

Curriculum Vitae

Pietro Rigo

April 28, 2017

Civil status and addresses

- Born in Arezzo, 9th january 1958. Married with a son.
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- Office: Department of Mathematics "F. Casorati", via Ferrata 1, 27100 Pavia, Italy; tel. 0382 985625.
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Education

- Degree in Statistics (Laurea in Scienze Statistiche ed Economiche), University of Siena, in 1982. Mark: summa cum laude (110/110 e lode). Supervisor: prof. Lorenzo Fattorini.
- PhD in Statistics (Dottorato di Ricerca in Statistica), University of Padova, in 1989. Supervisor: prof. Antonio Moro.
- Summer schools: (i) Perugia, 1985 (Probability, J. Brooks; Mathematical Statistics, P. Protter); (ii) Cortona, 1989 (Probability, P. Billingsley; Mathematical Statistics, E. Regazzini).
- Visiting: Minneapolis, summer 1994 (School of Statistics, working with A. Maitra and W. Sudderth).

Past and present positions

- Assistant professor in Statistics (ricercatore, S01A), Faculty of Economics, University of Firenze (1989-1992; qualified in 1993).
- Associate professor in Statistics (professore associato, S01A), Faculty of Economics, University of Firenze (1992-2000; qualified in 1997).
- Associate professor in Probability and Mathematical Statistics (A02B), Faculty of Economics, University of Pavia (2000-2001).
- Full professor in Probability and Mathematical Statistics (MAT/06), Faculty of Economics, University of Pavia (from 2001; qualified in 2004).

Miscellanea

- Associate Editor of: Statistical Methods and Applications (ex: Journal of the Italian Statistical Society) from 2005 to 2009; Bulletin of Statistics and Economics from 2009.
- Member of the board (Collegio Docenti) of the following PhD's (Dottorati di Ricerca): Statistica Applicata (University of Firenze, 1994-1997); Statistica Matematica (University of Pavia, 1998-2000); Matematica e Statistica (University of Pavia, from 2001).
- Member of various national research groups on Probability and/or Mathematical Statistics. In a few cases, local coordinator (for Firenze) of such groups.
- Member of the following scientific associations: U.M.I. (Unione Matematica Italiana), S.I.S. (Società Italiana di Statistica), A.M.S. (American Mathematical Society), I.S.B.A. (International Society for Bayesian Analysis), Bernoulli Society for Mathematical Statistics and Probability.

Teaching

- **Accademic courses (not PhD)**
 - (a) Practical Exercises (Esercitazioni) to the courses of **Calcolo delle Probabilità** and **Statistica I** (1989/90, 1990/91, 1991/92) Faculty of Economics, University of Firenze.
 - (b) **Istituzioni di Statistica** (1992/93, 1993/94, 1994/95) degree in Scienze Statistiche ed Attuariali, Faculty of Economics, University of Firenze.
 - (c) **Processi Stocastici** (1992/93, 1993/94, 1994/95) degree in Scienze Statistiche ed Attuariali, Faculty of Economics, University of Firenze.
 - (d) **Calcolo delle Probabilità e Statistica** (1993/94, 1994/95, 1995/96) degree in Scienze dell'Informazione, Faculty of Science (S.M.F.N.), University of Firenze.
 - (e) **Calcolo delle Probabilità** (from 1995/96 to 1999/2000) degrees in Scienze Statistiche ed Attuariali and Scienze Statistiche ed Economiche, Faculty of Economics, University of Firenze.
 - (f) **Statistica II** (from 1995/96 to 1999/2000) degrees in Scienze Statistiche ed Attuariali and Scienze Statistiche ed Economiche, Faculty of Economics, University of Firenze.
 - (g) **Probabilità** (ex **Calcolo delle Probabilità**, from 2000/01 to 2008/09) Faculty of Economics, University of Pavia.
 - (h) **Processi Stocastici** (from 2002/03 to 2007/08) Faculty of Economics, University of Pavia.
 - (i) **Statistica Base** (ex **Statistica II**, from 1999/2000 to 2003/04 and from 2006/07 to 2008/09) Faculty of Economics, University of Pavia.
 - (j) **Statistica Istituzioni** (ex **Statistica I**, from 2002/03 to 2005/06 and 2008/09) Faculty of Economics, University of Pavia.
 - (k) **Probabilità e Processi Stocastici** (oppure: Probability and Stochastic Processes; union of the previous two courses: **1. Probabilità**, **2. Processi Stocastici**; 2009/2010, 2010/2011 and 2013/2014, 2014/2015, 2015/2016) Faculty of Economics, University of Pavia.
 - (l) **Statistica** (union of the previous two courses: **1. Analisi dei dati**, **2. Statistica Istituzioni**; from 2009/2010 to 2011/2012) Faculty of Economics, University of Pavia.
 - (m) **Statistical Methods** (oppure: **Statistical Methods and Models for Finance**) (2011/2012, 2012/2013) Faculty of Economics, University of Pavia.

- (n) **Finanza Matematica** (2001/02, 2002/03, 2004/05, 2006/07, 2008/09) degree in Mathematics (Laurea Specialistica) Faculty of Science (S.M.F.N.), University of Pavia.
 - (o) **Teoria delle Probabilità** (2003/04, 2005/06, 2007/08) degree in Mathematics (Laurea Specialistica) Faculty of Science (S.M.F.N.), University of Pavia.
 - (p) **Processi Stocastici** (from 2009/2010 to 2014/2015 and 2016/2017) degree in Mathematics (Laurea Magistrale) Faculty of Science (S.M.F.N.), University of Pavia.
 - (q) **Elementi di Matematica e Statistica** (2014/2015) degree in Scienze e Tecnologie per la Natura, Faculty of Science (S.M.F.N.), University of Pavia.
 - (r) **Probabilità** (2015/2016) degree in Mathematics (Laurea Magistrale) Faculty of Science (S.M.F.N.), University of Pavia.
 - (s) **Complementi di Analisi Matematica e Statistica** (2015/2016 and 2016/2017) degree in Industrial Engineering, Faculty of Engineering, University of Pavia.
- **PhD courses**
 - (a) **Probability and Stochastic Processes**, Dottorato in Statistica Applicata, University of Firenze, from 1992 to 1999 and from 2004 to 2008.
 - (b) **Probability Theory**, Dottorato in Matematica, University of Firenze, in 1995.
 - (c) Some lectures on **Stochastic Processes**, Dottorato in Statistica, University of Bologna, in 1994, 1995 and 1998.
 - (d) **Weak convergence of probability measures on metric spaces**, Dottorato in Statistica Matematica or Dottorato in Matematica e Statistica, University of Pavia, in 1999, 2000 and 2012.
 - (e) **Weak convergence of probability measures and empirical processes**, Inter-Dottorato (Universities of: Pavia, Milano Bicocca, Milano Politecnico, Milano Statale), in 2013 and 2017.
 - (f) **Exchangeability and (some of) its applications**, Inter-Dottorato (Universities of: Pavia, Milano Bicocca, Milano Politecnico, Milano Statale), in 2015.
 - **Summer Schools**
Perugia (Scuola Matematica Interuniversitaria), august 2004, Mathematical Statistics.
 - **Others**
Collaboration (as a tutor or giving short courses) to some Masters or Specialized Schools (M.A.P.E., S.U.S.) organized by the University of Pavia in 2001 and 2002.

Research

So far, the main subject of my research is *conditional probability*, regarded in the standard framework (based on Kolmogorov's axioms) as well as in the finitely additive framework (based on de Finetti's notion of coherence). Actually, most of my research topics (listed below) can be referred, directly or indirectly, to conditional probability. In dealing with such topics, I cooperated with Patrizia Berti (systematically) and with Eugenio Regazzini and Luca Pratelli (very often). Roughly speaking, dating from 1983, my papers can be classified (but not partitioned, some papers appear in more than one class) as follows:

- (a) **Disintegrability, regular conditional distributions, Skorohod representation theorem**
[54], [47], [52], [50], [46], [39], [29], [30], [26], [24], [21], [16], [74], [75], [73], [69], [62], [63], [17], [10], [9], [5], [2], [84], [1].

(b) Coherence for conditional probabilities, finitely additive probability measures, integral representation of functionals

[54], [42], [55], [53], [52], [48], [43], [39], [35], [32], [33], [31], [15], [6], [58], [11], [18], [76], [77], [74], [75], [72], [73], [70], [71], [69], [68], [65], [63], [9], [7], [84].

(c) Bayesian inference and Gibbs sampling

[54], [45], [55], [52], [50], [48], [46], [44], [27], [28], [25], [4], [57], [23], [22], [79], [77], [74], [72], [70], [69], [68], [67], [65], [62], [59], [60], [20], [3], [17], [10], [83], [1].

(d) Empirical processes, exchangeability, limit theorems (weak, stable, almost sure uniform)

[41], [48], [49], [38], [40], [35], [36], [32], [33], [34], [29], [27], [28], [25], [4], [57], [24], [16], [5], [23], [22], [21], [73], [69], [68], [59], [60], [19], [20], [3], [14], [13], [8], [83].

(e) Miscellanea (concentration, stochastic integration, and others)

[56], [51], [82], [81], [80], [78], [64], [37], [66], [7], [2], [85].

Complete list of publications

Journals

- [1] Dreassi E., Rigo P. (2017) A note on compatibility of conditional autoregressive models, *Statistics and Probability Letters*, 125, 9-16.
- [2] Rigo P., Thorisson H. (2016) Transfer theorems and right-continuous processes, *Theory of Stochastic Processes*, to appear.
- [3] Berti P., Crimaldi I., Pratelli L., Rigo P. (2016) Asymptotics for randomly reinforced urns with random barriers, *Journal of Applied Probability*, 53, 1206-1220.
- [4] Berti P., Pratelli L., Rigo P. (2016) Rate of convergence of empirical measures for exchangeable sequences, *Mathematica Slovaca*, to appear.
- [5] Berti P., Pratelli L., Rigo P. (2015) A survey on Skorokhod representation theorem without separability, *Theory of Stochastic Processes*, 20, 1-12.
- [6] Berti P., Pratelli L., Rigo P. (2015) Two versions of the fundamental theorem of asset pricing, *Electronic Journal of Probability*, 20, 1-21.
- [7] Berti P., Pratelli L., Rigo P., Spizzichino F. (2015) Equivalent or absolutely continuous probability measures with given marginals, *Dependence Modeling*, 3, 47-58.
- [8] Berti P., Crimaldi I., Pratelli L., Rigo P. (2015) Central limit theorems for an Indian buffet model with random weights, *The Annals of Applied Probability*, 25, 523-547.
- [9] Berti P., Pratelli L., Rigo P. (2015) Gluing lemmas and Skorokhod representations, *Electronic Communications in Probability*, 20, 1-11.
- [10] Berti P., Dreassi E., Rigo P. (2014) Compatibility results for conditional distributions, *Journal of Multivariate Analysis*, 125, 190-203.

- [11] Berti P., Pratelli L., Rigo P. (2014) Price uniqueness and fundamental theorem of asset pricing with finitely additive probabilities, *Stochastics: An International Journal of Probability and Stochastic Processes* (ex: *Stochastics and Stochastic Reports*), 86, 135-146.
- [12] Berti P., Pratelli L., Rigo P. (2014) A unifying view on some problems in probability and statistics, *Statistical Methods and Applications*, 23, 483-500.
- [13] Berti P., Crimaldi I., Pratelli L., Rigo P. (2014) An Anscombe-type theorem, *Journal of Mathematical Sciences*, 196, 15-22.
- [14] Berti P., Pratelli L., Rigo P. (2013) Exchangeable sequences driven by an absolutely continuous random measure, *The Annals of Probability*, 41, 2090-2102.
- [15] Berti P., Pratelli L., Rigo P. (2013) Finitely additive equivalent martingale measures, *Journal of Theoretical Probability*, 26, 46-57.
- [16] Berti P., Pratelli L., Rigo P. (2013) A Skorohod representation theorem without separability, *Electronic Communications in Probability*, 18, 1-12.
- [17] Berti P., Dreassi E., Rigo P. (2013) A consistency theorem for regular conditional distributions, *Stochastics: An International Journal of Probability and Stochastic Processes* (ex: *Stochastics and Stochastic Reports*), 85, 500-509.
- [18] Berti P., Gori M., Rigo P. (2012) A note on the absurd law of large numbers in economics, *Journal of Mathematical Analysis and Applications*, 388, 98-101.
- [19] Berti P., Pratelli L., Rigo P. (2012) Limit theorems for empirical processes based on dependent data, *Electronic Journal of Probability*, 17, 1-18.
- [20] Berti P., Crimaldi I., Pratelli L., Rigo P. (2011) A central limit theorem and its applications to multicolor randomly reinforced urns, *Journal of Applied Probability*, 48, 527-546.
- [21] Berti P., Pratelli L., Rigo P. (2011) A Skorohod representation theorem for uniform distance, *Probability Theory and Related Fields*, 150, 321-335.
- [22] Berti P., Crimaldi I., Pratelli L., Rigo P. (2010) Central limit theorems for multicolor urns with dominated colors, *Stochastic Processes and their Applications*, 120, 1473-1491.
- [23] Berti P., Pratelli L., Rigo P. (2010) Atomic intersection of σ -fields and some of its consequences, *Probability Theory and Related Fields*, 148, 269-283.
- [24] Berti P., Pratelli L., Rigo P. (2010) Skorohod representation theorem via disintegrations, *Sankhya*, 72, 208-220.
- [25] Berti P., Crimaldi I., Pratelli L., Rigo P. (2009) Rate of convergence of predictive distributions for dependent data, *Bernoulli*, 15, 1351-1367.
- [26] Berti P., Rigo P. (2008) A conditional 0-1 law for the symmetric σ -field, *Journal of Theoretical Probability*, 21, 517-526.
- [27] Berti P., Pratelli L., Rigo P. (2008) Trivial intersection of σ -fields and Gibbs sampling, *The Annals of Probability*, 36, 2215-2234.
- [28] Berti P., Consonni G., Pratelli L., Rigo P. (2008) Comment: Gibbs sampling, exponential families and orthogonal polynomials (by P. Diaconis, K. Khare, L. Saloff-Coste), *Statistical Science*, 23, 179-182.
- [29] Berti P., Pratelli L., Rigo P. (2007) Skorohod representation on a given probability space, *Probability Theory and Related Fields*, 137, 277-288.

- [30] Berti P., Rigo P. (2007) 0-1 laws for regular conditional distributions, *The Annals of Probability*, 35, 649-662.
- [31] Berti P., Regazzini E., Rigo P. (2007) Modes of convergence in the coherent framework, *Sankhya*, 69, 314-329.
- [32] Berti P., Pratelli L., Rigo P. (2006) Asymptotic behaviour of the empirical process for exchangeable data, *Stochastic Processes and their Applications*, 116, 337-344.
- [33] Berti P., Rigo P. (2006) Finitely additive uniform limit theorems, *Sankhya*, 68, 24-44.
- [34] Berti P., Pratelli L., Rigo P. (2006) Almost sure weak convergence of random probability measures, *Stochastics: An International Journal of Probability and Stochastic Processes* (ex: *Stochastics and Stochastic Reports*), 78, 91-97.
- [35] Berti P., Rigo P. (2004) Convergence in distribution of non measurable random elements, *The Annals of Probability*, 32, 365-379.
- [36] Berti P., Pratelli L., Rigo P. (2004) Limit theorems for a class of identically distributed random variables, *The Annals of Probability*, 32, 2029-2052.
- [37] Berti P., Regazzini E., Rigo P. (2003) Integration with respect to Brownian-like processes, *Sankhya*, 65, 715-732.
- [38] Berti P., Rigo P. (2002) A uniform limit theorem for predictive distributions, *Statistics and Probability Letters*, 56, 113-120. 11-28.
- [39] Berti P., Rigo P. (2002) On coherent conditional probabilities and disintegrations, *Annals of Mathematics and Artificial Intelligence*, 35, 71-82.
- [40] Berti P., Pratelli L., Rigo P. (2002) Almost sure uniform convergence of empirical distribution functions, *International Mathematical Journal*, 2, 1237-1250.
- [41] Berti P., Mattei A., Rigo P. (2002) Uniform convergence of empirical and predictive measures, *Atti del Seminario Matematico e Fisico dell'Università di Modena*, L, 465-477.
- [42] Berti P., Regazzini E., Rigo P. (2001) Strong previsions of random elements, *Statistical Methods and Applications* (ex: *Journal of the Italian Statistical Society*), 10, 11-28.
- [43] Berti P., Rigo P. (2000) Integral representation of linear functionals on spaces of unbounded functions, *Proceedings of the American Mathematical Society*, 128, 3251-3258.
- [44] Berti P., Fattorini L., Rigo P. (2000) Eliminating nuisance parameters: two characterizations, *Test*, 9, 133-148.
- [45] Berti P., Fortini S., Ladelli L., Regazzini E., Rigo P. (2000) On parametric models for invariant probability measures, *Quaderni di Statistica*, vol. 2, 39-57.
- [46] Berti P., Rigo P. (1999) Sufficient conditions for the existence of disintegrations, *Journal of Theoretical Probability*, 12, 75-86.
- [47] Berti P., Rigo P. (1999) Existence of non measurable disintegrations, *Atti del Seminario Matematico e Fisico dell'Università di Modena*, XLVII, 65-76.
- [48] Berti P., Regazzini E., Rigo P. (1997) Well-calibrated, coherent forecasting systems, *Theory of Probability and its Applications*, 42, 82-102.
- [49] Berti P., Rigo P. (1997) A Glivenko-Cantelli theorem for exchangeable random variables, *Statistics and Probability Letters*, 32, 385-391.

- [50] Berti P., Rigo P. (1996) On the existence of inferences which are consistent with a given model, *The Annals of Statistics*, 24, 1235-1249.
- [51] Berti P., Rigo P. (1995) A note on Zenga concentration index, *Journal of the Italian Statistical Society*, 4, 397-404.
- [52] Berti P., Rigo P. (1994) Coherent inferences and improper priors, *The Annals of Statistics*, 22, 1177-1194.
- [53] Berti P., Regazzini E., Rigo P. (1992) Finitely additive Radon-Nikodym theorem and concentration function of a probability with respect to a probability, *Proceedings of the American Mathematical Society*, 114, 1069-1078.
- [54] Berti P., Rigo P. (1992) Weak disintegrability as a form of preservation of coherence, *Journal of the Italian Statistical Society*, 1, 161-181.
- [55] Berti P., Regazzini E., Rigo P. (1991) Coherent statistical inference and Bayes theorem, *The Annals of Statistics*, 19, 366-381.
- [56] Rigo P. (1987) Two inequalities for the Gini index, *Statistica*, XLVII, n. 4, 531-541.

Proceedings, Monographs, Encyclopedia-items

- [57] Berti P., Pratelli L., Rigo P. (2017) Asymptotics of predictive distributions, *Soft Methods for Data Science, Advances in Intelligence Systems and Computing 456 (Ferraro M.B. et al. Eds.)* SMPS 2016, Roma, 53-60, Springer.
- [58] Berti P., Pratelli L., Rigo P. (2012) Finitely additive FTAP under an atomic reference measure, *Advances in Computational Intelligence (Greco S. et al. Eds.)* IPMU 2012, Catania, 114-123, Springer.
- [59] Berti P., Rigo P. (2003) Bayesian nonparametrics for invariant, non-exchangeable data, *Invited Papers of the 54th Session of the I.S.I.*, Berlino, 106-109.
- [60] Berti P., Rigo P. (2003) Some results on Bayesian nonparametrics for invariant data, *Giornate Scientifiche in ricordo di Antonio C. Capelo*, Padova gennaio 2003, CLEUP, 21-29.
- [61] Berti P., Rigo P. (2002) Convergence in distribution of non measurable random elements, *Atti della XLI Riunione Scientifica della S.I.S.*, Milano, 463-466.
- [62] Berti P., Rigo P. (2000) On sufficiency and disintegrations, *Atti della XL Riunione Scientifica della S.I.S.*, Firenze, 479-482.
- [63] Berti P., Rigo P. (2000) Alcuni usi dell'additività finita in probabilità, *Riunione del Progetto Nazionale 40% "Analisi Reale"*, Trieste, Giugno 2000.
- [64] Berti P., Rigo P. (1999) Zenga concentration curve and index, *Encyclopedia of Statistical Sciences, Update Volume 3* (Kotz, Read, Banks Editors), Wiley-Interscience, 101-104.
- [65] Berti P., Rigo P. (1999) Coherence II (Update), *Encyclopedia of Statistical Sciences, Update Volume 3* (Kotz, Read, Banks Editors), Wiley-Interscience, 93-96.
- [66] Berti P., Regazzini E., Rigo P. (1996) Brownian-like processes and related stochastic calculus: some preliminary results, *Working papers n. 66*, Dipartimento Statistico, Università di Firenze.
- [67] Berti P., Petrone S., Rigo P. (1994) Su alcune classi complete di funzioni di decisione, *Atti della XXXVII Riunione Scientifica della S.I.S.*, San Remo, 483-489.

- [68] Berti P., Rigo P. (1993) Coherent predictive inferences, *Invited Papers of the 49th Session of the I.S.I.*, Firenze, 15-32.
- [69] Berti P., Regazzini E., Rigo P. (1992) Inferenze predittive strategiche, *Atti della XXXVI Riunione Scientifica della S.I.S.*, Pescara, 51-58.
- [70] Berti P., Rigo P. (1991) Probabilità ed inferenze statistiche coerenti, *Atti del convegno "L'inferenza statistica pura"*, Bagni di Lucca, Luglio 1990, Pubblicazione del Dipartimento Statistico dell'Università di Firenze, 63-77.
- [71] Berti P., Rigo P. (1991) Qualche commento su "il problema dei tre carcerati", *Atti del convegno "L'inferenza statistica pura"*, Bagni di Lucca, Luglio 1990, Pubblicazione del Dipartimento Statistico dell'Università di Firenze, 108-109.
- [72] Berti P., Rigo P. (1990) Alcune osservazioni circa la rappresentazione delle conoscenze iniziali, *Atti della XXXV Riunione Scientifica della S.I.S.*, Padova, 411-417.
- [73] Berti P., Regazzini E., Rigo P. (1990) de Finetti's coherence and complete predictive inferences, *Quaderno I.A.M.I. n. 5*, Milano.
- [74] Rigo P. (1989) Probabilità condizionali finitamente additive ed inferenza statistica, *Tesi di Dottorato di Ricerca*, Università di Padova.
- [75] Berti P., Rigo P. (1989) Conglomerabilità, disintegrabilità e coerenza, *Serie Ricerche Teoriche n. 11*, Dipartimento Statistico, Università di Firenze.
- [76] Rigo P. (1988) Un teorema di estensione per probabilità condizionate finitamente additive, *Atti della XXXIV Riunione Scientifica della S.I.S.*, Siena, 27-34.
- [77] Rigo P. (1988) Qualitative probabilities, pseudodensities and improper priors, *Quaderni del Dipartimento Statistico n. 29*, Università di Firenze.
- [78] Ferrari G., Rigo P. (1987) Sulla scomposizione del rapporto di concentrazione di Gini, *Atti del convegno "La distribuzione personale del reddito: problemi di formazione, di ripartizione e di misurazione"*, Brescia giugno 1985, Edizioni Vita e Pensiero, 347-363.
- [79] Rigo P. (1987) Fuzzy sets and vague prior information in statistical inference, *Contributed Papers of the 46th Session of the I.S.I.*, Tokyo, 369-370.
- [80] Grassini L., Rigo P. (1986) Alcuni aspetti formali delle misure di variabilità e di concentrazione, *Atti della XXXIII Riunione Scientifica della S.I.S.*, Bari, 353-361.
- [81] Rigo P. (1985) Lower and upper distribution free bounds for Gini's concentration ratio, *Contributed Papers of the 45th Session of the I.S.I.*, Amsterdam, 629-630.
- [82] Rigo P. (1983) Sulle stime lineari dei parametri di una distribuzione rettangolare in presenza di una osservazione anomala, *Quaderni dell'Istituto di Statistica n. 53*, Università di Siena.

Submitted

- [83] Berti P., Pratelli L., Rigo P. (2016) Asymptotic predictive inference with exchangeable data.
- [84] Berti P., Miranda E., Rigo P. (2016) Basic ideas underlying conglomerability and disintegrability.
- [85] Puccetti G., Rigo P., Wang B., Wang R. (2017) Centers of probability measures without the mean.