Dobrislav Dobrev

CURRICULUM VITAE

Federal Reserve Board of Governors
20th Street and Constitution Avenue NW
Washington, DC 20551
Office: + 1 202 452 2953
Work e-mail: Dobrislav.P.Dobrev@frb.gov

Mailing Address
1214 Merchant Ln
McLean, VA 22101
Cell: + 1 224 392 0782
E-mail: Dobrislav.Dobrev@gmail.com

PROFESSIONAL EXPERIENCE

Federal Reserve Board of Governors **Washington, DC** **2007 – present**

Principal Economist, Monetary Affairs Division (MA)
Federal Reserve Board contributing member of the BIS Markets Committee Study Group on "The Use of FX Execution Algorithms and Implications for Market Functioning" (2019-present)
Acting section chief of Monetary and Financial Market Analysis (MFMA) during the August 2019 market turmoil (2019)
Member of the MA/MFMA Recruiting Committee (2018–present)
Led Federal Reserve System QS call on "High-Speed Cross-Market Linkages in U.S. Treasury and Related Markets" (2018)
Assisted with preparing Governor Brainard's keynote speech "The Structure of the Treasury Market: What Are We Learning?" at the Fourth Annual FRBNY Conference on the Evolving Structure of the U.S. Treasury Market (2018)
Assisted with preparing Chair Powell's opening remarks at the Federal Reserve Board Conference on Risk, Uncertainty and Volatility (2018)
Member of Board/FRBNY/Treasury collaborative effort on studying the new TRACE for Treasuries data (2017-present)
Led and contributed to MFMA projects aiming to improve Treasury market surveillance (2016-present)
Performed standard duties as a MFMA contributor to Tealbook A, Tealbook B, QS/FSR, FOMC minutes (2016-present)

Senior Economist / Economist, International Finance Division (IF)
Member of Quantitative Risk Analysis exam team on risk management of Central Clearing Counterparties (2015-2016)
Member of inter-agency team of the Joint Staff Report "The U.S. Treasury Market on October 15, 2014" (2014-2015)

- **2015 Distinction**: Special Achievement Award from the Board of Governors of the Federal Reserve System.

Member of Office of Financial Stability team for work stream on new volatility-specific financial products (2014)
Member of Office of Financial Stability team for work stream on new risks from high-frequency trading (2013–2014)
Project leader for pilot automated monitoring system of market shocks based on high-frequency data (2010–2012)
Member of the IF Recruiting Committee (2009–2010) and the IF Visiting Scholars Committee (2008–2011)
Internal consultant in financial econometrics and high-performance computing (2007–present)

Bulgarian National Bank **Sofia, Bulgaria** **1998 – 2001**

Head of Risk Analysis, Risk Analysis & Control Directorate (2000 – 2001)
Built up the quantitative risk analysis function of the newly established Risk Analysis & Control Directorate.

Member of the Investment Committee (1999 – 2001)
Evaluated and voted on the asset allocation and risk exposure of $3bn bank FX reserves and fixed income portfolios.

Senior Risk Analyst / Risk Analyst, Treasury Directorate (1998 – 2000)
Developed a stress-testing framework for managing the bank foreign reserves and net worth under a currency board.
Developed methodologies for strategic asset allocation, benchmark selection and portfolio performance measurement.

EDUCATION AND POSTGRADUATE ACADEMICS

University of Chicago **Chicago, IL** **2013 (Winter-Spring)**

Visiting Scholar, Booth School of Business (Econometrics and Statistics Area) and Stevanovich Center for Financial Mathematics

Kellogg School of Management, Northwestern University **Evanston, IL** **2001 – 2007**

Ph.D., Finance

Sofia University "St. Kliment Ohridski" **Sofia, Bulgaria** **1993 – 1998**

M.Sc., Applied Mathematics (Mathematical Economics)

HONORS, AWARDS & DISTINCTIONS

2017 Paper "Jump-Robust Volatility Estimation Using Nearest Neighbor Truncation" reached top on Elsevier's list of most cited Journal of Econometrics articles published in the past five years.

2015 Special Achievement Award from the Board of Governors of the Federal Reserve System.

2007 Chookaszian Prize in Risk Management, Kellogg School of Management.

2007 Best Poster Award, Chicago-Argonne Institute on Computational Economics, University of Chicago.

2001-2006 Kellogg School of Management Fellowship and Tuition Scholarship.

1998 Best Student Grant in honor of the 110th anniversary of Sofia University, Faculty of Mathematics and Informatics.

1993-1998 Top merit-based Sofia University Fellowship.

1992 Top Ten Award from the Bulgarian National Olympiad in Mathematics.

1991 First Prize at the Spring National Math Competition & Second Prize at the Winter National Competition, Bulgaria.

TEACHING EXPERIENCE

International Finance Division, Federal Reserve Board of Governors **Washington, DC** **Fall 2010**
Lecturer, Internal Mini-Course Program for Economists
Developed and taught mini-course: A Primer on Volatility Risk Premia.

Department of Economics, Northwestern University **Evanston, IL** **Spring 2006**
Lecturer, Economics Undergraduate Program
Taught an advanced undergraduate course: Foundations of Corporate Finance Theory (54 students).
Student Evaluation: 5.4/6.0 compared to past average 5.0/6.0 for this course.

Kellogg School of Management, Northwestern University **Evanston, IL** **2002 – 2008**
Teaching Assistant, Finance PhD, MBA, and Executive MBA Programs
PhD courses: Intro to Financial Theory (Fall 2003); Dynamic Asset Pricing (Winter 2004); Econometrics of Financial Markets (Winter 2006). MBA courses: Derivatives Markets I (Winter/Spring/Fall 2003, Spring 2004); Derivatives Markets II (Winter 2003); International Finance (Fall 2002, Winter/Spring 2005); Macroeconomics (Winter/Fall 2004). Executive MBA courses: Macroeconomics (Evanston Campus 2002-2007; Miami Campus 2007-2008).

Sofia University "St. Kliment Ohridski" **Sofia, Bulgaria** **1998 – 2001**
Adjunct Instructor, MSc Program in Applied Mathematics
MSc courses: Theory of Finance I & II (Winter & Spring 1998, 1999, 2001)

RESERACH INTERESTS

Financial Econometrics; High-Frequency Volatility, Jumps, and Comovements; Market Liquidity and Microstructure; Financial Risk Measurement and Forecasting; Robust Inference and Forecasting in Data-Rich Environments;

PUBLICATIONS

"Comments on Nonparametric Tail Risk, Stock Returns and the Macroeconomy" (with Ernst Schaumburg), *Journal of Financial Econometrics* 15*,* 388-409, 2017

"Accurate Evaluation of Expected Shortfall for Linear Portfolios with Elliptically Distributed Risk Factors" (with Travis Nesmith and Dong Hwan Oh), *Journal of Risk and Financial Management* 10 (Special Issue edited by Stefan Mittnik and Marc S. Paolella on Advances in Modeling Value at Risk and Expected Shortfall), 2017

"A Robust Neighborhood Truncation Approach to Estimation of Integrated Quarticity" (with Torben G. Andersen and Ernst Schaumburg), *Econometric Theory* 30, 3-59, 2014.

"Jump Robust Volatility Estimation using Nearest Neighbor Truncation" (with Torben G. Andersen and Ernst Schaumburg), *Journal of Econometrics* 169, 75-93, 2012.

- **2017 Distinction**: Top on Elsevier's list of most cited articles published in this journal in the last five years.

"No-Arbitrage Semi-Martingale Restrictions for Continuous-Time Volatility Models Subject to Leverage Effects, Jumps and i.i.d. Noise: Theory and Testable Distributional Implications" (with Torben G. Andersen and Tim Bollerslev), *Journal of Econometrics* 138, 125–180, 2007.

"The Currency Board in Bulgaria: Design, Peculiarities, and Management of Foreign Exchange Cover," *Bulgarian National Bank Discussion Papers* 9, 1-51, 1999.

FINANCE BLOGS & MEDIA COVERAGE

"Breaking Down TRACE Volumes Further" (with eight co-authors), joint FEDS Note and Liberty Street Economics Blog from staff at the Federal Reserve Board & Federal Reserve Bank of New York, November 29, 2018

"Unlocking the Treasury Market through TRACE" (with ten co-authors), joint FEDS Note and Liberty Street Economics Blog from staff at the Federal Reserve Board & Federal Reserve Bank of New York, September 28, 2018

"FT Explainer: Keeping up with high-frequency traders", Financial Times, September 5, 2016

"High-Frequency Cross-Market Trading and Market Volatility" (with Ernst Schaumburg), Liberty Street Economics Blog, February 17, 2016

"Fed warns on liquidity mirage for US treasuries", The DESK Magazine, February 3, 2016

"The Liquidity Mirage" (with Ernst Schaumburg), Liberty Street Economics Blog, October 9, 2015

"The fast and the furious: HFT in US Treasury markets", Risk Magazine, October 1, 2015

"High-Frequency Cross-Market Trading in U.S. Treasury Markets" (with Ernst Schaumburg), Liberty Street Economics Blog, August 19, 2015

"High Frequency Traders Do 'Risk' Better" (with Pawel Szerszen), Financial Times Alphaville, September 8, 2010

ACADEMIC SERVICE

Associate Editorship: "High Frequency" – Wiley (2016 – 2019).

Conference Organization: 2020, 2019, 2018, 2017, 2016, 2015, 2014, 2013 Annual SoFiE Conference (Program Committee Member); 2018 Federal Reserve Board Conference on Risk, Uncertainty and Volatility (Local Organizer, Program Committee Member and Session Chair); 2017 Annual SoFiE Conference (Session Chair); 2017 Vienna-Copenhagen Financial Econometrics Conference (Session Chair); 2016, 2015, 2014, 2013 EFA Annual Meeting (Program Committee Member); 2013 NBER-NSF Time Series Conference (Local Organizer and Program Committee Member); 2013 EFA Annual Meeting (Session Chair); 2013, 2012 WFA Annual Meeting (Program Committee Member); 2012 International Symposium on Forecasting (Invited Session Organizer); 2009 $(EC)^2$ Conference on Real Time Econometrics (Scientific Committee Member).

Conference Discussant: 2020 MFA Annual Meeting (two papers - scheduled); 2018 UCSD Financial Econometrics Conference for Tim Bollerslev's 60th Birthday; 2017 Annual SoFiE Conference; 2017 3rd International Workshop on "Financial Markets and Nonlinear Dynamics" (FMND); 2016 Duke University Conference "New Developments in Measuring & Forecasting Financial Volatility"; 2016 Annual SoFiE Conference; 2015 MFA Annual Meeting (two papers); 2013 EFA Annual Meeting; 2012 WFA Annual Meeting; 2012 US Census Bureau DSMD-CSMR Distinguished Seminar Series; 2010 International Conference on Computational and Financial Econometrics; 2009 Federal Reserve System Conference on Macroeconomics; 2005 FMA Annual Meeting.

Ad-hoc Referee: Econometrica; Journal of Applied Econometrics; Journal of Banking and Finance; Journal of Business and Economic Statistics; Journal of Econometrics; Journal of Empirical Finance; Journal of Finance; Journal of Financial Econometrics; Journal of Money, Credit, and Banking; Econometric Theory; Empirical Economics; International Journal of Forecasting; Management Science; Review of Economics and Statistics; Review of Financial Studies, Review of Finance.

CONFERENCE PRESENTATIONS

2020 Conference on Intrinsic Time in Finance, University of Konstanz (invited speaker - scheduled).
2020 Midwest Finance Association Annual Meeting, Chicago (scheduled).
2019 Conference on Market Microstructure and High Frequency Data, University of Chicago.
2019 Midwest Finance Association Annual Meeting, Chicago.
2018 NBER-NSF Time Series Conference, University of California, San Diego.
2018 Conference on Financial Stability Implications of New Technology, Federal Reserve Bank of Atlanta.
2018 2nd Annual Conference of the Central Bank Research Association (BIS Sponsored Session), Goethe University.
2018 24th Annual Conference on Computing in Economics and Finance, Milan, Italy.
2017 NBER-NSF Time Series Conference, Northwestern University.
2017 Tenth Annual Society for Financial Econometrics (SoFiE) Conference, New York University.
2017 Vienna-Copenhagen Financial Econometrics Conference, University of Vienna.
2017 3rd International Workshop on "Financial Markets and Nonlinear Dynamics", Paris.
2017 25th Symposium of the Society for Nonlinear Dynamics and Econometrics, Paris.
2016 Seventh Annual Conference on High Frequency Finance and Data Analytics, Stevens Institute of Technology.

2016 European Meeting of the Econometric Society (ESEM), University of Geneva.
2016 Ninth Annual Society for Financial Econometrics (SoFiE) Conference, City University of Hong Kong.
2016 Financial Econometrics and Empirical Asset Pricing Conference, Lancaster University.
2015 Hitotsubashi Summer Institute Workshop "Frontiers in Financial Econometrics", Tokyo.
2014 22nd Symposium of the Society for Nonlinear Dynamics and Econometrics, New York.
2013 Fifth Annual Conference on Modeling High-Frequency Data in Finance, Stevens Institute of Technology.
2013 Conference on High Frequency Data and High Frequency Trading, University of Chicago.
2013 4th Applied Financial Time Series Workshop, HEC Montreal.
2012 Fifth Annual Society for Financial Econometrics (SoFiE) Conference, Oxford University.
2012 NBER-NSF Time Series Conference, Texas A&M University.
2012 NBER Summer Institute, Boston.
2012 North American Summer Meeting of the Econometric Society, Northwestern University.
2012 32nd International Symposium on Forecasting, Boston.
2012 Financial Econometrics Conference, Toulouse School of Economics.
2011 11th OxMetrics User Conference, Washington, DC.
2011 5th International Conference on Computational and Financial Econometrics, University of London.
2011 NBER-NSF Time Series Conference, Michigan State University.
2011 North American Winter Meeting of the Econometric Society, Denver.
2010 4th International Conference on Computational and Financial Econometrics, University of London.
2010 SoFiE-CREATES Joint Conference on Measuring and Predicting Risk from Financial High-Frequency Data, Aarhus.
2010 Global Financial Crisis Research Workshop, Federal Reserve Board, Washington DC.
2010 30th International Symposium on Forecasting, San Diego.
2009 Second Annual Society for Financial Econometrics (SoFiE) Conference, University of Geneva.
2009 North American Summer Meeting of the Econometric Society, Boston.
2008 European Meeting of the Econometric Society, Bocconi University.
2008 Far Eastern and South Asian Meeting of the Econometric Society, Singapore.
2008 CREATES Volatility Symposium, Aarhus.
2008 SITE Workshop on Econometric Analysis of High-Frequency Data and the Impact of Economic News, Stanford.
2007 CIREQ Financial Econometrics Conference, Montreal.
2007 Stevanovich Center Conference on Volatility and High Frequency Data, Chicago.
2006 CIREQ Conference on Realized Volatility, Montreal.

SEMINAR PRESENTATIONS

2018 Northwestern University; U.S. Securities and Exchange Commission.
2017 Duke University; Rutgers University; Erasmus University; Stevens Institute of Technology;
2016 Bank of England; Stevens Institute of Technology; University of California, Berkeley.
2015 University of Tokyo; Bank of Japan; Federal Reserve Bank of Chicago.
2014 Bureau for Economic Analysis.
2013 University of Chicago; Northwestern University; George Washington University.
2012 Pompeu Fabra University; Cass Business School; North Carolina State University.
2010 Johns Hopkins University; Office of the Comptroller of the Currency.
2009 U.S. Commodity Futures Trading Commission.
2008 University of California San Diego; University of Maryland; Chicago-Argonne Institute on Computational Economics, University of Chicago.
2007 Barclays Global Investors; Board of Governors of the Federal Reserve System; Carnegie Mellon University; Federal Reserve Bank of Boston; Federal Reserve Bank of Chicago; Lehman Brothers; Moody's KMV; Northwestern University; University of Chicago; University of Michigan.

PROFESSIONAL MEMBERSHIPS

Society for Financial Econometrics, Econometric Society, American Economic Association, American Finance Association, European Finance Association,

COMPUTING AND DATA ANALYSIS SKILLS

Scientific computing: HPC cluster experience, MATLAB, C/C++, Python/NumPy, R, Ox, Maple, Mathematica.
Data sources: TRTH, TAQ, BrokerTec, Nanotick, AlgoSeek, CRSP, Reuters 3000 Fixed Income, Bloomberg.
Data management and integration: SQL, Python/Pandas, SAS, MS Excel/Query, VBA, MS Access, DAO, Java Script.

PERSONAL INFORMATION

Hobbies: Avid computer enthusiast; Photography and digital imaging; Hiking, biking, swimming, sailing, gardening.
Languages: English (fluent), Italian (proficient), Russian (some), Bulgarian (native).
Citizenship: Dual U.S. and Bulgarian.

ACADEMIC REFERENCES

Torben G. Andersen (PhD Advisor), Nathan S. and Mary P. Sharp Professor of Finance, Northwestern University
E-mail: t-andersen@kellogg.northwestern.edu

Federico Bandi, James Carey Endowed Professor of Economics and Finance, Johns Hopkins University
E-mail: fbandi1@jhu.edu

Nicholas Polson, Robert Law, Jr. Professor of Econometrics and Statistics, University of Chicago
E-mail: ngp@chicagobooth.edu

ADDENDUM: RECENT WORKING PAPERS

"**High-Frequency Cross-Market Trading: Model Free Measurement and Applications**" (with Ernst Schaumburg)
We propose a set of intuitive model-free measures of cross-market trading activity based on publicly available trade and quote data with sufficient time stamp granularity. By virtue of capturing the offset at which co-activity peaks, as well as its magnitude and dispersion, the measures allow us to shed new light on the distinct features of the high-frequency cross-market linkages in US Treasury and equity markets. First, the measures avoid reliance on noisy high-frequency return series often used in the literature and demonstrate sharp identification of the prevailing lead-lag relationships between trading activity across markets. Second, we show how the measures can be used to examine price impact and liquidity provision in (near) arbitrage linked markets. In particular, we provide new evidence suggesting that price discovery in US Treasury and equity markets primarily takes place in futures rather than cash markets. We further show that our measures of cross-market activity are closely linked with observed market volatility even after controlling for commonly used measures of market activity such as trading volume and number of transactions. Finally, we use our measures to draw an important distinction between the 2010 U.S. equity market flash crash and the 2014 U.S. Treasury market flash rally underscoring the role played by high-speed cross-market activity in maintaining the no-arbitrage price link between futures and cash markets during periods of significant market stress. Overall, our empirical findings suggest that accounting for cross-market trading activity is important when studying the volatility and liquidity of U.S. Treasury and equity markets.

"**A Randomized Missing Data Approach to Robust Filtering with Applications to Economics and Finance**" (with Derek Hansen and Pawel Szerszen)
We put forward a simple new approach to robust filtering of state-space models, motivated by the idea that the inclusion of only a small fraction of available highly precise measurements can still extract most of the attainable efficiency gains for filtering latent states, estimating model parameters, and producing out-of-sample forecasts. The new class of particle filters we develop aims to achieve a degree of robustness to outliers and model misspecification by purposely randomizing the subset of utilized highly precise but possibly misspecified or outlier contaminated data measurements, while treating the rest as if missing. The arising robustness-efficiency trade-off is controlled by varying the fraction of randomly utilized measurements or the incurred relative efficiency loss from such randomized utilization of the available measurements. As an empirical illustration, we consider popular state space models for inflation and equity returns with stochastic volatility and document favorable performance of our robust particle filter and density forecasts on both simulated and real data. More generally, our randomization approach makes it easy to robustly incorporate highly informative but possibly contaminated modern ``big data" streams for improved state-space filtering and forecasting.

"**Robust Forecasting by Regularization**" (with Ernst Schaumburg)
The prediction of multivariate outcomes in a linear regression setting with a large number of potential regressors is a common problem in macroeconomic and financial forecasting. We exploit that the frequently encountered problem of nearly collinear regressors can be addressed using standard shrinkage type estimation. Furthermore, when the outcomes

are high-dimensional correlated random variables, univariate forecasting is often sub-optimal and can be improved upon by shrinkage based on a canonical correlation analysis. In this paper, we consider a family of models for multivariate prediction that employ both types of shrinkage to identify a parsimonious set of common forecasting factors with the ability to enforce factor interpretability via variable grouping constraints implied by economic theory. As an important special case, our approach generalizes principal component regression by applying reduced rank rather than linear regression to the principal components of the regressors, thereby disentangling the forecasting factors driving the outcomes from the factor structure in the predictors. We illustrate its promising performance in applications to several standard forecasting problems in macroeconomics and finance relative to existing approaches. In particular, we show that a single factor model can almost double the predictability of one-month bond excess returns across a wide maturity range by using a set of predictors combining the yield slopes of Cochrane and Piazzesi (2005) and the maturity related cycles of Cieslak and Povala (2011).

"**The Impact of Waiting Times on Volatility Filtering and Dynamic Portfolio Allocation**" (with Nick Polson)
Financial decision-makers monitor market information to determine when to act and whether to update asset allocations. For example, investors follow stock market movements to assess portfolio rebalancing requirements, while central banks follow macroeconomic and financial developments as an input to monetary policy decisions. By monitoring waiting times which measure how long it takes for a functional of economic interest to exceed a given tolerance threshold we provide a unifying framework to address these problems. We introduce the duration-powered (DP) GARCH model aiming to better represent shot-noise volatility patterns and return-volatility asymmetries by combining reciprocal waiting times and squared returns. Viewed as alternative local spot variance estimators, reciprocal waiting times complement squared returns in DP-GARCH allowing for richer volatility dynamics in response to return shocks based on the same information set as GARCH. As an empirical application to dynamic portfolio allocation between the S&P 500 index and Treasury bills over a century-long horizon, we show that inferences dictated by "sufficiently large" changes in the market conditions and the agent's objective are particularly advantageous during major economic downturns thanks to promptly reflecting rapid fluctuations in the underlying volatility.

"**Duration-Based Volatility Estimation**" (with Torben G. Andersen and Ernst Schaumburg)
We develop a novel duration-based approach to estimating the integrated variance (IV) of a general jump-diffusion with stochastic volatility robustly to both jumps and market microstructure noise. Our approach builds on the relationship between the speed (distance traveled per fixed time unit) and passage time (time taken to travel a fixed distance) of the Brownian motion. In particular, we exploit that measuring the waiting times to observe economically significant threshold crossings automatically adapts to the inherent variations in the local arrival rates of information as an important distinction from return-based estimation methods relying on a fixed sampling frequency throughout the day. Data-based ranking against commonly used benchmark IV estimators indicates consistently higher accuracy rank of our duration-based estimators across the majority of Dow Jones 30 stocks.