Clifford Lam

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Past and Present Position

- **London School of Economics and Political Science, UK.**

  Programme director:

  - MPhil/PhD in Statistics   2022-

  - MSc Statistics (Financial Statistics)   2014 - 2016, 2017-2021 (sabbatical 2016-17)

  - LSE-Fudan Double Master's in Financial Statistics and Chinese Economy   2019 - 2021

  Professor, Department of Statistics   2020-

  Associate Professor, Department of Statistics   2013 - 2020

  Lecturer, Department of Statistics   2008 - 2013

Education

- **Princeton University, U.S.A.**   **2004 - 2008**
  Ph.D. student in Operations Research & Fin. Eng.

  Ph.D. thesis: High-dimensional profile likelihood inference and covariance matrices estimation.
  Adviser: Prof. Jianqing Fan.

  Courses taken include: Statistical Theory and Methods, Linear and Non-linear Optimization, Stochastic Modeling, Probability Theory, Stochastic Calculus and Finance, Financial Econometrics, Generalized Linear Models, Markov Processes, Asymptotic Theory in Statistics, Nonparametric Modeling and Functional Data Analysis.

- **University of Oxford, U.K.**   **2000 - 2001**
  M.Sc. in Applied Statistic   Class: Distinction

  M.Sc. dissertation : The British General Election : Analysis Of The Changes Of Electoral Results From 1997 To 2001.
  Adviser: Prof. David Firth.

- **University of Oxford, U.K.**   **1997 - 2000**
  B.A. in Mathematical Sciences   Class: First Class Honor

Research Grants

- STICERD/Annual Fund New Researcher Award. "Dimension Reduction Using Factor Models : With Applications in Finance". April 2009 - September 2012

Research Interests

My research focused in 1) statistical learning techniques, especially for high dimensional data, and 2) time series analysis. These include semiparametric modelling, variables and feature selection, regularization methods for high dimensional time series analysis, to name but a few areas. Over the years I have developed research interests in the following key themes in particular:

1. Large covariance/precision matrix estimation

With random matrix theories more developed over the past decade, it is a high time for further developments of theories and methodologies in the area of high dimensional matrix estimation and applications. This area is important in a wide variety of scientific fields, including portfolio allocation and risk assessment in finance, classification and large scale hypothesis testing in bioinformatics, forecasting in macroeconomics time series, or cosmological survey in astrophysics.

2. Dimension reduction and regularization in high dimensional time series

High dimensional time series modelling is needed nowadays for making sense of vast volume of data we can find everyday around us, including those from the internet. One particular research interest I have on high dimensional time series analysis is to find "factors" that can explain/summarise a majority of time series dynamics, like market factors that explain the dynamics of most stock prices in FTSE 100. A goal is to incorporate large number of variables that we can observe, and then summarise these into factors for increasing the explanatory and predictive power of various time series models.

Another goal is to develop regularization techniques for traditional statistical tests/procedures where they fail due to the sheer dimension of input data. Change point detection for high dimensional time series and hypothesis testing for a large number of time series are two examples.

3. Spatial econometrics

Another area of research is in spatial econometrics modelling. A commonly used model is the spatial lag/error model for a large spatial panel of time series. To be able to use such a model, a component called the spatial weight matrix, which is a square matrix of the same size as the dimension of the panel, has to be pre-specified. This matrix represents the underlying spatial interdependence structure of the data. Yet there are no universal rules in doing so, and most practitioners use certain distance metrics to specify such a matrix, which is at best a crude approximation to the said structure. Moreover, when the dimension of the panel increases, it becomes more difficult to specify this spatial weight matrix. There are in fact various ways to estimate the said matrix from data, and inference in the models with such a matrix estimated rather than pre-specified is also an important research element.

Papers/Working Papers

- Lam, C. and Cen, Z. (2024). Matrix-valued Factor Model with Time-varying Main Effects. *Manuscript.* Supplementary materials can be found here. Instruction in using `MEFM` can be found here.

- Chen, W. and Lam, C. (2024). Factor Strength Estimation in Vector and Matrix Time Series Factor Models. *Manuscript.*

- Cen, Z. and Lam, C. (2024). Tensor Time Series Imputation through Tensor Factor Modelling. *Manuscript.* Supplementary materials can be found here. Instruction in using `tensorMiss` can be found here.

- Chen, W. and Lam, C. (2024). Rank and Factor Loadings Estimation in Time Series Tensor Factor Model by Pre-averaging. *Annals of Statistics, 52(1): 364-391.* Supplementary materials can be found here. R codes for replicating our simulation results and real data analyses (including two real

data sets) can be downloaded here.

- Lam, C. (2021). Rank Determination for Time Series Tensor Factor Model Using Correlation Thresholding. *Manuscript.*

- Lam, C. and Cheng, W. (2020). Robust Mean and Eigenvalues Regularized Covariance Matrix Estimation. *Manuscript.*

- Lam, C. (2019). High Dimensional Covariance Matrix Estimation. *Wiley Interdisciplinary Reviews (WIREs): Computational Statistics 2020*, 12:e1485. doi:10.1002/wics.1485.

- Lam, C. and Pedro CL Souza (2019). Estimation and Selection of Spatial Weight Matrix in a Spatial Lag Model. *Journal of Business & Economic Statistics*, doi:10.1080/07350015.2019.1569526. Supplementary materials can be found here.

- Lam, C. and Cheng, Q. (2019). Integrated Volatility Matrix Estimation with Nonparametric Eigenvalue Regularization. *Manuscript.* Supplementary materials can be found here.

- Li, Z., Lam, C., Yao, J. and Yao, Q. (2018). On testing a high-dimensional white noise. *Annals of Statistics*, **47(6)**, 3382–3412. Supplementary materials can be found here.

- Lam, C. and Feng, P. (2018). A Nonparametric Eigenvalue-Regularized Integrated Covariance Matrix Estimator Using High-Frequency Data for Portfolio Allocation. *Journal of Econometrics*, **206(1)**, 226–257.

- Wang, H., Cheng, Q. and Lam, C. (2017). Inference for Spatial Dynamic Panel Model with Different Spatial Dependence Characterizations. *Manuscript.*

- Lam, C. and Cheng, Q. (2017). Spatial Lag Model with Time-lagged Effects and Spatial Weight Matrix Estimation. *Manuscript.*

- Lam, C. and Feng, P. (2017). Integrating Regularized Covariance Matrix Estimators. *Manuscript.* Supplementary materials can be found here.

- Lam, C., Feng, P. and Hu, C. (2017). Nonlinear Shrinkage Estimation of Large Integrated Covariance Matrices. *Biometrika*, **104(2)**, 481–488.

- Lam, C. and Souza, P.C.L. (2016). Spatial Lag Model Estimation with Sparse Adjustment for Spatial Weight Matrix. *Manuscript.* Supplementary material can be found here.

- Lam, C. (2016). Nonparametric Eigenvalue-Regularized Precision or Covariance Matrix Estimator. *Ann. Statist.*, **44(3)**, 928–953. Supplementary material can be found here.

- Lam, C. and Souza, P.C.L. (2015). One-Step Regularized Spatial Weight Matrix and Fixed Effects Estimation with Instrumental Variables. *Manuscript.*

- Lam, C. and Souza, P.C.L. (2015). Detection And Estimation Of Block Structure In Spatial Weight Matrix. *Econometrics Review*, **35(8-10)**, 1347–1376.

- Lam, C. and Souza, P.C.L. (2014). Regularization for Spatial Panel Time Series Using the Adaptive LASSO. *LSE STICERD, Econometrics Paper Series.*

- Lam, C. and Qu, C. (2013). Discussion of "Large covariance estimation by thresholding principal orthogonal complements" by Fan, Liu and Mincheva. *Journal of Royal Statistical Society B.*

- Lam, C. (2012). Challenges to Time Series Analysis in the Computer Age. *To be published in the book "Statistics - Discovering your future power"*, China Statistics Press.

- Lam, C. and Yao, Q. (2012).Factor Modeling for High Dimensional Time-Series: Inference for the Number of Factors. *Ann. Statist.*, **40(2)**, 694–726. Supplementary materials can be found here.

- Lam, C., Yao, Q. and Bathia, N. (2011). Estimation of Latent Factors for High-Dimensional Time Series. *Biometrika*, **98(4)**, 901–918.

- Lam, C. (2010). Estimation of Large Precision Matrices Through Block Penalization. *Manuscript.*

- Lam, C. and Fan, J. (2009). Sparsistency and Rates of Convergence in Large Covariance Matrix Estimation. *Ann. statist.*, **37(6B)**, 4254–4278.

- Lam, C. and Fan, J. (2008). Profile-kernel likelihood inference with diverging number of parameters. *Ann. Statist.*, **36(5)**, 2232–2260.

Referee Services

Associate editor of:
- Biometrika (2018-)
- Statistica Sinica (2011-2014)
- Journal of Statistical Planning and Inference (2012-)

Also served as a referee for journals including (but not limited to):
Annals of Statistics, Journal of the American Statistical Association, Journal of the Royal Statistical Society: Series B, Econometrica, Journal of Time Series Analysis.

Organized Conference/Workshop/Session
- Session "Methodologies in analysing high dimensional dependent data" in the 18th International Joint Conference on Computational and Financial Econometrics (CFE) and Computational and Methodological Statistics (CMStatistics), 14-16 December 2024, King's College London, UK.
- Session in the 6th International Conference on Econometrics and Statistics, August 1-3, 2023, Waseda University, Tokyo, Japan.
- Co-chair, local organising committee, 2022 IMS Annual Meeting.
- Session "Statistical learning of high dimensional data" in the 14th International Conference Computational and Financial Econometrics (CFE 2020).
- Session "High dimensionality and time series" in the The 3rd International Conference on Econometrics and Statistics (EcoSta 2019).

- Session "Vast time series analysis and applications" in the 10th International Conference of the ERCIM WG on CMStatistics 2017.
- Session "Modelling and estimation in financial time series " in the 1st International Conference on Econometrics and Statistics, 15-17 June 2017, HKUST.
- Session "Estimation of large random matrices: Theories and applications" in the 8th International Conference of the ERCIM WG on CMStatistics 2015.
- Complex Systems in Time Series, LSE, December 4-5, 2015.

Past and current PhD students

Zetai Cen (2022 -)

Weilin Chen (2020 - 2024)

Wenyu Cheng (2019 -)

Toby Wade (Starting from 2018-19, part-time; graduated 2024)

Qian Cheng (graduated 2019)

Phoenix Feng (graduated 2018)

Charlie Hu (graduated 2016)

Past experience as an examiner of a PhD/MPhil examination

(PhD, internal examiner) Anica Kostic, 2022

(PhD, internal examiner) Gianluca Giudice, 2022

(PhD, external examiner) Jonathan Embleton, 2021

(PhD, internal examiner) Christine Yuen, 2020

(PhD, external examiner) Abdul Aziz, 2019

(PhD, external examiner) Qingze Li, 2017

(PhD, internal examiner) Na Huang, 2016

(PhD, internal examiner) Karolos Korkas, 2014

(PhD, internal examiner) Haeran Cho, 2013

(MPhil, internal examiner) Billy Wu, 2012

(PhD, internal examiner) Neil Bathia, 2011

Presentations

- Statistics seminar series at ISBA at UCLouvain, Belgium, December 9, 2022. Online presentation.
- IMS Annual Meeting, London, 27-30 June, 2022.
- EcoSta2022, Kyoto, 4-6 June, 2022. Presentation via Zoom.
- Seminar, University of Delaware Statistics Seminar Series, May 6, 2022. Presentation via Zoom.
- Seminar, School of Economics, University of Surrey. Online presentation, December 2, 2021.
- Workshop on "Stein's method and high-dimensional time series analysis". Presentation via Zoom. March 29-31, 2021.
- School of Data Science Seminar, City University of Hong Kong. Presentation via Zoom. February 3, 2021.
- The CIRM conference "New Results on Time Series and their Statistical Applications". Hybrid conference, 14-18 September, 2020.
- The 11th ICSA International Conference nnovation with Statistics and Data Science? Zhejiang University, Hangzhou, China, 20-22 December 2019.

- The inaugural LSE-SWUFE workshop, Southwestern University of Finance and Economics, Chengdu, 16 December, 2019.
- Seminar, Department of Economics, University of York, May 9, 2019.
- 1st Southampton Workshop in Econometrics & Statistics, 23-24 April 2019.
- 14th Workshop on Stochastic Models, Statistics and their Application (SMSA). March 6th to 8th, 2019, TU Dresden, Germany.
- Seminar, Alan Turing Institute, Feb 5, 2019.
- 4th Conference of the International Society for Nonparametric Statistic, 11-15 June, 2018, SALERNO, Italy.
- Big Data in Financial Markets, Cambridge University, 24-25 May 2018.
- Seminar for "Statistical Scalability", Issac Newton Institute for Mathematical Sciences, Cambridge University, 15 Feb 2018.
- 1st International Conference on Econometrics and Statistics, 15-17 June 2017, HKUST.
- One-day workshop on Modern Statistical Methods in Health and Environment, Brunel University, 9 June 2017.
- Seminar, University of Southampton, May 11, 2017.
- Southampton Finance and Econometrics Workshop, 4-5 May, 2017.
- Seminar, Bristol University, March 10, 2017.
- 6th Workshop on New Developments in Econometrics and Time Series. Institute of Financial Big Data, Universidad Carlos III de Madrid, 6-7 October, 2016.
- 2016 Asia Meeting of the Econometric Society on August 11 - 13, 2016. Doshisha University Imadegawa Campus, Kyoto.
- Seminar, Statistical Laboratory, Cambridge University, January 22, 2016.
- ERCIM 2015, University College London, December 14, 2015.
- EMS 2015, VU University Amsterdam, July 6-10, 2015.
- CRiSM Seminar, The University of Warwick, May 29, 2015.
- Econometrics seminar, CORE, Université catholique de Louvain, April 27, 2015.
- Speaker, 1st UCL Workshop on the Theory of Big Data, 7-9 January 2015.
- Invited speaker, Nonlinear Time Series Analysis Thresholding and Beyond, in honour of Professor Howell Tongs 70th Birthday, September 19-20, 2014, LSE, London.
- Invited speaker, FERM, June 25-28, 2014, Central University of Finance and Economics, Beijing, China.
- Invited speaker, ISNPS, June 12-16, 2014, Cádiz, Spain.
- Seminar, University of York, May 1, 2014.
- Invited speaker for ICSA Hong Kong, December 2013.
- Organized session speaker for CFE-ERCIM 2013, London.
- Invited speaker for the Oberwolfach Workshop "Statistical Inference for Complex Time Series Data", September 22-28, 2013.
- Invited speaker for the 12th International Workshop Spatial Econometrics and Statistics, Université d'Orléans (France), June 17-19, 2013.
- Seminar, Queen Mary University of London, February 28, 2013.

- Invited speaker for the conference "Meeting the Challenges of High Dimension: Statistical Methodology, Theory and Applications", 13 Aug - 26 Oct, 2012, IMS, National University of Singapore.

- Invited speaker for the conference "Financial Time Series Analysis: High-dimensionality, Nonstationarity and the Financial Crisis", June 1-22, 2012, National University of Singapore.

- Seminar, ECARES, Universit?Libre de Bruxelles, April 26, 2012.

- Seminar, the University of Bristol, December 2, 2011.

- Invited speaker for JSM 2011, July 30 - August 4, Miami Beach, Florida.
- Invited speaker for IWFOS 2011, June 16-18, 2011, Santander, Spain.

- Seminar, the University of Manchester, March 9, 2011.

- Invited speaker for ICSA 2010, December 19-22, 2010, Guangzhou University, Guangzhou, China.

- Invited speaker for INSPIRE 2010 Conference on information representation and estimation, September 6-8, 2010, UCL, UK.

- Invited speaker for EMS 2010, August 17-22, 2010, The University of Piraeus, Greece.

- Guest Lectures on Factor Modeling, July 27 - August 9, 2010, Center for the Study of Finance and Insurance, Osaka University.

- Invited speaker for the "Young Researchers Workshop on Finance 2010", Tokyo Metropolitan University & CARF, The University of Tokyo.

- Seminar, Department of Mathematics, University of York. February 25, 2010.

- Invited speaker for the conference in celebration of Howell Tong's 65th birthday, Hong Kong University. December 2009.

- TSE-IMT Workshop "Statistics and Econometrics with High Dimensional Data", Toulouse School of Economics, "Estimation of Large Latent Factor Models for Time Series Data", December 1, 2009.

- Seminar, Universiteé catholique de Louvain, "Estimation of Large Latent Factor Models for Time Series Data", October 23, 2009.

- Invited speaker for the 2009 International Conference on Financial Statistics and Financial Econometrics, Southwestern University of Finance and Economics, Chengdu, Sichuan. July 2009.

- Seminar, Oxford-Man Institute of Quantitative Finance. "Large Precision Matrix Estimation for Time Series Data with Latent Factor Model", April 28, 2009.

- Sparsity in Machine Learning and Statistics 2009. "Large Precision Matrix Estimation for Time Series Data with Latent Factor Model", Cumberland Lodge, UK, 1 - 3 April 2009.

- The Fourth London Oxbridge Time Series Conference 2009. "Large Precision Matrix Estimation for Time Series Data with Latent Factor Model", March 20, 2009.

- Seminar, Dept. of Statistics, LSE. "Large Precision Matrix Estimation for Time Series Data with Latent Factor Model", Feb 6, 2009.

- Dept. of Statistics, LSE. "High Dimensional Factor Analysis with Time Series Data", Dec 10, 2008.

- Dept. of Statistics, UCL. "Block Penalisation for Precision Matrix Estimation".

- Dept. of Statistics, the University of Bath. "Block Penalisation for Precision Matrix Estimation", Oct 3 2008.

- 7th World Congress in Probability and Statistics Singapore 2008. "Estimation of large covariance matrices through block penalization".

- Invited seminar, Dept. Of Statistics and Actuarial Science, the University of Hong Kong, "Estimation of large covariance matrices through penalization", Feb 13, 2008.

- Invited seminar, Statistics Dept., the Chinese University of Hong Kong, "Estimation of large covariance matrices through penalization", Feb 12, 2008.

- The Joint Statistical Meetings 2007, Salt Lake City, Utah, USA. Presentation of "Profile-kernel likelihood inference with diverging number of parameters".

- ICSA 2007 Applied Statistics Symposium, Raleigh, North Carolina, USA. Student award presentation of "Profile-kernel likelihood inference with diverging number of parameters".

Teaching Experience
- Excellence in Education and Teaching Promotion Prize, 2019, 2021.

  ◯ Courses in LSE (Sabbatical 2016-17)
- 2019- : Lecture, ST326 Financial Statistics.

- 2017-19 : Lecture, ST308 Bayesian Inference.

- 2011/12 : Lecture, ST203 Statistical Models and Data Analysis.

- 2010- : Lecture, ST422 Time Series.

- 2008-2016 : Lecture, ST300 Regression and Generalised Linear Models.

- 2008/10 : Class tutor, ST201 Statistical Models and Data Analysis.

  ◯ Course "Introduction to Statistical Learning", Jump Trading Ltd, July and September, 2016. Course notes available upon request.

◯ London Taught Course Center (LTCC)
- 2011/2012 : Introduction to Semiparametric Modeling.

◯ Teaching Assistant, Princeton University.
- Undergraduate level:
    - ORF 245: Fundamentals of Engineering Statistics (by Prof Jianqing Fan).
    - For four academic terms, including one hour of precept every week. Office hours and grading responsibility.
- Graduate level:
    - ORF 524: Statistical Theory and Methods (by Prof Jianqing Fan).
    - ORF 535: Financial Risk Management (by Prof Patrick Cheridito).
    - ORF 525: Generalized Regression Models (by a postdoctoral student of Prof Jianqing Fan).

Each course requires office hours and grading responsibility, and I have been a teaching assistant for one academic term for each of these courses.

Languages
- English (fluent in reading, speaking and writing)
- Cantonese (fluent in reading, speaking and writing)
- Mandarin (Intermediate in speaking, fluent in reading and writing)