UNIVERSITÀ DEGLI STUDI DI MILANO

DIPARTIMENTO DI MATEMATICA "FEDERIGO ENRIQUES"

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Lectures delivered by Marco Frittelli

Invited Speaker:

1) *Dominated Families of quasimartingale and supermartingale measures*, Programme on Financial Mathematics, Newton Institute for Mathematical Science, University of Cambridge, Cambridge, March 17, 1995

2) *Asset pricing in frictional markets.* Programme on Financial Mathematics, Newton Institute for Mathematical Science, University of Cambridge, U.K., June 2, 1995.

3) *Valuation principle in security markets models with frictions*. Workshop on Mathematical Finance, Columbia University, New York, October 9, 1995.

4) *Valuation principles in complete and incomplete markets*. Forschungsseminar Quantitative Methoden in der Oekonomie, Zurich University, November 11, 1996.

5) *Entropy minimization and valuation principles in incomplete markets*. Humboldt University, Berlin, November 28, 1996.

6) *Certainty equivalent and no arbitrage pricing in incomplete markets*. Vienna University, June 19, 1997.

7) *Valuation principles in incomplete markets.* Stochastic Analysis in Finance and Insurance, Mathematisches Forschunsinstitute Oberwolfach, Oberwolfach, Germany, September 15, 1997.

8) *Certainty equivalent and no arbitrage: a reconciliation via duality theory*. ETH Zurich, November 27, 1997.

9) *Duality methods for pricing in incomplete markets*. Banach Center, Symposium on Stochastic Systems, Warsaw, Poland, June 6, 1998.

10) *Certo equivalente dinamico*. "Università della Svizzera Italiana", Lugano, April 15, 1999.

11) *Sublinear risk measures and pricing rules*. The Bachelier Colloquium on Mathematical Finance, Universite de Franche-Comte, Besancon, France, March 29, 2000.

12) *Minimal measures and utility maximization*. Freiburg University, Germany, July 13, 2000.

13) *Utility maximization in incomplete markets.* The Bachelier Seminar on Mathematical Finance, H. Poincarè Institute, Paris, November 24, 2000.

14) *Optimal solution to utility maximization in incomplete markets:* International Conference on Mathematical Finance, Shanghai, China, May 12, 2001.

15) *Entropy in mathematical finance*, Workshop: "Application of Information Theory in Biology, Finance and Phisics", Banach Center, Warsaw, Poland, May 21, 2001.

16) *Arbitrage and preferences*, Minisymposium "Mathematical modeling for pricing and hedging financial risk", EMS-SMAI-SMF Conference: Applied Mathematics and Applications of Mathematics, Nice, France, February 13, 2003.

17) *The interplay between preferences and arbitrage, super-replication, risk measures.* Stochastic Analysis in Finance and Insurance, Mathematisches Forschunsinstitute Oberwolfach, Oberwolfach, Germany, March 5, 2003.

18) *Preferences and risk measures*, Università della Svizzera Italiana, Lugano, March 20, 2003.

19) *On a class of dynamic risk measures,* Humbold University, Berlin, June 12, 2003.

20) *Super-replication price and preferences*, EMS Weekend, Lisbon, Portugal, September 14, 2003.

21) *Duality in mathematical finance*, Semimartingale Theory and Practice in Finance, Banff International Research Station for Mathematical Innovation, Banff, Canada, June 4-10 2004

22) *Utility maximization in incomplete markets with unbounded processes*, The Second Bachelier Colloquium on Mathematical Finance, Universite de Franche-Comte, Metabief, France, January 12, 2005.

23) *Utility maximization in incomplete markets with general semimartingales*, Winter School on Mathematical Finance, Lunteren, The Netherlands, January 24, 2005.

24) *Risk measures and capital requirements for processes*, ETH Zurich, April 7, 2005.

25) *A unifying approach to utility maximization in incomplete market with general semimartingales*, Bachelier Seminar, Paris, April 15, 2005.

26) *A unifying approach to utility maximization in incomplete market with general semimartingales*, Programme on Quantitative Methods in Finance, Newton Institute for Mathematical Science, University of Cambridge, U.K., April 26, 2005.

27) *Capital requirements for processes* Programme on Quantitative Methods in Finance, Newton Institute for Mathematical Science, University of Cambridge, U.K., June 7, 2005.

28) *A unifying framework for utility maximization problems with unbounded semimartingales*, The Fields Institute: Seminar series on Quantitative Finance, Toronto, Canada, October 26, 2005.

29) *Risk measures and capital requirements for processes*, XII Workshop on Derivative Securities and Risk Management, Center of Applied Probability, Columbia University, New York, October 28, 2005.

30) *Risk measures and capital requirements for processes*, Seminar at The McMaster University, Canada, November 1, 2005

31) *A unified framework for utility maximization problems: an Orlicz space approach*, Carnegie Mellon, Pittsburgh, USA, April 3, 2006.

32) *Utility maximization with unbounded semimartingales: on the supermartingale property and on the indifference price*, Carnegie Mellon, Pittsburgh, USA, April 10, 2006.

33) *Indifference price and risk measures in Orlicz spaces: modeling catastrophic risk*. International Workshop on Mathematical Finance and Insurance, Lijiang, China, May 29, 2006

34) *A Unified framework for utility maximization problems: an Orlicz space approach,* University of Munich, Germany, June 9, 2006.

35) *Advanced course on risk measures: five lectures,* Technical University of Lisbon, June 21-23, 2006.

36) *Risk measures on Banach lattices and Orlicz spaces.* Conference on Risk Measure, Evry, France July 6, 2006.

37) *Indifference price with unbounded processes and claims: an Orlicz space approach*. Illinois Institute of Technology, Chicago, USA, October 5, 2006

38) *Risk measures on Banach lattices and Orlicz spaces*, Annual Conference on "Dynamic Risk Measures and Robust Control in Finance", Bendheim Center for Finance, Princeton University, USA, October 6-7, 2006.

39) *Indifference price with unbounded processes and claims: an Orlicz space approach*. Boston University, Boston, USA, October 10, 2006

40) *Indifference prices and convex risk measures in Orlicz spaces,* Annual Meeting of the American Mathematical Society, New Orleans, USA, January, 5-7, 2007.

41) *Risk measures on Banach lattices and Orlicz spaces*, Austin University, Texas, January 8, 2007.

42) *Indifference Price for general semimartingale: an Orlicz space approach*, University of California at Irvine, May 2008.

43) *Ten Lectures on Convex Duality Methods in Mathematical Finance*, NSF/CBMS Regional Conference, University of California at Santa Barbara, June 22-27 2008.

44) *Utility maximization and indifference pricing: an Orlicz space approach*, Plenary Lecture at the 5th World Congress of the Bachelier Finance Society, London, UK, 15-17 July, 2008.

45) *On the conditional certainty equivalent*, University of Southern California USA, April 2009.

46) *Robust representation of dynamic quasiconvex maps*, Workshop on "Foundations of Mathematical Finance", during the Thematic Program on Quantitative Finance, Fields Institute, Toronto Jan. 2010.

47) *On the representation of conditional quasiconvex maps,* Nomura Centre, University of Oxford, UK, Jan. 2010.

48) *Five Lectures on Duality Methods in Mathematical Finance,* Third Summer School in Mathematical Finance, African Institute for Mathematical Sciences, Capetown, South Africa 2010

49) Guest Lecturer in the Course: "Foundations of Mathematical Finance", during the Thematic Program on Quantitative Finance, Fields Institute, Toronto April 2010.

50) *Dual representation of conditional quasiconvex maps*, University of California at Santa Barbara, Oct. 2010.

51) *On quasiconvex dynamic risk measures*, University of Southern California, USA, Nov. 2010.

52) *On quasiconvex dynamic risk measures,* Plenary Lecturer at the SIAM Conference on Financial Mathematics and Engineering, San Francisco, Nov. 2010.

53) *On quasiconvex dynamic risk measures*, Research in Options, Mathematics and Finance Conference, Rio de Janeiro, Brazil, Dec. 2010.

54) *Complete Duality for Quasiconvex Conditional Maps*, Seventh Seminar on Stochastic Analysis, Random Fields and Applications, Ascona, Switzerland, May 2011.

55) *On Quasiconvex Dynamic Risk Measures and Performance Indices*, ICIAM 2011 Conference, Vancouver, Canada, July 2011.

56) *Two applications of quasi-convex analysis*, UCSB, USA, April, 2012.

57) *On Quasiconvex Dynamic Risk Measures and Performance Indices,* Quantitative Methods in Finance, Cairns, Australia, June 2012.

58) *On Quasiconvex Dynamic Risk Measures and Performance Indices,* Perspectives in Analysis and Probability, Conference in Honour of Freddy Delbaen, ETH, September 2012.

59) *Tutorial on Risk Measures*, Three Lectures at Ecole CEA EDF INRIA – Systemic Risk and Quantitative Risk Management, Paris, Oct. 2012.

60) *Tutorial on Risk Measures*, Four Lectures at the Workshop on Non Linear Expectation and Stochastic Calculus under Knightian Uncertainty, Institute of Mathematical Science, National University Singapore, June 28, 2013.

61) *Robust Arbitrage*, Quantitative Finance Retrospective Workshop, Fields Institute, Toronto, October 27, 2013.

62) *Conditionally evenly convex sets and the representation of conditional maps*, Southern California Probability Symposium 2013, USC, Los Angeles, December 7, 2013.

63) *Conditionally evenly convex sets and the representation of conditional quasi-convex risk measures*, Mathematical Finance Colloquium, USC, Los Angeles, February 3, 2014.

64) *Robust Arbitrage under Uncertainty in Discrete Time*, Workshop on Mathematical Finance, Banff Canada, May 2014

65) *Robust Arbitrage under Uncertainty in Discrete Time*, Advances in stochastic analysis for risk modeling, CIRM, Marseille France, September 2014.

66) Systemic risk Measures, IMPA, UCLA, March 24, 2015

67) *Model Free Arbitrage and Superhedging*, Mathematische Kolloquium, LMU Munich, June 11, 2015.

68) *Model free arbitrage and superhedging duality*, Advanced Methods in Mathematical Finance Conference, Angers, September 2015.

69) *Model Free Arbitrage and Superhedging*, International Conference on Stochastic Analysis and Applications, Hammamet, 19-23 October 2015.

70) *Model-free Arbitrage and Superhedging*, Research in Options 2015, IMPA Rio de Janeiro, December 2015.

71) *A unified approach to systemic risk measures via acceptance set,* King's College London, March 2016.

72) *Disentangle Price and Risk,* Risk Measures Workshop SAIF, Shanghai China, October 2016.

73) *Disentangling Price and Risk and Model Risk,* Pricing-Hedging Duality Workshop, ETH Zurich, March 2017.

74) *Pathwise Finance: Arbitrage and Pricing-Hedging Duality*, CFMAR-UCSB, USA, May 2017.

75) *Pathwise Finance,* Workshop on Recent Advances in Model Uncertainty, LMU-Munich, June 2017.

76) *Pathwise Finance: Arbitrage and Pricing-Hedging Duality*, CFMAR International Conference on Stochastic Analysis and Applications, Hammamet, October 2017

77) *Disentangle Price, Risk and Model Risk,* Advances in stochastic analysis for risk modeling, CIRM, Marseille France, November 2017.

78) *On Fairness of Systemic Risk Measures*, Mathematical Finance Seminar, Bielefeld University, Germany, April 2018.

79) *On Fairness of Systemic Risk Measures* Advanced Methods in Mathematical Finance, Anger, France, August 2018.

80) *On Fairness of Systemic Risk Measures,* International Conference on Control, Games and Stochastic Analysis, Hammamet, Tunisia, October 2018.

81) *On Fairness of Systemic Risk Measures*, ETH Zurich, November 2018.

82) *On Fairness of Systemic Risk Measures*, SIAM Conference on Financial Mathematics, Toronto June 2019

83) *Systemic Optimal Risk Transfer Equilibrium*, SIAM Conference on Financial Mathematics, Toronto June 2019.

84) *Systemic Optimal Risk Transfer Equilibrium,* Advances in Stochastic Analysis for Handling Risks in Finance and Insurance, CIRM, Marseille France, October 2019.

85) *Systemic Optimal Risk Transfer Equilibrium,* International Conference on Control, Games and Stochastic Analysis, Hammamet, Tunisia, October 2019.

86) *Multivariate Systemic Optimal Risk Transfer Equilibrium,* Research in Options 2019, IMPA Rio de Janeiro, December 2019.

87) *Entropy martingale optimal transport*, Paris Bachelier Seminar, October 2020 (Webinar).

88) *Entropy martingale optimal transport*, Research in Options 2020, IMPA Rio de Janeiro, December 2020 (Webinar).

89) *On systemic risk measures*, University of Le Mans, France, March 2021 (Webinar).

90) *Entropy martingale optimal transport*, Workshop on Mathematics and Computation of Financial Engineering, Erice, September 2021.

91) *Entropy martingale optimal transport*, Advances in Stochastic Analysis for Handling Risks in Finance and Insurance, CIRM, Marseille France, September 2021.

92) *Entropy martingale optimal transport*, Bachelier Finance Society One World seminar, September 2021 (Webinar).

Invited speaker in Italy:

93) *Quasi-martingales in frictional markets*. International Conference organized by the University of Udine in honor of Prof. Alberto Frigerio, Udine, September 13, 1994.

94) *Probabilità equivalente di martingala: applicazione nei mercati finanziari.* Seminars of the "Centro Volterra", Università Tor Vergata, Roma, March 15, 1995.

95) *Metodi di valutazione in mercati finanziari Incompleti*, Modena University, October 23, 1996.

96) *Certainty equivalent and martingale pricing in incomplete markets.* III Italian Conference on Mathematical Finance, Trento, May 27, 1997.

97) *Certo equivalente dinamico,* Math. Dept. "Guido Castelnuovo", University of Roma, January 29, 1999.

98) *Misure minimax di martingala*, IAC CNR-Roma, January 28, 1999.

99) *Certo equivalente dinamico*, Politecnico of Milano, March 11, 1999.

100) *Certo equivalente dinamico*, DIMADEFAS, Firenze University, May 19, 1999.

101) *Utility pricing in incomplete markets*, Conference on Quantitative Methods in Finance, Math. Dept., University of Milano, November 15, 1999.

102) *Principi di valutazione finanziaria,* Politecnico of Milano, November 16, 2000.

103) *Optimal investments in financial markets,* Roma University, March 20, 2001.

104) *Duality and pricing in incomplete markets,* International Workshop on Functional Analysis Methods in Economics and Finance, Diamante, Cosenza, June 29, 2001.

105) *Utility maximization in semimartingale markets models,* International Conference, University of Pisa, September 13, 2001.

106) *Dynamic convex risk measures*, Conferenza su Misura e Controllo del Rischio, Roma, June 17-20, 2003.

107) *Utility maximization in incomplete markets with general semimartingales*, Luiss-IAC Seminars, Rome, January 19, 2005.

108) *Utility maximization in incomplete markets with general semimartingales*, Statistics and Probability Seminars, Politecnico of Torino, March 16, 2005.

109) *Advanced course on* stochastic *calculus with application in finance:* 8 Lectures for junior researchers at the 8th Italian-Spanish Meeting on Financial Mathematics, Verbania, Italy, June 28-29, 2005

110) *A unifying framework for utility maximization,* International Conference on Functional Analysis Methods in Economics and Finance, Cetraro, Italy, July 9, 2005.

111) *Advanced course on "Valuation Principles and risk measures"*: 12 Lectures at the "Scuola di Alta Formazione in Finanza Matematica", Bologna University, Italy, January 2006.

112) *Indifference price and risk measures*, Workshop on "Modelli Dinamici in Economia e Finanza, Urbino, Italy, September 22, 2006.

113) *Indifference price with unbounded processes and claims: convex risk measures on Orlicz spaces*, Stochastic Processes: Theory and Applications: A Conference in Honor of the 65th birthday of Wolfgang J. Runggaldier , Bressanone, Italy, July 2007.

114) *Risk Measures and Scientific Impact Indices: from Risk Measures to Research Measures*, DEAS, University of Milano, May 2011.

115) From Risk Measures to Research Measures, Congresso AMASES 2011, Napoli, September 2011.

116) Risk Measures to Research Measures and V@R, Università Federico II Napoli, January 2012.

117) Value at Risk with Probability/Loss function, Prometeia, Bologna, March 2012.

118) Scientific Research Measures, BolzanoWorkshop on Research Evaluation, Free University of Bozen, Italy, May 10, 2013

119) *Finanza Matematica e crisi finanziarie*, Lectio Magistralis, AlfaClass Summer School of Mathematics, Politecnico di Torino, September 2015.

120) Systemic Risk Measures, Dependence and Risk Measures, University of Milano Bicocca, November 2015.

121) *On Fairness of Systemic Risk Measures,* Workshop in Honour of Maurizio Pratelli*,* Pisa University, June 2018.

122) *On Fairness of Systemic Risk Measures,* New Frontiers in Stochastics for Economics and Finance, Siena University, May 2019.

Talks:

123) *On the existence of equivalent martingale measures*, 22° International Conference on Stochastic Processes and their Applications, Bernoulli Mathematical Society, Amsterdam, June 93.

124) *The minimal entropy martingale measure and the valuation problem in incomplete markets*, AFFI - 13° International Conference in Finance, French Finance Association, Ginevra, 1996.

125) *Certainty equivalent and no arbitrage principles in incomplete markets*, Quantitative Methods in Finance, Canberra, Australia, September 1997.

126) *Certainty equivalent and no arbitrage: a reconciliation via duality theory*, International Conference in Finance-AFFI, Lille, France, July 1998.

127) *On the martingale measure that minimizes the maximum expected utility*, IME International Conference: Insurance, Mathematics and Economics, Losanna, Switzerland, July 1998.

128) *On the existence of minimax martingale measures*, International Conference on Mathematical Finance at Hammamet, Tunis, June 15, 1999.

129) *Dynamic certainty equivalent*, International Conference on Mathematical Finance at Hammamet, Tunis, June 15, 1999.

130) *On the existence of minimax martingale measures*, 10th INFORMS Applied Probability Conference, Ulm Germany, July 27, 1999.

131) *Representing sublinear risk measures and pricing rules,* The first World Congress of the Bachelier Finance Society, Paris, June 30, 2000.

132) *Optimal solutions to utility maximization and to the dual problem,* The second World Congress of the Bachelier Finance Society, Creta, June 13, 2002.

133) *Representing risk measures and preferences,* Quantitative Methods in Finance 2002 Conference, Cairns, Australia, December 9, 2002.

134) *A unified framework for utility maximization problems: an Orlicz space approach*, The 4th World Congress of the Bachelier Finance Society, Tokyo, Japan, August, 2006.

135) *Dual representation of quasiconvex conditional maps*, The 6th World Congress of the Bachelier Finance Society, Toronto, Canada, June, 2010.

136) *Model-free superhedging duality*, The 9th World Congress of the Bachelier Finance Society, New York USA, July, 2016.

Talks in Italy:

137) *Caratterizzazione delle martingale nella classe dei processi limitati inferiormente: applicazioni all'arbitraggio*, XVI Congress AMASES. Treviso, September 1992.

138) *Sull'esistenza di una misura equivalente di martingala*, XVII Congress AMASES, Ischia, September 1993.

139) *Misure equivalenti di martingala: applicazioni alla valutazione di strumenti finanziari,* Mathematical Finance and Economic, CNR-GNAFA Conference, Pisa, October 1993.

140) *Valutazioni di opzioni sui futures: un programma software*, Congress Real-time trading nei mercati finanziari, Bergamo University, November 1993.

141) *M-sets and dominated families of martingales measures*, International Conference CNR-GNAFA on recent advances in Mathematical Finance, Cortona, May - June 1994.

142) *Asset pricing in frictional markets,* XXII Congress European Finance Association, Milano, August 1995.

143) Valuation principle in security markets models with frictions, XIX Congress AMASES, Pugnochiuso, September 1995.

144) Semimartingales and financial markets, Seminari of "Probabilità e Statistica Matematica di Milano", Math. Dept., Milano University, May 1996.

145) *The valuation problem in incomplete markets: the entropy approach,* Seminar at the CIME Course on Financial Mathematics, Bressanone, July 1996.

146) *Entropy minimization and utility pricing in incomplete markets,* XX Congress AMASES, Urbino, September 1996.

147) *Utility and martingale pricing in incomplete markets*, XXI Congress AMASES, Roma, September 1997.

148) *Pricing in insurance and financial markets*, XXII Congress AMASES, Genova, September 1998.

149) *Utility pricing in incomplete markets*, Politecnico of Milano, May 2001.

150) *Putting order in risk measures*, XXX Euro Working Group Conference, May 2002, Capri.

151) *Cycle of five seminars "Duality in mathematical finance: introduction to convex analysis and duality theory*", Firenze University, February 2002.

152) *Cycle of five seminars "Duality in mathematical finance: arbitrage*" Firenze University, March 2002.

153) *Cycle of five seminars "Duality in mathematical finance: valuation principles*", Firenze University, March 2002.

154) *Cycle of five seminars "Duality in mathematical finance: optimal portfolio*", Firenze University, April 2002.

155) *Cycle of five seminars "Dualità in mathematical finance: risk measures*" Firenze University, May 2002.

156) *Arbitrage and preferences in stochastic securities market models*, XXVII Congress AMASES, Cagliari, September 2003.

157) *A unified framework for utility maximization problems: an Orlicz space approach,* Lecce University, September 15, 2006.

158) *Indifference price with unbounded semimartingales: an Orlicz space approach,* Lecce University, September 15, 2006.

159) *A unified framework for utility maximization problems: an Orlicz space approach,* Venezia, XIII Workshop on Quantitative finance, January 26, 2007.

160) *Complete Duality for Quasiconvex Dynamic Risk Measures*, Belgirate, Italy, Games and Decisions in Reliability and Risk, May 19, 2011.