HAYUN SONG

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CONTACT INFORMATION

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EDUCATION

Ph.D., Economics, University of Southern California, CA, US — Expected 2024

High-dimensional Bayesian nonparanormal dynamic conditional model with multivariate volatility applications

Committee: M. Hashem Pesaran (Chair), Cheng Hsaio, Timothy Armstrong

M.S., Economics, University of Wisconsin, Madison, WI, US — 2016

M.A., Economics, Boston University, MA, US — 2014

B.A., Economics, Sungkyunkwan University, Seoul, South Korea — 2012

B.A., Business Administration, Sungkyunkwan University, Seoul, South Korea — 2012

FIELDS OF INTEREST

Econometrics, Applied Econometrics, Bayesian Statistics

FELLOWSHIPS, HONORS, AND AWARDS

Summer Research Award, Department of Economics, USC — 2021

Best 3rd-year paper award.

Summer Research Award, Department of Economics, USC — 2018

Best 2nd-year paper award.

Scholarship for Excellence, Sungkyunkwan University — 2009

Scholarships for the top 50 students in the department in the semester.

ACADEMIC PAPERS

1. Song, Hayun. (2023). *High-dimensional Bayesian nonparanormal dynamic conditional model with multivariate volatility applications.*

   Abstract: This paper proposes a Bayesian approach for the estimation of large conditional precision matrices instead of inverting conditional covariance matrices estimated, using, for example, the dynamic conditional correlations (DCC) approach. By adopting a Wishart distribution and horseshoe priors within a DCC–GARCH(1,1) model, our method imposes sparsity and circumvents the inversion of conditional covariance matrices. We also employ a nonparanormal method with rank transformation to allow for conditional dependence without estimating transformation functions to achieve Gaussianity. Monte Carlo simulations show that our approach is effective at

estimating the conditional precision matrix, particularly when the number of variables (N) exceeds the number of observations (T). We investigate the utility of our proposed approach with two real-world applications. First, to study conditional partial correlations among international stock price indices. Second, to test for $\boldsymbol{\alpha}$ in the context of CAPM and Fama-French 5 factor models with a conditional precision matrix-based Wald-type test. The results indicate stable conditional partial correlations through market disruptions. When there are market disruptions, blue chip stocks chosen from S&P 500 daily returns provide statistically significant evidence against the CAPM and Fama-French five models.

2. Lee, Junghyuk and Hayun Song. (2023). *Female labor force participation and gender role attitudes*, [Manuscript under preparation].

3. Song, Hayun. (2021). *Bayesian dynamic factor augmented structure learning: cross-sectional dependence for residuals*

   Abstract: We propose a Bayesian approach to estimate the dynamic factor-augmented VAR model. As a result, we can obtain contemporaneous connectedness as a graphical model of cross-sectional dependence. In this paper, we estimate unobserved factors as principal components, given the known number of factors. Then, we draw factors through the Gibbs sampler using the forward-filtering backward-sampling algorithm. For the transition matrix, we use a rescaled version of the spike and slab priors for our coefficients of lagged variables, which solves the matrices' collinearity (or possible rank deficiency) when the number of variables is high-dimensional. We check the properties of the estimators derived from the rescaled spike and slab prior by converting the original Bayesian problem into the Frequentists' ridge estimation problem. We show that the posterior mean asymptotically maximizes the posterior distribution by analyzing the sensitivity of the choice of prior coefficients. Lastly, we use the fractional Bayes factor to implement the Bayesian graphical model selection based on the graphical VAR. MC simulation shows the performance of our estimation strategy, and we consider weak cross-sectional dependencies in U.S. house prices.

4. Song, Hayun. (2018). *Individual heterogeneity in the returns to schooling: instrumental variable quantile regression*, Department of Economics, University of Southern California.

   Abstract: The main focus of this paper is to investigate whether people with varying levels of unobserved ability obtain different earnings based on their years of schooling. This paper's contribution to the literature is to use the instrumental quantile regression (IVQR) method to capture the heterogeneity of returns on the twins' sample while controlling for ability and measurement error biases. After controlling all covariates and biases, the range of estimates is between 9 percent and 15 percent. Although there is a weak identification problem, the results from both the levels and the proxy models are statistically significant. This paper shows the existence of heterogeneity across individuals through the general Wald-type location shift test. This indicates the complementary relationship between education and schooling in the generation of earnings. Furthermore, I check the positive ability bias, negative measurement error, linearity of schooling, and the heterogeneity of returns of other covariates: age, race, gender, union membership, and tenure.

TEACHING/RESEARCH ASSISTANCE EXPERIENCE

Research Assistant, University of Southern California F2021 to Present

RA for Prof. Hashem Pesaran (with Prof. Ron Smith)

Teaching Assistant, University of Southern California

ECON 318: Introduction to Econometrics (undergraduate) Summer 2022

ECON 318: Introduction to Econometrics (undergraduate) S2022

ECON 513: Practice of Econometrics (master) F2021

ECON 611: Probability and Statistics for Economists (Ph.D.) F2018

ECON 401: Mathematical Methods in Economics (undergraduate) F2018

ECON 305: Intermediate Macroeconomic Theory (undergraduate) F2017, S2018

DATA ANALYTIC PROJECTS

1. **LGBT Clinic Data Analysis** 2018

   Analyzed clinic data and determined that Monday was the most popular day for patients of all ages to visit the clinic and Wednesday was the preferred appointment date for Orange County patients. Found that gay and lesbian individuals were more likely to be insured with Cigna, while bi/pan individuals were less likely to be insured with Health-Net or to be uninsured.

2. **Anti-AgingGames.com Senior Center Cognitive Training Pilot Study** 2018

   Assessed the impact of playing anti-aging games (https://www.anti-aginggames.com/) on word and digit memory scores and found that the games improved performance by approximately 1.38 and 0.23 respectively and that scores positively correlated with the number of logins. Proposed a new game concept to clients utilizing separated visual and auditory effects for improved transparency in memory enhancement analysis.

3. **Psychology Evaluation of Fotonovela,** with Aviroop Ghosal 2018

   Evaluated the effectiveness of a fotonovela, a type of comic book or graphic novel that originated in Latin America similar to a traditional comic book, but is illustrated with photographs rather than drawings, as an educational tool for teaching information about dementia compared to a standard brochure. Conducted regression analysis and found that the fotonovela had a significant positive impact on post-knowledge and follow-up-knowledge test scores for dementia with an increase of 3.467 and 7.980 respectively.

OTHER INFORMATION

Military Service: Corporal, Republic of South Korea Army (ROKA) Feb. 2019 - 2020

Programming Languages and Frameworks:

Python (CuPy, PyTorch), R, STATA, Gauss, Git, LaTex, MATLAB, MySQL, Microsoft Office

Languages: English (Native Fluency), Japanese (Native Fluency), Korean (Native)

Citizenship: South Korea

REFERENCES

M. Hashem Pesaran (Chair)
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John Elliott Distinguished Chair
University of Southern California
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Cheng Hsiao
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Timothy Armstrong
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