

Director of Research. Hanlin Shang  
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## Biography

### Research Interests

Functional data analysis

Nonparametric and semiparametric statistics

Bayesian econometrics

Computational statistics

Demographic forecasting

### Editorial Board

Editor, Australian and New Zealand Journal of Statistics (7/2019-)

Associate Editor, Journal of Computational and Graphical Statistics (1/2017-)

Associate Editor, Journal of the Royal Statistical Society: Series A (1/2019-)

Associate Editor, Computational Statistics (1/2019-)

Associate Editor, Forecasting (3/2020-)

Associate Editor, International Journal of Forecasting (2/2021-)

Associate Editor, Demographic Research (4/2022-)

Associate Editor, Australian and New Zealand Journal of Statistics (1/2017-6/2019)

### Grants & Awards

2022: ARC Discovery Project, DP230102250

2022: Enterprise Partnership Scheme, Macquarie University

2020: Research Accelerator Grant Scheme, Macquarie University

2018, 2019: Mid-Career Research Grant Scheme, Australian National University

2018, 2019: RSFAS Cross-Disciplinary Grant Scheme, Australian National University

2017: ARC Discovery Project, DP170102468

2016, 2017: Research School of Social Science Cross-College Grant

2017: IUSSP Travel Grant

2016: SOA Travel Grant

2013: IIF Travel Grant

2010: Mollie Holman Doctoral Medal, Monash University

### Visiting Experience

Department of Child & Adolescent Psychiatry, New York University (7/2013)

Mailman School of Public Health, Columbia University (8/2013; 4/2018)

Cass Business School, City, University of London (6/2014; 12/2015; 6/2018)

Institute of Statistical Science, Academia Sinica, Taipei (12/2014)

ESRC Centre for Population Change, University of Southampton (12/2015; 6/2017; 7/2018)

Department of Statistics, Colorado State University (1/2017; 2/2018)

Department of Statistical Science, Cornell University (3/2018)

United Nations Population Division (3/2018)

Department of Statistics & Actuarial Science, University of Waterloo (4/2018)

Department of Statistics & Actuarial Science, Simon Fraser University (5/2018)

Department of Mathematics, University of York (5/2018)

Postdoc Experience

ESRC Centre for Population at the University of Southampton (January - December, 2013)

Department of Econometrics and Business Statistics, Monash University (July, 2010 - December, 2012)

Affiliations

I am also a visiting scholar at the ESRC Centre for Population Change at the University of Southampton.

I am an affiliated member at the School of Demography at the Australian National University.

Supervision

Supervised Dr Jasmine Ha for her postdoc project, Australian National University, July 2018 - June 2020 (a Lecturer at Vietnam National University)

Supervised Dr. Philip Drummond as a panel member for his Ph.D. program, February 2014 - July 2018 (a Lecturer at Monash University)

Supervised Dr. Antonio Elias Fernandez, visiting 4th year Ph.D. student from Universidad Carlos III de Madrid, November 2018 - April 2019 (a postdoc research fellow at Universidad de Málaga)

Supervised Dr. Yuan Gao as the chair for her Ph.D. program, April 2015 - July 2020 (a Lecturer at the ANU from July 2020)

Supervised Dr. Yang Yang as the chair for his Ph.D. program, February 2016 - September 2020, September 2020 - August 2022 (a postdoc research fellow at Monash University); September 2022 - present (a Lecturer at the University of Newcastle)

Supervised Dr. Chen Tang as the chair for his Ph.D. program, March 2016 - April 2021 (a Lecturer at the ANU from February 2021)

Supervised Dr. Xin (Landy) Huang as the chair for her Ph.D. program, September 2020 - May 2022 (a data analyst at Deloitte Australia); June 2022 - present (a data analyst at Commonwealth Bank of Australia)

Supervising Ms. Michelle Dong (currently a senior manager at Deloitte Australia)

## Qualifications

Statistics, Ph.D., Monash University

1 Mar 2007 → 28 Feb 2010

Award Date: 23 Sep 2010

Statistics, Bachelor with First Class Honours, La Trobe University

1 Mar 2004 → 29 Dec 2006

Award Date: 29 Dec 2006

31 Dec 2020 HDR30: HDR Supervision Orientation 2020-2023, HDR31

## Employment

### Professor

Professor

Department of Actuarial Studies and Business Analytics

Macquarie University

1 Jun 2020 → present

## Research outputs

### Change point detection for COVID-19 excess deaths in Belgium

Shang, H. L. & Xu, R., Dec 2022, In: Journal of Population Research. 39, 4, p. 557-565 9 p.

### Clustering and forecasting multiple functional time series

Tang, C., Shang, H. L. & Yang, Y., Dec 2022, In: Annals of Applied Statistics. 16, 4, p. 2523-2553 31 p.

### Stopping time detection of wood panel compression: A functional time series approach

Shang, H. L., Cao, J. & Sang, P., Nov 2022, In: Journal of the Royal Statistical Society. Series C: Applied Statistics. 71, 5, p. 1205-1224 20 p.

### On partial least squares estimation in scalar-on-function regression models

Saricam, S., Beyaztas, U., Asikgil, B. & Shang, H. L., 12 Oct 2022, (E-pub ahead of print) In: Journal of Chemometrics. 16 p.

### Nonlinear autocorrelation function of functional time series

Huang, L. & Shang, H. L., 7 Oct 2022, (E-pub ahead of print) In: Nonlinear Dynamics. 18 p.

### Sieve bootstrapping the memory parameter in long-range dependent stationary functional time series

Shang, H. L., 1 Oct 2022, (E-pub ahead of print) In: ASTA Advances in Statistical Analysis. 21 p.

### Depth-based reconstruction method for incomplete functional data

Elías, A., Jiménez, R. & Shang, H. L., 26 Sep 2022, (E-pub ahead of print) In: Computational Statistics. 29 p.

### Multi-population modelling and forecasting life-table death counts

Shang, H. L., Haberman, S. & Xu, R., Sep 2022, In: Insurance: Mathematics and Economics. 106, p. 239-253 15 p.

### Forecasting Australian fertility by age, region, and birthplace

Yang, Y., Shang, H. L. & Raymer, J., 31 Aug 2022, (E-pub ahead of print) In: International Journal of Forecasting.

### A model sufficiency test using permutation entropy

Huang, X., Shang, H. L. & Pitt, D., Aug 2022, In: Journal of Forecasting. 41, 5, p. 1017-1036 20 p.

### Permutation entropy and its variants for measuring temporal dependence

Huang, X., Shang, H. L. & Pitt, D., 28 Jul 2022, In: Australian and New Zealand Journal of Statistics.

### Dynamic functional time-series forecasts of foreign exchange implied volatility surfaces

Shang, H. L. & Kearney, F., Jul 2022, In: International Journal of Forecasting. 38, 3, p. 1025-1049 25 p.

### Forecasting: theory and practice

Petropoulos, F., Apiletti, D., Assimakopoulos, V., Babai, M. Z., Barrow, D. K., Ben Taieb, S., Bergmeir, C., Bessa, R. J., Bijak, J., Boylan, J. E., Browell, J., Carnevale, C., Castle, J., Cirillo, P., Clements, M. P., Cordeiro, C., Cyrino Oliveira, F. L., De Baets, S., Dokumentov, A., Ellison, J. & 60 others, Fiszeder, P., Franses, P. H., Frazier, D. T., Gilliland, M., Gönül, M. S., Goodwin, P., Grossi, L., Grushka-Cockayne, Y., Guidolin, M., Guidolin, M., Gunter, U., Guo, X., Guess, R., Harvey, N., Hendry, D. F., Hollyman, R., Januschowski, T., Jeon, J., Jose, V. R. R., Kang, Y., Koehler, A. B., Kolassa, S., Kourentzes, N., Leva, S., Li, F., Litsiou, K., Makridakis, S., Martin, G. M., Martinez, A. B., Meeran, S., Modis, T., Nikolopoulos, K., Önköl, D., Paccagnini, A., Panagiotelis, A., Panapakidis, I., Pavia, J. M., Pedio, M., Pedregal, D. J., Pinson, P., Ramos, P., Rapach, D. E., Reade, J. J., Rostami-Tabar, B., Rubaszek, M., Sermpinis, G., Shang, H. L., Spiliotis, E., Syntetos, A. A., Talagala, P. D., Talagala, T. S., Tashman, L., Thomakos, D., Thorarindottir, T., Todini, E., Trapero Arenas, J. R., Wang, X., Winkler, R. L., Yusupova, A. & Ziel, F., Jul 2022, In: International Journal of Forecasting. 38, 3, p. 705-871 167 p.

### Is the group structure important in grouped functional time series?

Yang, Y. & Shang, H. L., Jul 2022, In: Journal of Data Science. 20, 3, p. 303-324 22 p.

**Air pollution and mortality impacts**

Dong, Z. M., Shang, H. L. & Bruhn, A., Jun 2022, In: *Risks*. 10, 6, p. 1-21 21 p., 126.

**A robust partial least squares approach for function-on-function regression**

Beyaztas, U. & Shang, H. L., Jun 2022, In: *Brazilian Journal of Probability and Statistics*. 36, 2, p. 199-219 21 p.

**Selecting the derivative of a functional covariate in scalar-on-function regression**

Hooker, G. & Shang, H. L., Jun 2022, In: *Statistics and Computing*. 32, 3, p. 1-12 12 p., 35.

**Nonstationary fractionally integrated functional time series**

Li, D., Robinson, P. M. & Shang, H., 6 May 2022, (Accepted/In press) In: *Bernoulli*.

**Feature extraction for functional time series: Theory and application to NIR spectroscopy data**

Yang, Y., Yang, Y. & Shang, H. L., May 2022, In: *Journal of Multivariate Analysis*. 189, p. 1-21 21 p., 104863.

**On projection methods for functional time series forecasting**

Elías, A., Jiménez, R. & Shang, H. L., May 2022, In: *Journal of Multivariate Analysis*. 189, p. 1-13 13 p., 104890.

**Function-on-function linear quantile regression**

Beyaztas, U. & Shang, H. L., 27 Apr 2022, In: *Mathematical Modelling and Analysis*. 27, 2, p. 322-341 20 p.

**A robust scalar-on-function logistic regression for classification**

Mutis, M., Beyaztas, U., Simsek, G. G. & Shang, H. L., 18 Apr 2022, (E-pub ahead of print) In: *Communications in Statistics - Theory and Methods*. 17 p.

**Factor-augmented model for functional data**

Gao, Y., Shang, H. & Yang, Y., 14 Apr 2022, (Accepted/In press) In: *Statistica Sinica*.

**Temporal and spatial Taylor's law: Application to Japanese subnational mortality rates**

Yang, Y., Shang, H. & Cohen, J., 9 Apr 2022, (Accepted/In press) In: *Journal of the Royal Statistical Society. Series A: Statistics in Society*.

**Robust bootstrap prediction intervals for univariate and multivariate autoregressive time series models**

Beyaztas, U. & Shang, H. L., 4 Apr 2022, In: *Journal of Applied Statistics*. 49, 5, p. 1179-1202 24 p.

**A robust functional partial least squares for scalar-on-multiple-function regression**

Beyaztas, U. & Shang, H. L., Apr 2022, In: *Journal of Chemometrics*. 36, 4, p. 1-19 19 p., e3394.

**Machine-learning-based functional time series forecasting: Application to age-specific mortality rates**

Beyaztas, U. & Shang, H., 18 Mar 2022, In: *Forecasting*. 4, 1, p. 394-408 15 p.

**Function-on-function partial quantile regression**

Beyaztas, U., Shang, H. L. & Alin, A., Mar 2022, In: *Journal of Agricultural, Biological, and Environmental Statistics*. 27, 1, p. 149-174 26 p.

**Not all long-memory estimators are born equal: The case of nonstationary functional time series**

Shang, H. L., Mar 2022, In: *Canadian Journal of Statistics*. 50, 1, p. 357-380 24 p.

**Bayesian bandwidth estimation for local linear fitting in nonparametric regression models**

Shang, H. & Zhang, X., Feb 2022, In: *Studies in Nonlinear Dynamics and Econometrics*. 26, 1, p. 55-71 17 p.

**A comparison of parameter estimation in function-on-function regression**

Beyaztas, U. & Shang, H. L., 2022, In: Communications in Statistics - Simulation and Computation. 51, 8, p. 4607-4637 31 p.

**Functional linear models for interval-valued data**

Beyaztas, U., Shang, H. L. & Abdel-Salam, A-S. G., 2022, In: Communications in Statistics - Simulation and Computation. 51, 7, p. 3513-3532 20 p.

**Bootstrap prediction bands for functional time series**

Paparoditis, E. & Shang, H. L., 16 Sep 2021, (E-pub ahead of print) In: Journal of the American Statistical Association. 15 p.

**Local Whittle estimation of long-range dependence for functional time series**

Li, D., Robinson, P. M. & Shang, H. L., Sep 2021, In: Journal of Time Series Analysis. 42, 5-6, p. 685-695 11 p.

**Double bootstrapping for visualizing the distribution of descriptive statistics of functional data**

Shang, H. L., 3 Jul 2021, In: Journal of Statistical Computation and Simulation. 91, 10, p. 2116-2132 17 p.

**A functional autoregressive model based on exogenous hydrometeorological variables for river flow prediction**

Beyaztas, U., Shang, H. & Yaseen, Z., Jul 2021, In: Journal of Hydrology. 598, p. 1-19 19 p., 126380.

**Granger causality of bivariate stationary curve time series**

Shang, H. L., Ji, K. & Beyaztas, U., Jul 2021, In: Journal of Forecasting. 40, 4, p. 626-635 10 p.

**Functional time series forecasting of extreme values**

Shang, H. & Xu, R., 8 Jun 2021, In: Communications in Statistics Case Studies Data Analysis and Applications. 7, 2, p. 182-199 18 p.

**A partial least squares approach for function-on-function interaction regression**

Beyaztas, U. & Shang, H. L., Jun 2021, In: Computational Statistics. 36, 2, p. 911-939 29 p.

**Forecasting the old-age dependency ratio to determine a sustainable pension age**

Hyndman, R. J., Zeng, Y. & Shang, H. L., Jun 2021, In: Australian and New Zealand Journal of Statistics. 63, 2, p. 241-256 16 p.

**Bayesian bandwidth estimation and semi-metric selection for a functional partial linear model with unknown error density**

Shang, H. L., 12 Mar 2021, In: Journal of Applied Statistics. 48, 4, p. 583-604 22 p.

**Forecasting Australian subnational age-specific mortality rates**

Shang, H. L. & Yang, Y., Mar 2021, In: Journal of Population Research. 38, 1, p. 1-24 24 p.

**Neural network prediction of crude oil futures using B-splines**

Butler, S., Kokoszka, P., Miao, H. & Shang, H. L., 1 Feb 2021, In: Energy Economics. 94, p. 1-11 11 p., 105080.

**Estimation of a functional single index model with dependent errors and unknown error density**

Shang, H. L., 1 Dec 2020, In: Communications in Statistics - Simulation and Computation. 49, 12, p. 3111-3133 23 p.

**Retiree mortality forecasting: A partial age-range or a full age-range model?**

Shang, H. L. & Haberman, S., Sep 2020, In: Risks. 8, 3, p. 1-11 11 p., 69.

**Synergy in fertility forecasting: improving forecast accuracy through model averaging**

Shang, H. & Booth, H., Sep 2020, In: *Genus*. 76, p. 1-27 23 p., 27.

**Modelling functional data with high-dimensional error structure**

Gao, Y., Shang, H. & Yang, Y., Jun 2020, *Functional and high-dimensional statistics and related fields*. Aneiros, G., Horová, I., Huésková, M. & Vieu, P. (eds.). Cham: Springer, Springer Nature, p. 99-106 8 p. (Contributions to Statistics).

**Forecasting multiple functional time series in a group structure: An application to mortality**

Shang, H. L. & Haberman, S., 18 May 2020, In: *ASTIN Bulletin*. 50, 2, p. 357-379 23 p.

**Dynamic principal component regression for forecasting functional time series in a group structure**

Shang, H. L., 20 Apr 2020, In: *Scandinavian Actuarial Journal*. 2020, 4, p. 307-322 16 p.

**Long-range dependent curve time series**

Li, D., Robinson, P. M. & Shang, H. L., 2 Apr 2020, In: *Journal of the American Statistical Association*. 115, 530, p. 957-971 15 p.

**Discussion on the Paper by Dubey and Müller**

Shang, H. L., Apr 2020, In: *Journal of the Royal Statistical Society. Series B: Statistical Methodology*. 82, 2, p. 320 1 p.

**Forecasting age distribution of death counts: an application to annuity pricing**

Shang, H. L. & Haberman, S., 17 Mar 2020, In: *Annals of Actuarial Science*. 14, 1, p. 150-169 20 p.

**On function-on-function regression: partial least squares approach**

Beyaztas, U. & Shang, H. L., 7 Mar 2020, In: *Environmental and Ecological Statistics*. 27, 1, p. 95–114 20 p.

**Uncovering predictability in the evolution of the WTI oil futures curve**

Kearney, F. & Shang, H. L., 14 Jan 2020, In: *European Financial Management*. 26, 1, p. 238-257 20 p.

**A comparison of Hurst exponent estimators in long-range dependent curve time series**

Shang, H., Jan 2020, In: *Journal of time series econometrics*. 12, 1, p. 1-39 39 p., 20190009.

**Incorporating model uncertainty in the construction of bootstrap prediction intervals for functional time series**

Paparoditis, E. & Shang, H., 2020, *Nonparametric Statistics: 4th ISNPS, Salerno, Italy, June 2018*. La Rocca, M., Liseo, B. & Salmaso, L. (eds.). Salerno: Springer, Springer Nature, p. 415-422 8 p. (Springer Proceedings in Mathematics & Statistics; vol. 339).

**Intraday forecasts of a volatility index: functional time series methods with dynamic updating**

Shang, H. L., Yang, Y. & Kearney, F., 7 Nov 2019, In: *Annals of Operations Research*. 282, 1-2, p. 331–354 24 p.

**Forecasting functional time series using weighted likelihood methodology**

Beyaztas, U. & Shang, H. L., 2 Nov 2019, In: *Journal of Statistical Computation and Simulation*. 89, 16, p. 3046-3060 15 p.

**Implied volatility surface predictability: the case of commodity markets**

Kearney, F., Shang, H. L. & Sheenan, L., Nov 2019, In: *Journal of Banking and Finance*. 108, 16 p., 105657.

**Semiparametric regression using variational approximations**

Hui, F. K. C., You, C., Shang, H. L. & Müller, S., 2 Oct 2019, In: *Journal of the American Statistical Association*. 114, 528, p. 1765-1777 13 p.

**Forecasting of density functions with an application to cross-sectional and intraday returns**

Kokoszka, P., Miao, H., Petersen, A. & Shang, H., 1 Oct 2019, In: *International Journal of Forecasting*. 35, 4, p. 1304-1317 14 p.

**Dynamic principal component regression: Application to age-specific mortality forecasting**

Shang, H. L., 20 Sep 2019, In: ASTIN Bulletin. 49, 3, p. 619-645 27 p.

**A robust functional time series forecasting method**

Shang, H. L., 24 Mar 2019, In: Journal of Statistical Computation and Simulation. 89, 5, p. 795-814 20 p.

**High-dimensional functional time series forecasting: An application to age-specific mortality rates**

Gao, Y., Shang, H. L. & Yang, Y., Mar 2019, In: Journal of Multivariate Analysis. 170, p. 232-243 12 p.

**Visualizing rate of change: an application to age-specific fertility rates**

Shang, H. L., Jan 2019, In: Journal of the Royal Statistical Society. Series A: Statistics in Society. 182, 1, p. 249-262 14 p.

**Model confidence sets and forecast combination: an application to age-specific mortality**

Shang, H. L. & Haberman, S., 21 Nov 2018, In: Genus. 74, 1, 23 p., 19.

**Bootstrap methods for stationary functional time series**

Shang, H. L., 8 Jan 2018, In: Statistics and Computing. 28, 1, p. 1-10 10 p.

**Forecasting intraday S&P 500 index returns: A functional time series approach**

Shang, H. L., Nov 2017, In: Journal of Forecasting. 36, 7, p. 741-755 15 p.

**Inference for the autocovariance of a functional time series under conditional heteroscedasticity**

Kokoszka, P., Rice, G. & Shang, H., Nov 2017, In: Journal of Multivariate Analysis. 162, p. 32-50 19 p.

**Methods for scalar-on-function regression**

Reiss, P. T., Goldsmith, J., Shang, H. L. & Ogden, R. T., Aug 2017, In: International Statistical Review. 85, 2, p. 228-249 22 p.

**A Plug-in bandwidth selection procedure for long-run covariance estimation with stationary functional time series**

Rice, G. & Shang, H. L., Jul 2017, In: Journal of Time Series Analysis. 38, 4, p. 591-609 19 p.

**Grouped multivariate and functional time series forecasting: An application to annuity pricing**

Shang, H. L. & Haberman, S., Jul 2017, In: Insurance: Mathematics and Economics. 75, p. 166-179 14 p.

**Grouped functional time series forecasting: An application to age-specific mortality rates**

Shang, H. L. & Hyndman, R. J., 3 Apr 2017, In: Journal of Computational and Graphical Statistics. 26, 2, p. 330-343 14 p.

**Multivariate functional time series forecasting: application to age-specific mortality rates**

Gao, Y. & Shang, H., Mar 2017, In: Risks. 5, 2, 18 p., 21.

**Reconciling forecasts of infant mortality rates at national and sub-national levels: grouped time-series methods**

Shang, H. L., 8 Feb 2017, In: Population Research and Policy Review. 36, 1, p. 55-84 30 p.

**Functional time series forecasting with dynamic updating: An application to intraday particulate matter concentration**

Shang, H. L., Jan 2017, In: Econometrics and Statistics. 1, p. 184-200 17 p.

**Grouped multivariate and functional time series forecasting: An application to annuity pricing**

Shang, H. & Haberman, S., 2017, *2017 Living to 100 Monograph*. Society of Actuaries, 27 p.

**Grouped multivariate functional time series method: An application to mortality forecasting**

Shang, H. L. & Yang, Y., 2017, *Functional statistics and related fields*. Aneiros, G., Bongiorno, E. G., Cao, R. & Vieu, P. (eds.). Cham: Springer, p. 233-241 9 p. (Contributions to statistics).

**High-dimensional functional time series forecasting**

Gao, Y., Shang, H. & Yang, Y., 2017, *Functional statistics and related fields*. Aneiros, G., Bongiorno, E. G., Cao, R. & Vieu, P. (eds.). Cham: Springer, p. 131-136 6 p. (Contributions to statistics).

**Mortality and life expectancy forecasting for a group of populations in developed countries: A multilevel functional data method**

Shang, H. L., Sep 2016, In: *Annals of Applied Statistics*. 10, 3, p. 1639-1672 34 p.

**A multilevel functional data method for forecasting population, with an application to the United Kingdom**

Shang, H. L., Smith, P., Bijak, J. & Wiśniowski, A., Jul 2016, In: *International Journal of Forecasting*. 32, 3, p. 629-649 21 p.

**Bayesian bandwidth selection for a nonparametric regression model with mixed types of regressors**

Zhang, X., King, M. L. & Shang, H. L., 22 Apr 2016, In: *Econometrics*. 4, 2, 27 p., 24.

**A Bayesian approach for determining the optimal semi-metric and bandwidth in scalar-on-function quantile regression with unknown error density and dependent functional data**

Shang, H. L., Apr 2016, In: *Journal of Multivariate Analysis*. 146, p. 95-104 10 p.

**Mortality and life expectancy forecasting for a group of populations in developed countries: A robust multilevel functional data method**

Shang, H. L., 2016, *Recent advances in robust statistics: theory and applications*. Agostinelli, C., Basu, A., Filzmoser, P. & Mukherjee, D. (eds.). New Delhi: Springer, p. 169-184 16 p.

**Statistically tested comparisons of the accuracy of forecasting methods for age-specific and sex-specific mortality and life expectancy**

Shang, H. L., 2 Sep 2015, In: *Population Studies*. 69, 3, p. 317-335 19 p.

**Selection of the optimal Box-Cox transformation parameter for modelling and forecasting age-specific fertility**

Shang, H. L., Mar 2015, In: *Journal of Population Research*. 32, 1, p. 69-79 11 p.

**Maximal autocorrelation factors for function-valued spatial/temporal data**

Hooker, G., Roberts, S. & Shang, H. L., 1 Jan 2015, *MODSIM 2015: Proceedings of the 21st International Congress on Modelling and Simulation*. Weber, T., McPhee, M. & Anderssen, R. (eds.). Gold Coast: Modelling and Simulation Society of Australia and New Zealand, p. 159-165 7 p.

**Resampling techniques for estimating the distribution of descriptive statistics of functional data**

Shang, H. L., 2015, In: *Communications in Statistics - Simulation and Computation*. 44, 3, p. 614-635 22 p.

**A sampling algorithm for bandwidth estimation in a nonparametric regression model with a flexible error density**

Zhang, X., King, M. L. & Shang, H. L., Oct 2014, In: *Computational Statistics and Data Analysis*. 78, p. 218-234 17 p.

**Forecasting scottish migration in the context of the 2014 constitutional change debate**

Wiśniowski, A., Bijak, J. & Shang, H. L., Jul 2014, In: *Population, Space and Place*. 20, 5, p. 455-464 10 p.

**Bayesian bandwidth estimation for a semi-functional partial linear regression model with unknown error density**

Shang, H. L., Jun 2014, In: *Computational Statistics*. 29, 3-4, p. 829-848 20 p.

**A survey of functional principal component analysis**

Shang, H. L., Apr 2014, In: *ASTA Advances in Statistical Analysis*. 98, 2, p. 121-142 22 p.



**A Bayesian method for determining the optimal semi-metric and bandwidth in functional partial linear model with unknown error density**

Shang, H. L., 2014, *Contributions in infinite-dimensional statistics and related topics*. Bongiorno, E. G., Salinelli, E., Goia, A. & Vieu, P. (eds.). Bologna : Societa Editrice Esculapio, p. 263-268 6 p.

**Bayesian bandwidth estimation for a functional nonparametric regression model with mixed types of regressors and unknown error density**

Shang, H. L., 2014, In: *Journal of Nonparametric Statistics*. 26, 3, p. 599-615 17 p.

**Bayesian functional models in population forecasting**

Shang, H. L., Wisniowski, A., Bijak, J., Smith, P. & Raymer, J., 2014, *Proceedings of the Sixth Eurostat/Unece Work Session on Demographic Projections*. Roma: Istituto nazionale di statistica, p. 313-325 13 p.

**Bayesian bandwidth estimation for a nonparametric functional regression model with unknown error density**

Shang, H. L., Nov 2013, In: *Computational Statistics and Data Analysis*. 67, p. 185-198 14 p.

**ftsa: An R package for analyzing functional time series**

Shang, H. L., Jun 2013, In: *R Journal*. 5, 1, p. 64-72 9 p.

**Functional time series approach for forecasting very short-term electricity demand**

Shang, H. L., 2013, In: *Journal of Applied Statistics*. 40, 1, p. 152-168 17 p.

**Point and interval forecasts of age-specific life expectancies: A model averaging approach**

Shang, H. L., 9 Nov 2012, In: *Demographic Research*. 27, p. 593-644 52 p., 21.

**Point and interval forecasts of age-specific fertility rates: a comparison of functional principal component methods**

Shang, H. L., Sep 2012, In: *Journal of Population Research*. 29, 3, p. 249-267 19 p.

**Writing posters with beamerposter package in LATEX**

Shang, H. L., 2012, In: *The PracTex Journal*. 2012, 1, 8 p.

**Rainbow: An R package for visualizing functional time series**

Shang, H. L., Dec 2011, In: *R Journal*. 3, 2, p. 54-59 6 p.

**Optimal combination forecasts for hierarchical time series**

Hyndman, R. J., Ahmed, R. A., Athanasopoulos, G. & Shang, H. L., 1 Sep 2011, In: *Computational Statistics and Data Analysis*. 55, 9, p. 2579-2589 21 p.

**Point and interval forecasts of mortality rates and life expectancy: A comparison of ten principal component methods**

Shang, H. L., Booth, H. & Hyndman, R., 15 Jul 2011, In: *Demographic Research*. 25, p. 173-214 42 p., 5.

**Nonparametric time series forecasting with dynamic updating**

Shang, H. L. & Hyndman, R. J., Mar 2011, In: *Mathematics and Computers in Simulation*. 81, 7, p. 1310-1324 15 p.

**Bootstrapping functional data: A study of distributional property of sample eigenvalues**

Shang, H. L., 2011, *MODSIM 2011: 19th International Congress on Modelling and Simulation: proceedings*. Chan, F., Marinova, D. & Anderssen, R. S. (eds.). Canberra: Modelling and Simulation Society of Australia and New Zealand, p. 740-746 7 p.

**Rainbow plots, bagplots, and boxplots for functional data**

Hyndman, R. J. & Shang, H. L., 2010, In: *Journal of Computational and Graphical Statistics*. 19, 1, p. 29-45 17 p.

**Forecasting functional time series**

Hyndman, R. J. & Shang, H. L., Sep 2009, In: Journal of the Korean Statistical Society. 38, 3, p. 199-211 13 p.

**Rejoinder: Forecasting functional time series**

Hyndman, R. J. & Shang, H. L., Sep 2009, In: Journal of the Korean Statistical Society. 38, 3, p. 219-221 3 p.

**Nonparametric time series forecasting with dynamic updating**

Shang, H. L. & Hyndman, R. J., 2009, *Interfacing modelling and simulation with mathematical and computational sciences: 18th IMACS World Congress, MODSIM09, Cairns, Australia 13-17 July 2009 : proceedings*. Anderssen, R. S., Braddock, R. D. & Newham, L. T. H. (eds.). Christchurch, NZ: Modelling and Simulation Society of Australia and New Zealand, p. 1552-1558 7 p.

**Bagplots, boxplots, and outlier detection for functional data**

Hyndman, R. J. & Shang, H. L., 2008, *Functional and operatorial statistics*. Dabo-Niang, S. & Ferraty, F. (eds.). Heidelberg: Springer, p. 201-207 7 p. (Contributions to statistics).

**Prizes****Mollie Holman Doctoral Medal**

Shang, Hanlin (Recipient), 23 Sep 2010