FAN ZHUO

400 Boren Ave N. Apt 509
Seattle, WA 98109
Cell: +1-410-920-4614
Email: zhuofan@amazon.com
Website: people.bu.edu/zhuo

EDUCATION

Ph.D., Economics, Boston University, Boston, MA, May 2016
Dissertation Title: *Essays on Regime Switching and DSGE Models with Applications to U.S. Business Cycle*
Dissertation Committee: Zhongjun Qu, Pierre Perron, Hiroaki Kaido and Jianjun Miao
M.A., Applied Economics, Ohio University, Athens OH, 2010
M.S., Applied Mathematics, Ohio University, Athens OH, 2009
M.S., Computational Mathematics, Sichuan University, Chengdu, China, 2007
B.S., Applied Mathematics, Beijing Institute of Technology, Beijing, China, 2004

FIELDS OF INTEREST

Econometrics, Time Series, Macroeconomics, Empirical Finance

TEACHING EXPERIENCE

As Lecturer:
Algebra, Department of Mathematics (B.S. course), Ohio University, 2007-2009

As Teaching Fellow:
Advanced Econometrics (Ph.D. course), Boston University, 2011-2012
Mathematical Economics (M.A. course), Boston University, 2013
Introductory Macroeconomic Analysis (B.S. course), Boston University, 2014

WORK EXPERIENCE

Economist, Amazon.com, 2016-Now
Research Assistant for Prof. Pierre Perron, Department of Economics, Boston University, 2015
Research Assistant for Prof. Zhongjun Qu, Department of Economics, Boston University, 2012-2014
Research Assistant for Prof. Julia Paxton, Department of Economics, Ohio University, 2009

FELLOWSHIPS AND AWARDS

Special Research Fellowship, Boston University, 2012-2015
Summer Research Grant, Boston University, 2012
Teaching Fellowship, Boston University, 2011- 2012
Teaching Assistantship, Ohio University, 2007-2009

PUBLICATION

"Economic Shocks and Savings Behavior by the Rural Poor," (with Julia Paxton) *Economics Bulletin*, (2011) 31(4): 3286-3293. (Master's thesis)
"Solutions Manual to Accompany Economic Dynamics in Discrete Time," (with Yue Jiang and Jianjun Miao), MIT Press, 2014.

WORKING PAPERS

"Likelihood Ratio Based Tests for Markov Regime Switching" (with Zhongjun Qu).
"Testing for Regime Switching in State Space Models"
"Estimating a Search and Matching Model with Sticky Price and Staggered Wage Negotiation"

WORK IN PROGRESS

"Falling Behind or Catching Up - Structural Break Story of Africa's Convergence" (with Aparna Dutta).

SEMINAR AND CONFERENCE PRESENTATIONS

Invited Seminar, Department of Mathematics and Statistics, Boston University, April 2015
The 11th World Congress of the Econometric Society, Montreal, August 2015
The 11th International Symposium on Econometric Theory and Applications, Tokyo, May 2015
The 23rd Symposium of the Society for Nonlinear Dynamics and Econometrics, Norway, March 2015
Invited Session, Joint Statistical Meetings, Boston, August 2014

LANGUAGES

Native in Chinese, Fluent in English

COMPUTER SKILLS

MATLAB, Parallel Computing, Stata, R, SAS (Certified Base Programmer)

CITIZENSHIP/VISA: China/H-1B

REFERENCES

Zhongjun Qu
Associate Professor
Department of Economics
Boston University
270 Bay State Road
Boston MA 02215 USA
Phone: +1-617-358-5921
Email: qu@bu.edu

Pierre Perron
Professor
Department of Economics
Boston University
270 Bay State Road
Boston MA 02215 USA
Phone: +1-617-353-3026
Email: perron@bu.edu

Hiroaki Kaido
Assistant Professor
Department of Economics
Boston University
270 Bay State Road
Boston MA 02215 USA
Phone: +1-617-358-5924
Email: hkaido@bu.edu

Jianjun Miao
Professor
Department of Economics
Boston University
270 Bay State Road
Boston MA 02215 USA
Phone: +1-617-353-6675
Email: miaoj@bu.edu

FAN ZHUO

Likelihood Ratio Based Tests for Markov Regime Switching (joint with Zhongjun Qu)
(Job Market Paper)

Markov regime switching models are widely considered in economics and finance. Although there have been persistent interests (see e.g., Hansen, 1992, Garcia, 1998, and Cho and White, 2007), the asymptotic distributions of likelihood ratio based tests have remained unknown. This paper considers such tests and establishes their asymptotic distributions in the context of nonlinear models allowing for multiple switching parameters. The analysis simultaneously addresses three difficulties: (i) some nuisance parameters are unidentified under the null hypothesis, (ii) the null hypothesis yields a local optimum, and (iii) conditional regime probabilities follow stochastic processes that can only be represented recursively. Addressing these issues permits substantial power gains in empirically relevant situations. Besides obtaining the tests' asymptotic distributions, this paper also obtains four sets of results that can be of independent interest: (1) a characterization of conditional regime probabilities and their high order derivatives with respect to the model's parameters, (2) a high order approximation to the log likelihood ratio permitting multiple switching parameters, (3) a refinement to the asymptotic distribution, and (4) a unified algorithm for simulating the critical values. For models that are linear under the null hypothesis, the elements needed for the algorithm can all be computed analytically. The above results also shed light on why some bootstrap procedures can be inconsistent and why standard information criteria, such as the Bayesian information criterion (BIC), can be sensitive to the hypothesis and the model's structure. When applied to the US quarterly real GDP growth rates, the methods suggest fairly strong evidence favoring the regime switching specification, which holds consistently over a range of sample periods.

Testing for Regime Switching in State Space Models

This paper develops a modified likelihood ratio (MLR) test for detecting regime switching in state space models. I apply the filtering algorithm introduced in Gordon and Smith (1988) to construct the modified likelihood function under the alternative hypothesis of two regimes and extend the analysis in Qu and Zhuo (2015) to establish the asymptotic distribution of the MLR statistic under the null. I also illustrate the test with an application to the U.S. unemployment rates. This paper is the first to develop a test that is based on the likelihood ratio principle for detecting regime switching in state space models.

Estimating a Search and Matching Model with Sticky Price and Staggered Wage Negotiation

This paper estimates a search and matching model of the aggregate labor market with sticky price and staggered wage negotiation. It starts with a partial equilibrium search and matching model and expands into a general equilibrium model with sticky price and staggered wage. I study the quantitative implications of the model. The results show that (1) the price stickiness and staggered wage are quantitatively important for the search and matching model of the aggregate labor market; (2) a relatively high outside alternative of the workers is needed to match the data; and (3) workers have relatively lower bargaining power than firms, which contrasts with the assumption in the calibration literature that workers and firms share equally the surplus generated from their employment relationship.