

# JUSHAN BAI

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## 1 Contact Information

Department of Economics, Columbia University, New York, NY 10027. Telephone: 212 854-8033, email: jushan.bai at columbia dot edu.

## 2 Education

University of California, Berkeley, Ph.D. in Economics, 1992

Pennsylvania State University, M.A. in Economics, 1988

Nankai University, Tianjin, China, B.S. 1982, M.A. in Mathematics, 1985

## 3 Employment

Professor, Department of Economics, Columbia, 2008-present

Professor, Department of Economics, NYU, 2002-2008

Professor, Department of Economics, Boston College, 1999-2002

Associate Professor, Boston College, 1998-1999

Associate Professor, Department of Economics, MIT 1997-1998

Assistant Professor, Department of Economics, MIT, 1992-1997

## 4 Research Interest

Research Field: Econometrics

Recent Research Topics: Clustered Standard Errors for panel data, Feasible Generalized Least Squares (FGLS) for Panel data, High Dimensional Factor Analysis, Estimating and Testing Time-Series Break Point, Structural Vector Autoregression Analysis (SVAR), Quantile Modelling of Panel Data

## 5 Selected Honors, Fellowships

- *2018 Best Paper Award* (Inaugural Award, announced in 2021) from the journal of *Econometric Reviews* for the paper: "Selecting the Regularization Parameters in High-Dimensional Panel Data Models: Consistency and Efficiency" (with Tomohiro Ando), *Econometric Reviews*, 37 (3), 183-211, 2018
- Fellow, International Association for Applied Econometrics, 2019
- Fellow, Econometric Society, 2013.
- Fellow, Journal of Econometrics, 2009
- Econometric Theory Award, in Recognition of Research Contributions to the Science of Econometrics, 1999.
- The Review of Economic Studies Tour, 1992.
- Alfred P. Sloan Foundation Dissertation Fellowship, UC Berkeley, 1991-1992

## 6 Recent Working Papers

- Scenario-based Quantile Connectedness of the U.S. Interbank Liquidity Risk Network (joint with Tomohiro Ando, Lina Lu, and Cindy M. Vojtech), 2022
- Likelihood approach to dynamic panel data models with interactive effects, revised 2022. Available at SSRN 2332992
- Likelihood ratio test for structural changes in factor models (with Jiangtao Duan, and Xu Han), 2022. <https://arxiv.org/pdf/2206.08052.pdf>
- A Quantile Based Asset Pricing Model (with Tomohiro Ando, M. Nishimura, and Jun Yu) Available at: <https://ink.library.smu.edu.sg/soe-research/2290>, 2019
- Robust principal component analysis with non-sparse errors (with Junlong Feng), <https://arxiv.org/abs/1902.08735>, 2019
- Practical notes on panel data models with interactive effects (Joint with Kunpeng Li), MPRA Paper No. 81087, 2017 <https://mpra.ub.uni-muenchen.de/81087>

## 7 Peer-reviewed Publications and Accepted Papers

1. Approximate Factor Models with Weaker Loadings (with Serena Ng)  
<https://arXiv.preprint.arXiv:2109.03773>, 2021, forthcoming *Journal of Econometrics*
2. Large-scale generalized linear longitudinal data models with grouped patterns of unobserved heterogeneity (with Tomohiro Ando), Available at SSRN 4004263, 2021, forthcoming in *Journal of Business and Economics Statistics*
3. Standard Errors for Panel Data Models with Unknown Clusters, (with Sung Hoon Choi, Yuan Liao), <https://arxiv.org/abs/1910.07406> 2019, forthcoming in *Journal of Econometrics*
4. Factor-based imputation of missing values and covariances in panel data of large dimensions (joint with Ercument Cahan and Serena Ng) <https://arxiv.org/pdf/2103.03045v1.pdf>, *Journal of Econometrics*, Volume 233 (1), 113-131, 2023
5. Quasi-maximum likelihood estimation of break point in high-dimensional factor models (with Jiangtao Duan and Xu Han), available at <https://arxiv.org/abs/2102.12666>, *Journal of Econometrics*, Volume 233 (1), 209-236, 2023
6. Bayesian and maximum likelihood analysis of large-scale panel choice models with unobserved heterogeneity (joint with Kunpeng Li, and Tomohiro Ando), *Journal of Econometrics* 230 (1), 20-38, 2022
7. Matrix Completion, Counterfactuals, and Factor Analysis of Missing Data (with Serena Ng), <https://arxiv.org/pdf/1910.06677.pdf> 2019.  
*Journal of American Statistical Association*, Vol 116 (536), 1746-1763, 2021
8. Dynamic Spatial Panel Data Models with Common Shocks (with Kunpeng Li)  
<https://economics.smu.edu.sg/sites/economics.smu.edu.sg/files/economics/pdf/Seminar/2018/20181>  
*Journal of Econometrics*, 224 (1), 134-160, 2021
9. Quantile co-movement in financial markets: a panel quantile model with unobserved heterogeneity (with Tomohiro Ando), *Journal of the American Statistical Association*, 115 (529), 266-279, 2020
10. Estimation and Inference of Structural Changes in High Dimensional Factor Models (with Xu Han and Yutang Shi), *Journal of Econometrics*, 219 (1), 66-100, 2020
11. Rank regularized estimation of approximate factor models (with Serena Ng), *Journal of Econometrics*, 212(1), 78-96, 2019

12. Selecting the Regularization Parameters in High-Dimensional Panel Data Models: Consistency and Efficiency” (with Tomohiro Ando), *Econometric Reviews*, 37 (3), 183-211, 2018
13. Inferences in panel data with interactive effects using large covariance matrices (with Yuan Liao), *Journal of Econometrics*, 200 (1) 59-78, 2017
14. Clustering huge number of financial time series: a panel data approach with high-dimensional predictors and factor structures (with Tomohiro Ando), *Journal of American Statistical Association*, 112, pages 1182-1198, July 2017
15. Estimation and inference of FAVAR models (with Kunpeng Li and Lina Lu), *Journal of Business and Economic Statistics*, 34 (4), 620-641, 2016
16. “Maximum likelihood estimation and inference for approximate factor models of high dimension,” (with Kunpeng Li) *Review of Economics and Statistics*, Vol. 98 (2) 298-309, 2016
17. Econometric Analysis of large factor models, (with Peng Wang) *Annual Review of Economics*, vol 8, 53-80, 2016
18. Panel data models with grouped factor structure under unknown group membership (with Tomohiro Ando), *Journal of Applied Econometrics*, 31(1) 163-191, 2016
19. “Efficient Estimation of Approximate Factor Models via Penalized Maximum Likelihood” (with Yuan Liao), *Journal of Econometrics*, 191(1). 1-18, 2016.
20. Fama-MacBeth Two-Pass Regressions: Improving Risk Premia Estimates,” (with Guofu Zhou), *Finance Research Letters*, 15(C). 31-40, 2015
21. A simple new test for slope homogeneity in panel data models with interactive effects (with Tomohiro Ando), *Economics Letters*, 136, 112-117, 2015
22. Asset pricing with a general multifactor structure, with (Tomohiro Ando), *Journal of Financial Econometrics*, 13 (3): 556-604, 2015
23. Identification and Bayesian estimation of dynamic factor models, (with Peng Wang), *Journal of Business and Economic Statistics*, 33 (2), 221-240, 2015
24. Identification theory for high dimensional static and dynamic factor models (with Peng Wang), *Journal of Econometrics*, 178 (2), 794-804, 2014

25. Theory and methods of panel data models with interactive effects (with Kunpeng Li), *Annals of Statistics*, 42(1), 142-170, 2014
26. Principal components estimation and identification of static factors (with S. Ng), *Journal of Econometrics*, 176, 178-189, 2013.
27. Testing panel cointegration with dynamic common factors that are correlated with the regressors (with Josep Lluís Carrion-i-Silvestre), *Econometrics Journal*, 16, 222-249, 2013.
28. Fixed effects dynamic panel data models, a factor analytical method, *Econometrica*, 81, 285-314, January, 2013
29. Statistical analysis of factor models of high dimension, (with K.P. Li), *Annals of Statistics*, 40, 436-465, 2012.
30. "The Theory and Applications of TAR Model with two Threshold Variables," (with T. Chong and H.Q. Chen), *Econometric Reviews*, 31(2), 142-170, 2012.
31. Estimating high dimensional covariance matrices and its applications (with Shuzhong Shi), *Annals of Economics and Finance*, 12, 199-215, 2011.
32. Conditional Markov Chain and its Application in Economic Time Series Analysis (with P. Wang), *Journal of Applied Econometrics*, 26, 715-734, 2011
33. A simple method for estimating betas when factors are measured with error (with G. Meng and G. Hu). *Journal of Financial Research*, Vol. 34, Issue 1, 27-60, 2011
34. Instrumental Variable estimation in a data rich environment (with Serena Ng), *Econometric Theory*, 26, 1577-1606, 2010
35. Panel Unit Root Tests with Cross-Section Dependence, a further investigation, (with Serena Ng) *Econometric Theory*, 26, 1088-1114, 2010
36. Common breaks in means and in variances for panel data, *Journal of Econometrics*, 157, 78-92, 2010.
37. Panel data models with interactive fixed effects, *Econometrica*, 77, 1229-1279, 2009
38. Structural Changes, Common Stochastic Trends, and Unit Roots in Panel Data (with Josep Lluís Carrion-i-Silvestre), *Review of Economic Studies*, 471-501, 2009

39. Selecting instrument variables in a data rich environment (with Serena Ng), *Journal of Time Series Econometrics*, 1, Article 4, 2009
40. Panel Cointegration with Global Stochastic Trends (with C. Kao, S. Ng) *Journal of Econometrics*, 145, 82-99, 2009
41. Boosting diffusion indices (with Serena Ng), *Journal of Applied Econometrics*. 24, 607-629, 2009
42. Forecasting Economic Time Series with Targeted Variables (with Serena Ng), *Journal of Econometrics*. 146, 304-317, 2008.
43. Extreme estimation when the predictors are estimated from large panels (with Serena Ng), *Annals of Economics and Finance*. 9-2, 201-222, 2008.
44. Large Dimensional Factor Models (with Serena Ng), *Foundations and Trends in Econometrics*, 3 (2), 89-163, 2008.
45. "Generic Consistency for Multiple Breaks under Misspecification (with Terence Chong, H. Chen, and S.X. Wang), *Econometrics Journal*, 11 (2), 287-307, 2008.
46. Testing multivariate distributions in GARCH models (with Zhihong Chen), *Journal of Econometrics*, Vol. 143, 19-36, 2008.
47. Determine the number of primitive shocks in factor models (with Serena Ng), *Journal of Business and Economics Statistics*, 83, 171-222, 2007
48. Confidence intervals for diffusion index forecast and inference with factor-augmented regressions (with Serena Ng), *Econometrica*, 74, 1133-1155, 2006.
49. Evaluating Latent and Observed Factors in Macroeconomics and Finance (with Serena Ng), *Journal of Econometrics*, 131, 507-537, 2006.
50. Testing Skewness, Kurtosis, and Normality for Time Series (with Serena Ng) , *Journal of Business and Economic Statistics*, 23, 49-61, 2005.
51. A Panic Attack on Unit Roots and Cointegration (with Serena Ng), *Econometrica*, 1127-1177, 2004.
52. Estimating Cross-Section Common Stochastic Trends in Nonstationary Panel Data, *Journal of Econometrics*, 137-183, 2004.

53. Testing Parametric Conditional Distributions of Dynamic Models, *Review of Economics and Statistics*, 85, 531-549, 2003.
54. Inferential Theory for Factor Models of Large Dimensions, *Econometrica* 71, 135-171, 2003.
55. Critical Values of Multiple Structural Change Tests (with Pierre Perron), *Econometrics Journal*, 6, 72-78, 2003.
56. Computation and Analysis of Multiple Structural Changes (with Pierre Perron), *Journal of Applied Econometrics*, 18, 1-22, 2003.
57. Determine the Number of Factors in Approximate Factor Models (with Serena Ng), *Econometrica*, 70, 191-221, 2002.
58. A Consistent Test for Conditional Symmetry of Time Series. (with Serena Ng) *Journal of Econometrics*, 103, 225-258, 2001.
59. Vector Autoregressive Models with Structural Change in Regression Coefficients and in Variance-Covariance Matrix, *Annals of Economics and Finance*, Vol. 1, 303-339, 2000.
60. Likelihood Ratio Tests for Multiple Structural Changes. *Journal of Econometrics*, Vol. 91, No. 2, 299-323, 1999.
61. Multiple-Regime Regression with Least Absolute Deviation Estimation. *Journal of Statistical Planning and Inference*, 74, 103-134, 1998.
62. A Note on Spurious Breaks. *Econometric Theory*, 14, 663-669, 1998.
63. Testing for and Dating Common Breaks in Multivariate Time Series, with Robin Lumsdaine and James Stock. *Review of Economic Studies*, 65, 395-432, 1998.
64. Testing for and Estimation of Multiple Structural Changes, (with Pierre Perron). *Econometrica*, 66, 47-79, 1998. Reprinted in *The Economics of Structural Change* (H. Hagemann, M. Landesmann, and R. Scazzieri, eds.), *The International Library of Critical Writings in Economics* (Series Editor: Mark Blaug and Adrian Darnell).
65. Estimation of a Change Point in Multiple Regressions *Review of Economics and Statistics*, 79, 551-563, 1997.
66. Estimating Multiple Breaks One at a Time. *Econometric Theory*, 13, 315-352, 1997.

67. Testing for Parameter Constancy in Linear Regressions: an Empirical Distribution Function Approach. *Econometrica*, 64, 597-622, 1996.
68. Least Absolute Deviation Estimation of a Shift. *Econometric Theory*, 11, 403-436, 1995.
69. The Impact of 1989 California Major Anti-Smoking Legislation on Cigarette Consumption: Three Years Later, with Tehwei Hu, Ted Keeler, and Paul Barnett. *Journal of Public Health Policy*, 15, 26-36, 1994.
70. Least Squares Estimation of a Shift in Linear Processes. *Journal of Time Series Analysis*, 15, 453-470, 1994. Reprinted in *Recent Developments in Time Series* (Paul Newbold and Stephen J. Leybourne eds.), *The International Library of Critical Writings in Economics* (Series Editor: Mark Blaug and Adrian Darnell).
71. “Weak Convergence of Sequential Empirical Processes of Residuals in ARMA Models. *Annals of Statistics*, 22, 2051-2061, 1994.
72. On the Partial Sum Processes of Residuals in Autoregressive and Moving Average Models. *Journal of Time Series Analysis*, 14, 247-260, 1993.

## 8 Book Chapters and Other Publications

- Feasible Generalized Least Squares for Panel Data with Cross-sectional and Serial Correlations, (with Sung Hoon Choi, Yuan Liao), <https://arxiv.org/abs/1910.09004>, 2019. *Empirical Economics* (a special issue in honor of Badi Baltagi), 60 (1), 309-326, 2021
- Structural changes in high dimensional factor models (with Xu Han), *Frontiers of Economics in China*, (a special issue in honor of Gregory Chow) 11(1), 123-141, 2016
- Unbalanced panel data models with interactive effects (with J. Yang and Y. Liao), *Oxford Handbook of Panel Data*, edited by Badi Baltagi. DOI: 10.1093/oxfordhb/9780199940042.013.0005, 2015
- Panel data models and factor analysis, *Advances in Economics and Econometrics, Theory and Applications*, The Tenth World Congress of the Econometric Society, edited by D. Acemoglu, M. Arellano, and E. Dekel, Vol. III, 437-484, 2013.
- Factor Models, *New Palgrave Dictionary of Economics*, 2008.



- A New Look at Panel Stationarity Tests and the PPP Hypothesis (with Serena Ng), in Identification and Inference for Econometric Models: Essays in Honor of Thomas J. Rothenberg, Cambridge University Press, edited by D.W.K. Andrews and J.H. Stock, 2005.
- Multiple Structural Changes Models: a Simulation Analysis, (with Pierre Perron). Econometric Theory and Practice: Essays in Honor of Peter Phillips, edited by D. Corbea, S. Durlauf and B.E. Hansen, Cambridge University Press, 2006, 212-234.
- On the estimation and inference of panel data cointegration with cross-section dependence (with Chihwa Kao), Panel data Econometrics, Theoretical Contributions and Empirical Applications, edited by B.H. Baltagi, 2006, page 1-30. Elsevier, New York.

## 9 Unpublished Old Papers

Limit Theory For Non-Stationary Panel Data, Revised August 2009.

Likelihood Approach To Small T Dynamic Panel Data Models With Interactive Effects, March 2009, revision December 2010.

Factor Analysis And Principal Components, Evaluating Commonly Used Estimation Procedures, November, 2010.

A Contribution To Dynamic Panel Data Analysis, February, 2011.

## 10 Research Fundings

National Science Foundation, SES1658770, 2017-2020

National Science Foundation, SES1357598, 2014-2017

National Science Foundation, SES0962410, 2010-2013

National Science Foundation, SES0551275, 2006-2009

National Science Foundation, SES0137084; SES0424540, 2002-2005

National Science Foundation, SBR9896329, 1999-2001

National Science Foundation, SBR9414083; SBR9709508, 1994-1998

Provost Fund of MIT, 1995, 1992

Deans Faculty Development Fund, MIT, 1993

## 11 Professional Services

- Editorial Boards:

Associate Editor, Journal of Econometrics, April, 2012-2021  
Associate Editor: Econometrica, January 2006-June 2014  
Associate Editor: Studies of Nonlinear Dynamics and Econometrics, 2001-2017  
Associate Editor: Frontiers of Economics in China, 2012-2020  
Associate Editor: Econometric Theory, 1997-2000  
Editorial board: Foundations and Trends in Econometrics, 2004-present  
Editorial board: Annals of Economics and Finance, 2000-present  
Advisory Editor: Economics Letters, 2003-present

Guest Editor: Journal of Applied Econometrics, Cross-sectional dependence for panel data, 2015

Guest Editor: Journal of Business and Economic Statistics, Big Data 2015

Scientific Committee of International Panel Data Conferences, 2009-present

- Referee for:

Econometrica; Journal of Econometrics; Econometric Theory; Review of Financial Studies; Econometric Reviews Journal of Applied Econometrics; Economics Letters; Review of Economics and Statistics; Review of Economic Studies American Economic Review; Rand Journal of Economics Quarterly Journal of Economics; Journal of Business and Economic Statistics; Journal of the Royal Statistical Society, Series B; Journal of Statistical Planning and Inference; Annals of Institute of Statistical Mathematics; Bernoulli; The Manchester School; Statistics and Probability Letters; Journal of Stochastic Processes and Their Applications; Communications in Statistics: Theory and Methods Journal of Time Series Analysis; Economic Inquiry; International Economic Review; Journal of International Money and Finance; Journal of Comparative Economics; National Science Foundation; European Economic Review; Journal of Forecasting; ESAIM: Probability and Statistics; Annals of Economics and Finance; Studies of Nonlinear Dynamics in Econometrics; Economic Modeling, Statistica Sinica; Annals of Statistics; Journal of the American Statistical Association; Journal of Financial Econometrics; International Journal of Forecasting; Quantitative Finance; Computational Economics; Journal of Banking and Finance; Empirical Economics; Economics and Politics; Journal of Money, Credit and Banking; The Scandinavian Journal of Economics; TEST; Journal of Applied Statistics; Review of Accounting and Finance; Journal of Development Economics; American Economic Journal: Macroeconomics; European Journal of Political Economy, Metrika; Canadian Journal of Economics.