal of Statistical Mechanics* P09010 doi:10.1088/1742-5468/2012/09/P09010, (2012).
- P55)** B. Toth, Z. Eisler, F. Lillo, J. Kockelkoren, J.-P. Bouchaud, J.D. Farmer, How does the market react to your order flow? *Quantitative Finance* **12**, 1015-1024 (2012)
- P54)** A. Carollo, G. Vaglica, F. Lillo, and R. N. Mantegna. Trading activity and price impact in parallel markets: SETS vs. off-book market at the London Stock Exchange. *Quantitative Finance* **12**, 517-530 (2012).
- P53)** M. Tumminello, F. Lillo, J. Piilo, and R.N. Mantegna. Identification of clusters of investors from their real trading activity in a financial market. *New Journal of Physics* **14** 013041 (2012). This paper has been featured in the following article of PhysOrg: <http://www.physorg.com/news/2012-01-stock-network-reveals-investor-clustering.html>
- P52)** M. Tumminello, S. Miccich  , F. Lillo, J. Piilo, and R.N. Mantegna, Statistically validated networks in bipartite complex systems, *PLOS ONE* **6**(3): e17994. doi:10.1371/journal.pone.0017994 (2011)
- P51)** E. Pantaleo, M. Tumminello, F. Lillo, and R. N. Mantegna, When do improved covariance matrix estimators enhance portfolio optimization? An empirical comparative study of nine estimators, *Quantitative Finance* **11**, 1067-1080 (2011)
- P50)** M. Tumminello, S. Miccich  , F. Lillo, J. Varho, J. Piilo, and R. N Mantegna, Community characterization of heterogeneous complex systems, *Journal of Statistical Mechanics* 2011/P01019 (2011).

- P49)** B. Tóth, F. Lillo, and J.D. Farmer, Segmentation algorithm for non-stationary compound Poisson processes. With an application to inventory time series of market members in a financial market *European Physical Journal B* **78**, 235-243 (2010)
- P48)** G. Vaglica, F. Lillo, R.N. Mantegna, Statistical identification with hidden Markov models of large order splitting strategies in an equity market, *New J. Phys.* **12** 075031 (2010)
- P47)** M. Tumminello, F. Lillo, R. N. Mantegna, Correlation, hierarchies, and networks in financial markets. *Journal of Economic Behavior and Organization* **75**, 40-58. (2010).
- P46)** E. Moro, J. Vicente, L.G. Moyano, A. Gerig, J.D. Farmer, G. Vaglica, F. Lillo, R. N. Mantegna, Market impact and trading profile of hidden orders in stock markets. *Physical Review E* **80**, 066102 (2009).
- P45)** A. Ponzi, F. Lillo, R. N. Mantegna, Market reaction to a bid-ask spread change: A power-law relaxation dynamics. *Physical Review E* **80**, 016112 (2009).
- P44)** Z. Eisler, J. Kertesz, F. Lillo, R. N. Mantegna, Diffusive behavior and the modeling of characteristic times in limit order executions. *Quantitative Finance* **9**, 547-563 (2009).
- P43)** F. Lillo, Econophysics and the challenge of efficiency, *Complexity* **14**, 39-54 (2009).
- P42)** M. Spanò, F. Lillo, S. Miccichè, and R.N. Mantegna, Statistical properties of thermodynamically predicted RNA secondary structures in viral genomes. *European Physical Journal B* **65**, 323-331 (2008).
- P41)** M. Tumminello, F. Lillo, and R.N. Mantegna, Generation of hierarchically correlated multivariate symbolic sequences: With an application to the assessment of bootstrap confidence in phylogenetic analysis. *European Physical Journal B* **65**, 333-340 (2008).
- P40)** G. La Spada, J.D. Farmer, F. Lillo, The non-random walk of stock prices: the long-term correlation between signs and sizes. *European Physical Journal B* **64**, 607-614 (2008).
- P39)** G. Vaglica, F. Lillo, E. Moro, and R.N. Mantegna, Scaling laws of strategic behavior and size heterogeneity in agent dynamics. *Physical Review E*, **77** 036110 (2008).
- P38)** F. Lillo, E. Moro, G. Vaglica, and R.N. Mantegna, Specialization and herding behavior of trading firms in a financial market. *New Journal of Physics*, **10**, 043019 (2008).
- P37)** V. Tola, F. Lillo, M. Gallegati, R. N. Mantegna, Cluster analysis for portfolio optimization. *Journal of Economic Dynamics and Control* **32**, 235–258 (2008).
- P36)** M. Tumminello, F. Lillo, and R.N. Mantegna, Shrinkage and spectral filtering of correlation matrices: a comparison via the Kullback-Leibler distance. *Acta Physica Polonica B* **38**, 4079–4088 (2007).
- P35)** F. Lillo and D.C. Krakauer, A statistical analysis of the three-fold evolution of genomic compression through frame overlaps in prokaryotes *Biology Direct* **2**, 22 (2007).
- P34)** M. Tumminello, F. Lillo, and R.N. Mantegna, Kullback-Leibler distance as a measure of the information filtered from multivariate data. *Physical Review E* **76**, 031123 (2007).
- P33)** F. Lillo and M. Spanò, Inverted and mirror repeats in model nucleotide sequences. *Physical Review E* **76**, 041914 (2007).
- P32)** M. Tumminello, F. Lillo, and R. N. Mantegna, Hierarchically nested factor model from multivariate data, *Europhysics Letters* **78**, 30006 (2007).
- P31)** F. Lillo, Limit order placement as an utility maximization problem and the origin of power law distribution of limit order prices, *European Physical Journal B* **55**, 453–459 (2007).
- P30)** M. Tumminello, C. Coronello, F. Lillo, S. Miccichè, R. N. Mantegna. Spanning Trees and bootstrap reliability estimation in correlation based networks, *International Journal of Bifurcation and Chaos*, **17**, 2319–2329 (2007)
- P29)** L. Gillemot, J. D. Farmer, F. Lillo, There's more to volatility than volume. *Quantitative Finance* **6**, 371-384 (2006).

- P28)** J. D. Farmer, A. Gerig, F. Lillo, S. Mike, Market efficiency and the long-memory of supply and demand: Is price impact variable and permanent or fixed and temporary? *Quantitative Finance* **6**, 107-112 (2006).
- P27)** M. Montero, J. Perellò, J. Masoliver, F. Lillo, S. Miccichè, e R. N. Mantegna, Scaling and data collapse for the mean exit time of asset prices. *Physical Review E* **72**, 056101 (2005).
- P26)** C. Coronello, M. Tumminello, F. Lillo, S. Miccichè, e R. N. Mantegna, Sector Identification in a Set of Stock Return Time Series Traded at the London Stock Exchange. *Acta Physica Polonica* **36** 2653–2680 (2005).
- P25)** F.Lillo e R.N. Mantegna, Spectral density of the correlation matrix of factor models: A random matrix theory approach. *Physical Review E* **72**, 016219 (2005).
- P24)** F. Lillo, S. Mike e J. Doyne Farmer, Theory for long memory in supply and demand. *Physical Review E* **71**, 066122 (2005).
- P23)** F. Lillo e J.Doyne Farmer, The key role of liquidity fluctuations in determining large price fluctuations. *Fluctuations and Noise Letters* **5**, L209 (2005).
- P22)** M. Spanò, F. Lillo, S. Miccichè and R. N. Mantegna, Inverted Repeats in Viral Genomes. *Fluctuations and Noise Letters* **5**, L193 (2005).
- P21)** F.Lillo and J.D. Farmer, The long memory of efficient market. *Studies in Nonlinear Dynamics and Econometrics* **8**, 1 (2004).
- P20)** J.D. Farmer, L. Gillemot, F. Lillo, S. Mike and A. Sen, What really causes large price changes? *Quantitative Finance* **4** 383–397 (2004).
This paper has been identified by the Essential Science Indicators (ISI Thompson) as a Fast Breaking Paper in the field Economics & Business for the high number of citations in a short time after publication. See http://esitopics.com/fbp/2006/october06-Farmer_Lillo.html.
- P19)** F. Lillo and R.N. Mantegna, Dynamics of a financial market index after a crash, *Physica A* **338** 125-134 (2004).
- P18)** G. Bonanno, G. Caldarelli, F. Lillo, S. Micciche', N. Vandewalle and R.N. Mantegna, Networks of equities in financial markets, *Eur. J. Phys. B* **38**, 363-371 (2004).
- P17)** J. Doyne Farmer and Fabrizio Lillo, On the origin of power law tails in price fluctuations, *Quantitative Finance* **4**, C7-C11 (2004).
- P16)** Giovanni Bonanno, Guido Caldarelli, Fabrizio Lillo and Rosario N. Mantegna, Topology of correlation based minimal spanning trees in real and model markets, *Physical Review E* **68**, 046130 (2003).
- P15)** Fabrizio Lillo and Rosario N. Mantegna, Power law relaxation in a complex system: Omori Law After a Financial Market Crash, *Physical Review E* **68**, 016119 (2003).
This paper has been reviewed in the section “Frontiers” of the journal *New Scientist*, **175** (2530), 17 (2002).
- P14)** Salvatore Miccichè, Giovanni Bonanno, Fabrizio Lillo and Rosario N. Mantegna, Degree stability of a minimum spanning tree of price return and volatility, *Physica A* **324** 66-73 (2003).
- P13)** Fabrizio Lillo J. Doyne Farmer e Rosario N. Mantegna, Master curve for the price-impact function, *Nature* **421**,129-130 (2003).
This paper has been reviewed in *The Industrial Physicist* dell’American Physical Society, **9** (2), 11 (2003).
- P12)** Fabrizio Lillo, Salvatore Basile e Rosario N. Mantegna, Comparative genomic study of inverted repeats in bacteria, *Bioinformatics* **18**, 971-979 (2002).
- P11)** Salvatore Miccicheè, Giovanni Bonanno, Fabrizio Lillo and Rosario N. Mantegna, Volatility in Financial Markets: Stochastic Models and Empirical Results, *Physica A* **314**, 756-761 (2002).
- P10)** Giovanni Bonanno, Fabrizio Lillo and Rosario N. Mantegna, High-frequency Cross-correlation in a Set of Stocks, *Quantitative Finance*, **1**, 96-104 (2001).
- P9)** Fabrizio Lillo and Rosario N. Mantegna, Ensemble properties of securities traded in the NASDAQ market, *Physica A* , **299**, 161-167 (2001).

- P8)** Giovanni Bonanno, Fabrizio Lillo and Rosario N. Mantegna, Levels of complexity in financial markets, *Physica A*, **299**, 16-27 (2001).
- P7)** Fabrizio Lillo and Rosario N. Mantegna, Empirical properties of the variety of a financial portfolio and the single-index model, *Eur Phys. J. B*, **20**, 503-509 (2001).
- P6)** Fabrizio Lillo and Rosario N. Mantegna, Variety and Volatility in Financial Markets, *Physical Review E* **62**, 6126-6134 (2000).
- P5)** Fabrizio Lillo and Rosario N. Mantegna, Symmetry alteration of ensemble return distribution in crash and rally days of financial market, *Eur Phys. J. B* **15**, 603-606 (2000).
- P4)** Fabrizio Lillo and Rosario N. Mantegna, Drift-Controlled Anomalous Diffusion: A Solvable Gaussian Model, *Physical Review E* **61**, R4675-R4678 (2000).
- P3)** Giovanni Bonanno, Fabrizio Lillo and Rosario N. Mantegna, Dynamics of the number of trades of financial securities, *Physica A* **280**, 136-141 (2000).
- P2)** Fabrizio Lillo and Rosario N. Mantegna, Anomalous Spreading of Power-Law Quantum Wave Packets, *Physical Review Letters* **84**, 1061-1065 (2000).
- P1)** G. Gennaro, C. Leonardi, F. Lillo, A. Vaglica and G. Vetri, Internal coherence and quantum phase-difference between two e.m. fields. *Opt. Comm.* **112**, 67 (1994).

Publication in international journals with referee

- I2)** Fabrizio Lillo, Rosario N. Mantegna, Jean-Philippe Bouchaud e Marc Potters, Introducing Variety in Risk Management, *Wilmott magazine*, John Wiley & Sons, Ltd, **December 2002**, 98-102.
- I1)** Fabrizio Lillo and Rosario N. Mantegna, Statistical Properties of Statistical Ensembles of Stock Returns, *International Journal of Theoretical and Applied Finance*, **3**, 405-408 (2000).

Conference proceedings and volume contributions

- C20)** Leonardo Bargigli, Giovanni di Iasio, Luigi Infante, Fabrizio Lillo, Federico Pierobon Interbank markets and multiplex networks: centrality measures and statistical null models, in *Interconnected Networks*, A. Garas e F. Schweitzer (eds.), Springer Complexity Series (in press 2015).
- C19)** G. Curato and F. Lillo, How tick size affects the high frequency scaling of stock return distributions, in *Financial Econometrics and Empirical Market Microstructure*, Springer (2014)
- C18)** C. Bongiorno, R.N. Mantegna, S. Micciché, G. Gurtner, F. Lillo, L. Valori, M. Ducci, B. Monechi, S. Pozzi, An Agent Based Model of Air Traffic Management, Proceedings on the Third SESAR Innovation Days Conference, Stockholm (Sweden) November 26 - November 28, 2013.
- C17)** S. Vitali, M. Cipolla, S. Micciché R. N. Mantegna, G. Gurtner, F. Lillo, V. Beato, S. Pozzi, Statistical Regularities in ATM: network properties, trajectory deviations and delays, Proceedings on the Second SESAR Innovation Days Conference, Braunschweig (Germany) November 27 - November 29, 2012.
- C16)** M. Zanin, M. Balbas, R. Herranz, D. Rivas, R. Vazquez, H. Blom, H. Helmke, F. Lillo, R. Mantegna, S. Micciché, A. Cook and G. Tanner, Complexity in Air Traffic Management in *The next global scenarios* (S. Affuso, S. D'Alessandro, G. Marini editors), Aracne Editrice 2011 (ISBN 978-88-548-4270-0).
- C15)** F. Lillo, S. Micciché, R. N. Mantegna, V. Beato, S. Pozzi, ELSA Project: Toward a complex network approach to ATM delays analysis. Proceedings on the EUROCONTROL Conference INO, Toulouse (France) November 29 - December 1, 2011.
- C14)** G. La Spada, J.D. Farmer, and F. Lillo, Tick Size and Price Diffusion. *Econophysics of Order-driven Markets*, F. Abergel, B. Chakrabarti, A. Chakraborti, Anirban, M. Mitra (Editors), Springer Milan.

C13) F. Lillo, S. Pozzi, A. Tedeschi G. Ferrara, G. Matrella, F. Lieutaud, B. Lucat, A. Licu, Coupling and Complexity of Interaction of STCA Networks. Proceedings on the EUROCONTROL Conference 8th Innovative Research Workshop & Exhibition, Bretigny-sur-Orge (France) December 1-3 2009.

C12) C. Coronello, M. Tumminello, F. Lillo, S. Miccichè, and R.N. Mantegna, Economic sector identification in a set of stocks traded at the New York Stock Exchange. Noise and Stochastics in Complex Systems and Finance. SPIE. Firenze (Italy). 21-24 May 2007. (pp. 66010T-1-66010T-12).

C11) Z. Eisler, J. Kertesz, and F. Lillo, The limit order book on different time scales. Noise and Stochastics in Complex Systems and Finance. SPIE. Firenze (Italy). 21-24 May 2007. (pp. 66010G-1-66010G11) (2007).

C10) M. Tumminello, F. Lillo, and R.N. Mantegna, Spectral properties of correlation matrices for some hierarchically nested factor models. International Conference on Complexity, Metastability and Nonextensivity. Catania (Italy) 1-5 July 2007. Complexity, Metastability and Nonextensivity-CTNEXT 07. (vol. 965, pp. 300-307). American Institute of Physics (2007).

C9) Salvatore Miccichè, Fabrizio Lillo and Rosario N. Mantegna, Correlation based hierarchical clustering in financial time series, Proceedings of the 31st Workshop of the International School of Solid State Physics "Complexity, metastability and nonextensivity", Erice 20-26 July 2004, C. Beck, A. Rapisarda and C. Tsallis (editors), World Scientific (2005).

C8) Fabrizio Lillo, J. Dooyne Farmer, and Rosario N. Mantegna, Price impact function of a single transaction, The Complex Dynamics of Economic Interaction Essays in Economics and Econophysics Series : Lecture Notes in Economics and Mathematical Systems , Vol. 531 Gallegati, Mauro; Kirman, Alan P.; Marsili, Matteo (Eds.) 2004

C7) Fabrizio Lillo and Rosario N. Mantegna, Modeling the dynamics of a financial index after a crash, The Complex Dynamics of Economic Interaction Essays in Economics and Econophysics Series : Lecture Notes in Economics and Mathematical Systems , Vol. 531 Gallegati, Mauro; Kirman, Alan P.; Marsili, Matteo (Eds.) 2004

C6) S. Miccichè, F. Lillo, G. Bonanno, R.N. Mantegna, Univariate and multivariate statistical aspects of equity volatility, in Application of Econophysics (Springer Verlag, Tokio), Proceedings of: "The Second Nikkei Econophysics Research Workshop and Symposium", 12-14 November 2002, Tokio, Japan edited by H. Takayasu (2003).

C5) Fabrizio Lillo, Giovanni Bonanno and Rosario N. Mantegna, Variety of Stock Returns in Normal and Extreme Market Days: The August 1998 Crisis, Proceedings of Empirical Science of Financial Fluctuations, Econophysics on the Horizon, Ed by H. Takayasu, Tokyo, 2002, pp.77-89.

C4) Giovanni Bonanno, Fabrizio Lillo, Salvatore Miccichè and Rosario N. Mantegna, Hierarchical Structures in Complex Systems: from DNA to Financial Markets, Proc. of Euroattractor2000, Varsavia, 2002, pp.62-79.

C3) Giovanni Bonanno, Fabrizio Lillo and Rosario N. Mantegna, $1/f$ and $1/f^2$ noise in financial time series, Proceedings of the 16th International Conference "Noise in Physical Systems and $1/f$ Fluctuations", Ed by G. Bosman, World Scientific, 2001, pp. 791-796.

C2) Fabrizio Lillo and Rosario N. Mantegna, "A Study of a Class of Power-Law Tail Quantum Wave Packets", Proc. of the VI CRRNSM Conference, Palermo, Italy, 2000, Edited by A. Messina, American Institute of Physics, Melville, New York (2000), pp. 134-137.

C1) C. Leonardi, F. Lillo, A. Vaglica and G. Vetri, "Majorana and Fano alternatives to the Hilbert space", in Proceedings of the Congress "Mysteries, Puzzles and Paradoxes in Quantum Mechanics", R. Bonifacio Editor, American Institute of Physics, Melville, New York (1999), pp. 312-315.

Popular press

N1) Fabrizio Lillo e Stefano Marmi, Il calcolo della velocità, Il Sole 24 Ore-Nova, May 19, 2011 (in Italian)

N2) Fabrizio Lillo e Stefano Marmi, Più instabilità, subito nuove regole, Il Resto del Carlino -Quotidiano Nazionale, August 8, 2011 (in Italian)

N3) Fabrizio Lillo e Stefano Marmi, Le Borse ai tempi dell'algoritmo, Il Sole 24 Ore, October 19, 2012 (in Italian)

Courses and Lectures

- Courses of Physics 1 and 2 at the undergraduate school in Chemical Engineering of Palermo University (2002-2010).
- “Introduction to Econophysics”, series of lectures given at the “Interdisciplinary School and Workshop on Complex Systems” Isla de Margarita, Venezuela, 26-29 November 2001.
- Series of lectures at the SOCRATES Intensive Programme 2002 “Non Linear Time Series Analysis: Theory and Applications”, Firenze, 5-12 July 2002.
- Series of lectures at the postgraduate master “Quantitative methods and operative strategies in financial risk management”, Palermo, October 2002-January 2003.
- Course on Stochastic Processes at the Graduate School (Dottorato) in Applied Physics and at the Advanced School in Medical Physics of Palermo University (2004-2010)
- Course on Bioinformatics at the Graduate School in (Dottorato) Applied Physics of Palermo University (2005-2007).
- Course on Scaling Laws with Applications in Financial Markets at the Master “European School of Advanced Studies in Methods for Management of Complex Systems”, IUSS, Pavia University (Italy), May 2006 and May 2008.
- Course on Market microstructure and market heterogeneity, Multidisciplinary Approaches to Economic and Social Complex Systems, Siena (Italy), July 1-2, 2010.
- Course on “Financial market microstructure: empirical studies” at the International Center for Theoretical Physics (Trieste, Italy), March 2011.
- Lectures on “From time series to financial networks” at the FOC-CRISIS School on Complex Financial Networks, IMT Lucca, October 2012
- Lectures on “Maximum Entropy Principle and application to networks”, at the Summer School of Mathematics for Economics and Social Sciences, San Miniato, September 16-20, 2013
- Lectures on “Workshop on High Frequency Finance, Market Microstructure, and High Frequency Trading”, National University of Singapore, November 2013
- Courses at the Scuola Normale Superiore di Pisa:
 - Course on “Quantitative Finance” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, January-June 2011 (50 hours).
 - Course on “Applied probability and stochastic processes” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, January-March 2012 (30 hours).
 - Course on “Quantitative Finance” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, April-June 2012 (30 hours).
 - Course on “Applied probability and stochastic processes” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, January-March 2013 (30 hours).
 - Course on “Quantitative Finance” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, March-May 2013 (30 hours).
 - Course on “Applied probability and stochastic processes” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, January-March 2014 (30 hours).
 - Course on “Quantitative Finance” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, March-May 2014 (30 hours).
 - Course “Reading course on systemic risk” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, February-May 2014 (20 hours).

- Part of the course “Mathematical Finance” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, November 2014-January 2015 (24 hours).
- Part of the course “Time series and networks” at the graduate school of the Scuola Normale Superiore di Pisa, Pisa, Italy, November 2014-January 2015 (16 hours).

Selected invited seminars

- *What really causes large price changes?* “Noise in condensed matter and complex system”, Terrasini (Italy), July 2004.
- *Scaling laws and price formation in microstructure of financial markets*, “Volatility of financial markets: theoretical models, forecasting and trading”, Leiden (Holland) 25 October 2004.
- *Spectral Density of the Correlation Matrix of Factor Models*, “Applications of Random Matrices to Economy and other Complex Systems”, Krakow (Poland), May 2005
- *Price formation and scaling laws and in the microstructure of financial markets*, “Complejidad en los Mercados Financieros”, Madrid (Spain), September 15, 2005
- *Ecology of trading firms in a financial markets*, “Econophysics of Stock Markets and Minority Game”, Kolkata (India), February 16, 2006
- *Ecology of trading firms in a financial markets*, “Complex Behavior in Economics : Modeling, Computing and Mastering Complexity”, Aix en Provence, (France), May 19, 2006
- *Market reaction to temporary liquidity crises and the permanent market impact*, “International School of Complexity - Physics of Socio-Economic Phenomena” Erice (Italy) September 19, 2006
- *Hierarchically nested factor models from dendrograms*, “Dynamics Days 2006”, Hersonissos (Crete, Greece), September 28, 2006.
- *Hierarchically nested factor models*, “Random Matrix Theory: from fundamental physics to applications”, Krakow (Poland), May 4, 2007.
- *Trading strategies and ecological interaction of firms in a financial market*, “SPIE Fluctuations and Noise Symposium”, Florence (Italy), May 21, 2007.
- *Compression of information in bacterial genomes*, “Ecological Complex Systems: Stochastic Dynamics and Patterns”, Terrasini (Italy), 23 July 2007
- *Strategies, specialization, and herding behavior of trading firms in a financial market*, COST meeting, Terrasini (Italy), 22 September 2007.
- *Strategies, specialization, and herding behavior of trading firms in a financial market*, Complexity in Economics and Finance, Leiden (Holland), 25 October 2007.
- *Scaling laws of strategic behavior, specialization of strategies, and price formation in financial markets*, Annual Meeting of the German Physical Society, Berlin (Germany) 26 February 2008.
- *How markets slowly digest changes in supply and demand*, 5th European Conference on Complex Systems, Jerusalem, September 14-19, 2008.
- *The evolution of high frequency financial databases: from daily data to agent resolved data*, 5th European Conference on Complex Systems, Jerusalem, September 14-19, 2008.
- *How markets slowly digest changes in supply and demand*, Ecole Polytechnique, Paris, December 8, 2008.

- *How markets slowly digest changes in supply and demand*, Centro Sistemi Complessi - Universita' di Siena, Siena (Italy), February 9, 2010.
- *An Introduction to High Frequency Finance and Market Microstructure*, Scuola Normale Superiore di Pisa, Pisa (Italy), February 11, 2010.
- *The origin of correlation in order flow and the market impact of large orders*, Econophys-Kolkata V Conference - Econophysics of order-driven markets, Kolkata (India), March 10, 2010.
- *Similarity based financial networks*, Cascading Events in Complex Financial Networks, Boston (USA), May 11, 2010.
- *Statistically validated co-occurrence networks*, Netsci 2009, Boston (USA), May 13, 2010.
- *Market reaction to temporary liquidity crises*, Liquidity Workshop, Budapest (Hungary), October 21-22, 2010.
- *On the origin of different types of market impact and Agent resolved financial data*, Market Microstructure: confronting many viewpoints, Paris, December 6-10, 2010.
- *Financial market microstructure and heterogeneous agents* 1st Workshop on Quantitative Finance and Economics, Tokyo, February 21-23, 2011.
- *Order flow in financial markets: Origin of persistence and impact of metaorders*, Workshop on Market microstructure: Design, efficiency and statistical regularities, Trieste (Italy) - March 25, 2011
- *How efficiency shapes market impact*, International Conference on Econophysics, Shanghai (China) June 4, 2011
- *Persistence of order flow: origin, market ecology, and optimal execution*, Econophysics Colloquium 2011, Wien - September 14, 2011
- *Persistence of order flow, market impact of large orders, and optimal execution*, FIESTA seminars, Ecole Polytechnique Paris (France), May 21, 2012
- *How efficiency shapes market impact*, Annual Financial Market Liquidity Conference, Budapest - November 15, 2012
- *How market microstructure affects liquidity and market risks*, Russian Risk Conference, Moscow (Russia), November 21, 2012
- *Econophysics: the contribution of physicists to the understanding of socio-economic systems*, Perm State University, Perm (Russia), November 26, 2012
- *Microstructure of Extreme Events*, Market Microstructure: confronting many viewpoints, Paris, December 2012.
- *How markets slowly digest changes in supply and demand*, University of Alessandria, January 17, 2013
- *Persistence of order flow, market impact of large orders, and market efficiency in financial markets*, Department of Economics, University Ca' Foscari, Venezia, January 22, 2013
- *Microstructure of Extreme Events*, Perm Winter School 2013, Perm (Russia), February 6, 2013
- *Modelling systemic price jumps with Hawkes factor models*, 5th Florence-Ritsumeikan (FLORIT) workshop, Florence, March 13, 2013
- *When Micro Prudence increases Macro Risk: The Destabilizing Effects of Financial Innovation, Leverage, and Diversification*, Complexity Models for Systemic Instabilities and Crises, Leiden (Holland) April 11, 2013
- *High frequency trading and market shocks*, Modeling High-Frequency Trading Activity - Banff International Research Station, Banff (Canada) September 4, 2013

- *How efficiency shapes market impact*, Ecole Centrale Paris - November 7, 2013
- *A dynamical system approach to systemic risk*, Monitoring Systemic Risk: Data, Models and Metrics, Isaac Newton Institute, Cambridge (UK) September 22, 2014
- *The adaptive nature of liquidity in limit order books*, Econofis'14, Rio De Janeiro (Brazil) October 2, 2014
- *Market Impact and Optimal Execution of Large Trades*, Annual Financial Market Liquidity Conference, Budapest - November 15, 2014
- *Market Impact and Optimal Execution of Large Trades*, Market Microstructure, Institute Bachelier, December 9, 2014
- *Econometric measures of flight-to-quality by means of Granger-causality tail risk networks*, Dependence in Risk Measurement and Risk Management, Florence (Italy), December 18, 2014