Jushan Bai

February, 2022

Contact Information

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

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

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

Research Interest

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

Selected Honors, Fellowships

- *2021 Best Paper Award* 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

Recent Working Papers

- Approximate Factor Models with Weaker Loadings (with Serena Ng) https://arXiv.preprint.arXiv:2109.03773, 2021
- Large-scale generalized linear longitudinal data models with grouped patterns of unobserved heterogeneity (with Tomohiro Ando), Available at SSRN 4004263, 2021
- 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

Refereed Journal Publications and Accepted Papers

1. Factor-based imputation of missing values and covariances in panel data of large dimensions (joint with Ercument Cahan and Serena Ng), available at https://arxiv.org/pdf/2103.03045v1.pdf, 2021, forthcoming in *Journal of Econometrics*
2. 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, 2021, forthcoming in *Journal of Econometrics*
3. Matrix Completion, Counterfactuals, and Factor Analysis of Missing Data (with Serena Ng), https://arxiv.org/pdf/1910.06677.pdf 2019. To appear in the *Journal of American Statistical Association*
4. 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*

5. Dynamic Spatial Panel Data Models with Common Shocks (with Kunpeng Li), revised 2020. Available at https://economics.smu.edu.sg/sites/economics.smu.edu.sg/files/economics/pdf/Seminar/2018/20181 *Journal of Econometrics*, 224 (1), 134-160, 2021
6. Bayesian and maximum likelihood analysis of large-scale panel choice models with unobserved heterogeneity (joint with Kunpeng Li, and Tomohiro Ando), forthcoming in *Journal of Econometrics*
7. "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
8. "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
9. "Rank regularized estimation of approximate factor models" (with Serena Ng), *Journal of Econometrics*, 212(1), 78-96, 2019
10. "Selecting the Regularization Parameters in High-Dimensional Panel Data Models: Consistency and Efficiency" (with Tomohiro Ando), *Econometric Reviews*, 37 (3), 183-211, 2018
11. "Inferences in panel data with interactive effects using large covariance matrices" (with Yuan Liao), *Journal of Econometrics*, 200 (1) 59-78, 2017
12. "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
13. "Estimation and inference of FAVAR models" (with Kunpeng Li and Lina Lu), *Journal of Business and Economic Statistics*, 34 (4), 620-641, 2016
14. "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
15. "Econometric Analysis of large factor models", (with Peng Wang) Annual Review of Economics, vol 8, 53-80, 2016
16. "Panel data models with grouped factor structure under unknown group membership" (with Tomohiro Ando), Journal of Applied Econometrics, 31(1) 163-191, 2016
17. "Efficient Estimation of Approximate Factor Models via Penalized Maximum

Likelihood" (with Yuan Liao), *Journal of Econometrics*, 191(1). 1-18, 2016.

18. "Fama-MacBeth Two-Pass Regressions: Improving Risk Premia Estimates," (with Guofu Zhou), Finance Research Letters, 15(C). 31-40, 2015
19. "A simple new test for slope homogeneity in panel data models with interactive effects" (with Tomohiro Ando), Economics Letters, 136, 112-117, 2015
20. "Asset pricing with a general multifactor structure," with (Tomohiro Ando), Journal of Financial Econometrics, 13 (3): 556-604, 2015
21. "Identification and Bayesian estimation of dynamic factor models," (with Peng Wang), Journal of Business and Economic Statistics, 33 (2), 221-240, 2015
22. Identification theory for high dimensional static and dynamic factor models (with Peng Wang), *Journal of Econometrics*, 178 (2), 794-804, 2014
23. Theory and methods of panel data models with interactive effects (with Kunpeng Li), Annals of Statistics, 42(1), 142-170, 2014
24. "Principal components estimation and identification of static factors" (with S. Ng), *Journal of Econometrics*, 176, 178-189, 2013.
25. Testing panel cointegration with dynamic common factors that are correlated with the regressors (with Josep Lluis Carrion-i-Silverstre), Econometrics Journal, 16, 222-249, 2013.
26. "Fixed effects dynamic panel data models, a factor analytical method," Econometrica, 81, 285-314, January, 2013
27. "Statistical analysis of factor models of high dimension", (with K.P. Li), Annals of Statistics, 40, 436-465, 2012.
28. "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.
29. "Estimating high dimensional covariance matrices and its applications" (with Shuzhong Shi), Annals of Economics and Finance, 12, 199-215, 2011.
30. "Conditional Markov Chain and its Application in Economic Time Series Analysis" (with P. Wang), Journal of Applied Econometrics, 26, 715-734, 2011
31. "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
32. "Instrumental Variable estimation in a data rich environment" (with Serena Ng), Econometric Theory, 26, 1577-1606, 2010

33. "Panel Unit Root Tests with Cross-Section Dependence, a further investigation," (with Serena Ng) Econometric Theory, 26, 1088-1114, 2010
34. "Common breaks in means and in variances for panel data," *Journal of Econometrics*, 157, 78-92, 2010.
35. "Panel data models with interactive fixed effects", Econometrica, 77, 1229-1279, 2009
36. "Structural Changes, Common Stochastic Trends, and Unit Roots in Panel Data" (with Josep Lluis Carrion-i-Silverstre), Review of Economic Studies, 471-501, 2009
37. "Selecting instrument variables in a data rich environment" (with Serena Ng), Journal of Time Series Econometrics, 1, Article 4, 2009
38. "Panel Cointegration with Global Stochastic Trends" (with C. Kao, S. Ng) *Journal of Econometrics*, 145, 82-99, 2009
39. "Boosting diffusion indices" (with Serena Ng), Journal of Applied Econometrics. 24, 607-629, 2009
40. "Forecasting Economic Time Series with Targeted Variables" (with Serena Ng), Journal of Econometrics. 146, 304-317, 2008.
41. "Extreme estimation when the predictors are estimated from large panels" (with Serena Ng), Annals of Economics and Finance. 9-2, 201-222, 2008.
42. "Factor Models," New Palgrave Dictionary of Economics, 2008.
43. "Large Dimensional Factor Models" (with Serena Ng), Foundations and Trends in Econometrics, 3 (2), 89-163, 2008.
44. "Generic Consistency for Multiple Breaks under Misspecification (with Terence Chong, H. Chen, and S.X. Wang), Econometrics Journal, 11 (2), 287-307, 2008.
45. "Testing multivariate distributions in GARCH models" (with Zhihong Chen), *Journal of Econometrics*, Vol. 143, 19-36, 2008.
46. "Determine the number of primitive shocks in factor models" (with Serena Ng), Journal of Business and Economics Statistics, 83, 171-222, 2007
47. "Confidence intervals for diffusion index forecast and inference with factor-augmented regressions" (with Serena Ng), Econometrica, 74, 1133-1155, 2006.
48. "Evaluating Latent and Observed Factors in Macroeconomics and Finance" (with Serena Ng), *Journal of Econometrics*, 131, 507-537, 2006.
49. "Testing Skewness, Kurtosis, and Normality for Time Series" (with Serena Ng) , Journal of Business and Economic Statistics, 23, 49-61, 2005.

50. "A Panic Attack on Unit Roots and Cointegration" (with Serena Ng), Econometrica, 1127-1177, 2004.

51. "Estimating Cross-Section Common Stochastic Trends in Nonstationary Panel Data," *Journal of Econometrics*, 137-183, 2004.

52. "Testing Parametric Conditional Distributions of Dynamic Models," Review of Economics and Statistics, 85, 531-549, 2003.

53. "Inferential Theory for Factor Models of Large Dimensions," Econometrica 71, 135-171, 2003.

54. "Critical Values of Multiple Structural Change Tests" (with Pierre Perron), Econometrics Journal, 6, 72-78, 2003.

55. "Computation and Analysis of Multiple Structural Changes" (with Pierre Perron), Journal of Applied Econometrics, 18, 1-22, 2003.

56. "Determine the Number of Factors in Approximate Factor Models" (with Serena Ng), Econometrica, 70, 191-221, 2002.

57. "A Consistent Test for Conditional Symmetry of Time Series." (with Serena Ng) *Journal of Econometrics*, 103, 225-258, 2001.

58. "Vector Autoregressive Models with Structural Change in Regression Coefficients and in Variance-Covariance Matrix," Annals of Economics and Finance, Vol. 1, 303-339, 2000.

59. "Likelihood Ratio Tests for Multiple Structural Changes." *Journal of Econometrics*, Vol. 91, No. 2, 299-323, 1999.

60. "Multiple-Regime Regression with Least Absolutes Deviation Estimation." Journal of Statistical Planning and Inference, 74, 103-134, 1998.

61. "A Note on Spurious Breaks." Econometric Theory, 14, 663-669, 1998.

62. "Testing for and Dating Common Breaks in Multivariate Time Series," with Robin Lumsdaine and James Stock. Review of Economic Studies, 65, 395-432, 1998.

63. "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).

64. "Estimation of a Change Point in Multiple Regressions" Review of Economics and Statistics, 79, 551-563, 1997.

65. "Estimating Multiple Breaks One at a Time." Econometric Theory, 13, 315-352, 1997.

66. "Testing for Parameter Constancy in Linear Regressions: an Empirical Distribution Function Approach." Econometrica, 64, 597-622, 1996.

67. "Least Absolute Deviation Estimation of a Shift." Econometric Theory, 11, 403-436, 1995.

68. "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.

69. "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).

70. "Weak Convergence of Sequential Empirical Processes of Residuals in ARMA Models." Annals of Statistics, 22, 2051-2061, 1994.

71. "On the Partial Sum Processes of Residuals in Autoregressive and Moving Average Models." Journal of Time Series Analysis, 14, 247-260, 1993.

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.

- "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.

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.

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
Dean's Faculty Development Fund, MIT, 1993

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: Trends and Foundations 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.