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# Marie Curie Career Integration Grant

### Advance Challenging Statistical Analysis for Massive High-Dimensional Nonlinear Spatial Time Series

In general, nonlinear features in spatial/temporal modelling are not possible within the traditional scope of covariance structures, and require more sophisticated tools. This proposal aims to develop new modelling and prediction tools with nonlinear time-lagged and spatial neighboring effects. In order to avoid the dangers of possible model mis-specification in using parametric approaches, we will develop nonparametric and semiparametric techniques for nonlinear spatio-temporal modelling and prediction, which allow the data to speak for themselves in determining the complex form of mathematical relationships between variables without prespecifying a parametric structure on the data-generating process.

### Recent Publications under acknowledgement of MC-CIG:

**[1]** Hiroshi Shiraishi & Zudi Lu (2018). Semiparametric estimation in the optimal dividend barrier for the classical risk model. Accepted by ***Scandinavian Actuarial Journal***, 2018, doi.org/10.1080/03461238.2018.1463557

**[2]** Chen, J., Li, D., Linton, O. & Lu, Z. (2017). Semiparametric Ultra-High Dimensional Model Averaging of Nonlinear Dynamic Time Series. Accepted by ***Journal of the American Statistician Association.*** dx.doi.org/10.1080/01621459.2017.1302339

[3] Al-Sulami, D., Jiang, Z., Lu, Z, & Zhu, J. (2017). Estimation for Semiparametric Nonlinear Regression of Irregularly Located Spatial Time Series Data. ***Econometrics and Statistics***, ttp://dx.doi.org/10.1016/ j.ecosta.2017.01.002

**[4]** Chen, J., Li, D., Linton, O. & Lu, Z. (2016). Semiparametric Dynamic Portfolio Choice with Multiple Conditioning Variables, ***Journal of Econometrics***, Volume 194, Issue 2, Pages 309–318. [Tier A* journal in ERA (Excellence in Research for Australia)] (Year2014 SCI Impact Factor (IF)= 1.533)

**[5]** Wong, Shiu Fung, Tong, Howell, Siu, Tak Kuen and Lu, Zudi (2016) A new multivariate nonlinear time series model for portfolio risk measurement: the threshold copula-based TAR approach. *Journal of Time Series Analysis,* DOI: 10.1111/jtsa.12206

**[6]** Wang, Zhengyan, Xu, Guanghua, Zhao, Peibiao and Lu, Zudi (2016) The optimal cash holding models for stochastic cash management of continuous time. *Journal of Industrial and Management Optimization*, accepted.

**[7]** Yuanyao Ding and Zudi Lu (2016) The optimal portfolios based on a modified safety-first rule with risk-free saving. ***Journal of Industrial and Management Optimization***, 12, (1), 83-102.

**[8]** Li, D., Linton, O. & Lu, Z. (2015). A Flexible Semiparametric Forecasting Model for Time Series. ***Journal of Econometrics***, 187, 345–357. [Tier A* journal in ERA] (IF= 1.533)

**[9]** Lu, Z. and Tjostheim, D. Nonparametric estimation of the probability density functions for irregularly observed spatial data. ***Journal of the American Statistician Association***, 2014, Volume 109, Issue 508, pages 1546-1564.

## Some Recent Publications related to this project:

[10] Xie, H., Wang, S., & Lu, Z. (2018). The behavioral implications of the bilateral gamma process. ***Physica A: Statistical Mechanics and its Applications***, 259-264. DOI: 10.1016/j.physa.2018.02.121

[11] Hu, F., Lu, Z., Wong, H. and Yuen, T.P. (2016). Analysis of air quality time series of Hong Kong with graphical modeling, ***Environmetrics***, accepted. DOI: 10.1002/env.238.

[12] Hallin, M., Lu, Z., Paindaveine, D. & Siman, M. (2015). Local Bilinear Multiple-Output Quantile/Depth Regression. ***Bernoulli***, 21, 1435-1466. [Tier A journal in ERA] (IF=1.296)

[13] Yan Sun, Hongjia Yan, Wenyang Zhang, and Zudi Lu "A semiparametric spatial dynamic model", ***Annals of Statistics***, 42 (2014), no. 2, 700-727.

[14] Zudi Lu, Qingguo Tang and Longsheng Cheng. Estimating Spatial Quantile Regression with Functional Coefficients: A robust semiparametric framework. ***Bernoulli***, Volume 20, Number 1 (February 2014), 164-189.

[15] Z. Jiang, C. Du, A. Jablensky, H. Liang, Z.Lu, Y. Ma & K.L. Teo. Analysis of Schizophrenia Data Using a Nonlinear Threshold Index Logistic Model. ***PLOS-ONE***, October 2014 | Volume 9 | Issue 10 | e109454. doi:10.1371/ journal.pone.0109454 (SCI Impact factor 3.534 in 2013).

## Invited Seminars and Conferences with support under this project:

[1] The 2nd International Conference on Econometrics and Statistics (EcoSta 2018) will take place at the City University of Hong Kong, Hong Kong 19-21 June 2018. Organiser, Chair an Speaker of the organized invited session EO059: Recent advances in time series and spatial econometrics and statistics.

[2] The 2018 ICSA China Conference with the Focus on Data Science will be held on July 2-5, 2018 at Shangri-La Hotel,9 Xiang Gang Zhong Lu, Qingdao, Shandong, China. Invited speaker for the session “Modelling and learning for spatiotemporal and truncated normal data”, giving a talk on “Semiparametric data-driven nonlinear model with penalized spatio-temporal lag interactions”.

[3] Invited Speaker of The York Econometrics Symposium, 26 & 27 April 2018, York, UK.

[4] Invited Speaker of The 7th Annual Econometrics Workshop (19th March 2018, ULMS, Liverpool, UK)

[5] The **11th International Conference on Computational and Financial Econometrics** (CFE 2017), at the Senate House, University of London, UK, 16-18 December 2017, speakers and organizer of sessions: CO120: Spatial econometric modelling (Organizers: *Maria Kyriacou*, *Zudi Lu),* and CO122: Financial time series modelling (Organizers: *Zudi Lu*, *Yan Sun)*

[6] The 31st European Meeting of Statisticians (EMS), Helsinki, Finland, 24 Jul - 28 Jul 2017. One of the three Invited speakers for invited session IS3: New Trends in Spatial Statistics.

[7] The 1st **International Conference on Econometrics and Statistics** (EcoSta2017), taking place at the Hong Kong University of Science and Technology, Hong Kong 15-17 June 2017. Member of Scientific Program Committee and organizer/chair of an invited session “Advances in statistical & econometric modelling of risk processes”.

[8] The 10**th International Conference on Computational and Financial Econometrics** (CFE 2016), the Higher Technical School of Engineering, University of Seville, Spain, 9-11 December 2016. Member of Scientific Program Committee, and organiser of invited sessions “CO403: Advances in complex spatial and spatio-temporal econometrics” (with *Maria Kyriacou*) and “CO533: Financial econometrics under uncertainty” (with *Yan Sun)*

[9] Organiser and Chair of an invited session **15 “New advances in inference for time series and econometric modeling” with the** 10th International Chinese Statistical Association (ICSA) conference on Global Growth of Modern Statistics in the 21st Century, held at Shanghai Jiao Tong University, 19-21 Dec. 2016.

[10] PhD student, Xiaohang Ren, attended and gave a talk on 41st IAEE (International Association for Energy Economics) International Conference Groningen, Netherlands, 10 – 13 June 2018.

[11] Invited Speaker for Statistics Seminar at University of Manchester, "Recent progress of nonlinear spatial modelling with nonparametric and semiparametric approaches: A personal review", 27 April 2016.

[12] Invited seminar speaker, School of Business, Hunan University, 30-31 Dec, 2015.

[13] Invited seminar speaker, School of Mathematics, Chongqing Normal University, 23-24 Dec, 2015.

[14] Invited seminar speaker, School of Economics, Southwestern University of Finance and Economics, 25-26 Dec, 2015.

[15] Invited Speaker for "**Workshop on Frontier Research in Statistics in memory of Professor Ping Cheng**", jointly held by Chinese Academy of Sciences (Academy of Mathematics and Systems Science) and Capital Normal University, Beijing, 18-20 Dec. 2015.

[16] The **9th International Conference on Computational and Financial Econometrics** (CFE 2015), Senate House, University of London, 12-14 Dec. 2015. Member of Scientific Program Committee, and organiser and chair of invited session "CO596: Temporal and spatial econometric modelling and testing".

[17] Invited Speaker for "**Workshop on recent developments in statistics for complex dependent data**", held, at Loccum, by Institut für Mathematische Stochastik, Technische Universität Braunschweig, August 27-30, 2015.

[18] Invited Speaker for "**Workshop on Financial Engineering and Risk Management**", held by Center for Financial Engineering and Risk Management, Sun Yat-Sen University, Guangzhou, China, 25-26, July, 2015.

[19] 2015 IMS-China International Conference on Statistics and Probability, Kunming, 1-4 July 2015, Organiser and chair of invited session "IS07 Semiparametric analysis of nonstationary time series and spatio-temporal processes".

[20] Invited seminar speaker, University of Kent, School of Mathematics, Statistics & Actuarial Science, 4 Dec. 2014.

[21] The **8th International Conference on Computational and Financial Econometrics** (CFE 2014), at the University of Pisa, Italy, 6-8 December 2014.

[22] Invited speaker , Nonlinear time series analysis - thresholding and beyond: a conference in honour of Professor Howell Tong to celebrate his 70th birthday, 19-20 Sept 2014, London School of Economics.

[23] Invited seminar speaker, School of Mathematics, Hefei University of Technology, 15 July, 2014.

[24] Invited short course and visiting School of Economics and Management, Nanjing University of Sci. & Tech., 1-15 July 2014.

[25] Invited speaker, Annual Meeting of China Engineering Applied Probability and Statistics, Tianjin University, 19-22, July 2014.

[26] **2014 China Meeting** of **Econometric Society**. June 25-27, **2014**. Xiamen University, China.

## Comments

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