

# Paul Sangrey

August 6, 2018

Department of Economics  
University of Pennsylvania  
133 South 36<sup>th</sup> Street  
Philadelphia, PA 19104

Website: <http://sangrey.io>  
Email: [paul@sangrey.io](mailto:paul@sangrey.io)  
Citizenship: United States  
Languages: English (native)

## EDUCATION

2019: Ph.D. Economics, University of Pennsylvania (Expected)  
2015: A.M. Economics, University of Pennsylvania  
2013: B.S. Mathematics and Economics, Grove City College, *summa cum laude*

## REFERENCES

Francis X. Diebold, Co-Advisor  
Department of Economics  
University of Pennsylvania  
133 South 36<sup>th</sup> Street  
Philadelphia, PA 19104  
[fdiebold@sas.upenn.edu](mailto:fdiebold@sas.upenn.edu)

Frank Schorfheide, Co-Advisor  
Department of Economics  
University of Pennsylvania  
133 South 36<sup>th</sup> Street  
Philadelphia, PA 19104  
[schorf@ssc.upenn.edu](mailto:schorf@ssc.upenn.edu)

Amir Yaron  
Department of Finance  
University of Pennsylvania  
3620 Locust Walk  
Philadelphia, PA 19104-6367  
[aron@wharton.upenn.edu](mailto:aron@wharton.upenn.edu)

Xu Cheng  
Department of Economics  
University of Pennsylvania  
133 South 36<sup>th</sup> Street  
Philadelphia, PA 19104  
[xucheng@econ.upenn.edu](mailto:xucheng@econ.upenn.edu)

## RESEARCH AND GRADUATE TEACHING FIELDS

Primary Fields: Econometrics, Financial Economics  
Secondary Fields: Big Data & Machine Learning

## TEACHING EXPERIENCE

Summer 2016, Spring 2018: International Economics, instructor  
Spring 2015 – Spring 2016: Introduction to Econometrics, recitation instructor for both Francis X. Diebold and Xu Cheng  
Fall 2014: Introduction to Microeconomics, recitation instructor for Rebecca Stein

## RESEARCH EXPERIENCE

Fall 2016 – Fall 2017: Research Assistant for Jesús Fernández-Villaverde  
Summer 2015 – Spring 2016: Research Assistant for Frank Schorfheide

## PRESENTATIONS

Society of Financial Econometrics Summer School in Chicago (2018)  
NBER-NSF Seminar on Bayesian Inference in Econometrics and Statistics (2018)  
George Washington Student Research Conference (2018)  
Penn Econometrics Lunch Seminar (Multiple)  
Wharton Finance Lunch Seminar (2018)  
Young Economists Symposium 2017 (Yale University)

## REFeree ACTIVITY

International Economic Review, Quantitative Economics

## HONORS AND FELLOWSHIPS

- 2018 University of Pennsylvania SAS Dissertation Completion Fellowship
- 2013 Institute for Human Studies Humane Studies Fellowship
- 2013 Grove City College Franklin C. Ketter Mathematics Prize

## COMPUTATIONAL SKILLS

Python, C++17, R, MATLAB, OpenMP, Git

## PYTHON PACKAGES

- `arma_wrapper` Provides wrapping code to use the C++ library Armadillo in Python.
- `bayesiankalman` Provides a Bayesian implementation of the Kalman Filter and Smoother.
- `cdpm` Provides estimators for the model developed by the “Feasible Density Estimation” Paper.
- `laplacejumps` Provides algorithms to estimate and forecast the jump volatility and the other quantities of interest in “Jumps, Realized Density, and News Premia”

## WORKING PAPERS

### [Jumps, Realized Densities, and News Premia](#)

Announcements and other news continuously barrage financial markets causing asset prices to jump hundreds of times per day. Recursive utility implies that these jump-driven uncertainty will be priced differently than equivalent diffusive driven uncertainty. I derive a tractable nonparametric continuous-time representation for the prices’ jumps and derive the implied sufficient statistic for the jump dynamics. This statistic — *jump volatility* — is the instantaneous variance of the jump part and measures news risk. I define the realized density as the daily return density conditional on its diffusion and jump volatilities. This solves the time-aggregation problem and reduces tracking the daily return density to forecasting its volatilities. I develop estimators for the volatilities and the realized density and estimate them using high-frequency data from SPY. This nonparametrically identifies the average curvature in investor’s certainty equivalence functional. I then apply these methods to high-frequency data from the S&P 500 and show that total volatility commands a positive risk premium and the proportion of volatility driven by jumps commands a negative premium. This implies that investor’s certainty equivalence function is quasiconvex.

### **Smooth Priors and the Curse of Dimensionality: Feasible Multivariate Density Estimation**

*with Minsu Chang*

Since most economic data are multivariate, a classic problem in the literature is to estimate a multivariate density. When you have more than a couple of series, the curse-of-dimensionality makes nonparametric estimators imprecise. We provide a simple mixture representation for the conditional density of a multivariate Markov process. For any finite number of periods, the number of mixture components required to approximate the density well is a random variable. Consider an asymptotic experiment where the econometrician picks a small positive number  $\delta$ , the number of series is fixed, and the number of periods  $T$  grows. We construct a bound on the number of mixture components as a function of  $T$  alone that holds with prior probability  $1 - \delta$ . Surprisingly, this estimator’s convergence rate —  $\log(T)/\sqrt{T}$  — does not decline as the number of series. This bound exploits smoothness in the prior and does not require the likelihood to be smooth. We provide a computationally efficient Bayesian estimator using a Dirichlet process and analyze its performance in two empirical examples. The first is a monthly macroeconomic panel where our method shows consumption’s conditional variance greatly increased during the Great Recession. The second is a daily financial panel where our method automatically detects the data’s stylized features, including stochastic volatility and fat tails.

WORK IN PROGRESS

**Inference for Risk Prices Using Equity Data**

*with Xu Cheng and Eric Renault*

**Jumps, Tail Risk, and the Distribution of Stock Returns**