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Education

Ph.D., Economics, University of Pennsylvania, 1986
B.S. Economics, University of Pennsylvania, 1981

Current Appointments (University of Pennsylvania)

Paul F. Miller, Jr. and E. Warren Shafer Miller Professor of Social Sciences
School of Arts and Sciences, 2008-present
Professor of Economics, School of Arts and Sciences, 2008-present
Professor of Finance, Wharton School, 2000-present
Professor of Statistics, Wharton School, 1996-present

Selected Current Research Institute Appointments

National Bureau of Economic Research, Cambridge, Mass., Research Associate, 1999-present
Penn Institute for Economic Research, University of Pennsylvania, Fellow, 2000-present
Jacobs Levy Center for Quantitative Financial Research, University of Pennsylvania, Board Member, 2014-present
Warren Center for Network and Data Sciences, University of Pennsylvania, Inaugural Affiliate, 2013-present

Past Appointments

University of Pennsylvania

Co-Director, Financial Institutions Center, Wharton School, 2007-2013
Professor of Economics, 1996-2008 (various chairs, 1999-2008)
Associate Professor of Economics (with tenure), 1992-1996
Assistant Professor of Economics, 1989-1992

Elsewhere

Executive Director, Morgan Stanley Investment Management, 2007-2008
(on leave from University of Pennsylvania)

Economist, Board of Governors of the Federal Reserve System, Washington, DC, 1986-1989

Visiting Appointments

New York University, Stern School of Business, Department of Finance, 1998-2000

Cambridge University, Trinity College and Faculty of Economics and Politics, Summer 1998

Princeton University, Department of Economics, Fall 1997

Johns Hopkins University, Department of Economics, Fall 1995

University of Chicago, Graduate School of Business, Department of Finance, Summer 1993

London School of Economics, Financial Markets Group, Spring 1992

Selected Honors

Fellow, Society for Economic Measurement, Elected 2014

Fellow, *Journal of Econometrics*, Awarded 2014

President, Society for Financial Econometrics, 2011-2013, Elected 2011

Honorary Fellow, International Institute of Forecasters, Elected 2012

Fellow, American Statistical Association, Elected 2004

Alexander von Humboldt Award, Germany, 2004

Fellow, John Simon Guggenheim Foundation, 2003-2004

“Club Six” Teaching Distinction, New York University, 1999

Fellow, Econometric Society, Elected 1998

Kravis Award for Outstanding Teaching, University of Pennsylvania, 1994, 1998

Fellow, Alfred P. Sloan Foundation, 1992-1993

Selected Lectures

Journal of Business and Economic Statistics, Annual Invited Lecture, Philadelphia, 2014

Presidential Address, Society for Financial Econometrics, Singapore, 2013

Journal of Applied Econometrics Annual Invited Lecture, Toulouse School of Economics, 2012

Distinguished Scholar Lecture, CREATES, University of Aarhus, Denmark, 2012

Tinbergen Lectures, Erasmus University Rotterdam, 2010 (Published by Princeton Univ. Press, 2013)

W.A. Mackintosh Lecture, Queen’s University, Kingston, Ontario, 2010

CASE Lecture, Humboldt University, Berlin, 2010

Plenary Lecture, Royal Economic Society Annual Meeting, Warwick, England, 2008

Hermann Otto Hirschfeld Lectures, Humboldt University, Berlin, 2005

Lawrence R. Klein Lecture, Project LINK, Mexico City, 2005
 Marshak Lecture, Econometric Society, Melbourne, 2004
 Purvis Lecture, Canadian Economic Association, Montreal, 2001
 Plenary Lecture, European Meeting of the Econometric Society, Santiago de Compostela, Spain, 1999

Editorial Boards

Journal of Financial Econometrics, 2000-present (advisory board)
Econometrics and Statistics, 2015-present (advisory board)
International Journal of Central Banking, 2005-present (associate editor)
Journal of Applied Econometrics, 1991-1997 (associate editor), 2011-2014 (co-editor)
Journal of Business and Economic Statistics, 1993-2003 (associate editor)
Econometrica, 1994-1997 (associate editor)
Review of Economics and Statistics, 1993-2002 (associate editor)
International Economic Review, 1993-2000 (co-editor)

Scientific Meetings Organized

University of Pennsylvania / University of Chicago Conference Series, 2015-present
 Big Data in Predictive Dynamic Econometric Modeling, University of Pennsylvania, 2017
 Econometrics of High-Dimensional Risk Networks, University of Chicago, 2015
 Conference in Honor of Marc Nerlove, Washington, DC 2015
 Conference in Memory of Lawrence R. Klein, University of Pennsylvania, 2014
 Society for Financial Econometrics, Annual Conference, Program Committee, 2010-2013
 Society for Financial Econometrics, Ad Hoc Conferences, Program Committee, 2010-2013
 Wharton Financial Institutions Center, Annual Financial Risk Roundtable, Founder and Organizer, 1998-2012
 Penn-Cambridge-Tinbergen Annual Conference on The Economics of Finance, Co-Founder and Organizer, 2009-2013
 American Finance Association, Annual Meeting, Program Committee, 2010
 Econometric Society, North American Summer Meeting, Program Committee, 2009
 Econometric Society, Ninth World Congress, Program Committee, 2005
 American Economic Association, Annual Meeting, Program Committee, 2004
 PIER-IGIER Conference on Macro- and Financial Econometrics, Milan, Co-Chairman, 2003
 National Science Foundation / National Bureau of Economic Research Time Series Conference, Chairman of the Organizing Committee and local host, 2002
 Econometric Society, North American Winter Meeting, Program Committee, 2003
 National Science Foundation / National Bureau of Economic Research Forecasting Seminar, Chairman, 1995-2001

National Bureau of Economic Research, Working Group on Empirical Methods in Macroeconomics and Finance, Co-Chairman, 1992-2001

Econometric Society, North American Winter Meeting, Program Committee, 1999

Econometric Society, North American Summer Meeting, Program Committee, 1993

Selected Additional Scientific Leadership

Advisory Board, Jacobs Levy Center for Quantitative Financial Research, University of Pennsylvania, 2014-present

Advisory Board, CSDA Annals of Computational and Financial Econometrics, 2014-present

Advisory Board, CAFIN, University of California, Santa Cruz, 2013-present

Advisory Board, Center For Applied Financial Economics, University of Southern California, 2012-present

Advisory Board, Center for Applied Statistics and Economics (CASE), Humboldt University Berlin, 2010-present

Advisory Board, Real Time Data Research Center, Federal Reserve Bank of Philadelphia, 2009-present

Founding Member, International Association of Applied Econometrics, 2011

Founding Council, Society for Financial Econometrics, 2007

National Science Foundation Economics Panel, 1998-2000

American Statistical Association, Program Chair, Business and Economic Statistics Section, 1991

Books

- [5] *Financial and Macroeconomic Connectedness: A Network Approach to Measurement and Monitoring*, Oxford University Press, 2015. With K. Yilmaz.
- [4] *Yield Curve Modeling and Forecasting: The Dynamic Nelson-Siegel Approach*. Princeton University Press (*The Tinbergen Lectures*), 2013. With G. Rudebusch.
- [3] *Business Cycles: Durations, Dynamics and Forecasting*. Princeton University Press, 1999. With G. Rudebusch. (Chapter 1 reprinted as "Five Questions About Business Cycles," *Economic Review*, Federal Reserve Bank of San Francisco, 1-15, 2001.)
- [2] *Elements of Forecasting*. Cincinnati: South-Western, 1998. Second edition, 2001. Third edition, 2004. Fourth edition, 2007. (Spanish editions: *Elementos de Pronosticos*. Indian Editions: *Forecasting: Applications and Methods*.)
- [1] *Empirical Modeling of Exchange Rate Dynamics*. Springer-Verlag, 1988.

Edited Volumes

- [3] *Financial Risk Measurement and Management (International Library of Critical Writings in Economics, Volume 267)*, Edward Elgar Publishing Ltd., 2012.
- [2] *The Known, the Unknown and the Unknowable in Financial Risk Management*. Princeton University Press, 2010, with N. Doherty and R. Herring. (Recipient of the American Risk and Insurance Association's Kulp-Wright Award; Finalist for TIAA-CREF's Paul A. Samuelson Award.)

- [1] *Risk Management for Central Bank Foreign Reserves*. Frankfurt: European Central Bank, 2004, with C. Bernadell, P. Cardon, J. Coche and S. Manganelli.

Edited Journal Issues and Symposia

- [9] *Big Data in Dynamic Predictive Econometric Modeling*, special issue of *Journal of Econometrics*, in progress. With E. Ghysels, P. Mykland and L. Zhang.
- [8] *The Econometrics of Macroeconomics, Finance and the Interface*, special issue of *Journal of Econometrics*, 131, 1-612, 2006. With R. Engle, C. Favero, G. Gallo and F. Schorfheide.
- [7] *New Directions in Financial Risk Management*, special issue of *Journal of Financial Econometrics*, 3, 1-168, 2005. With R. Garcia, S. Mittnik and E. Renault.
- [6] *Regulatory Capital and Operational Risk Management*, special issue of *Journal of Risk Finance*, 4, 2002, 25-56. With J. Drzik, R. Herring and A. Kuritzkes.
- [5] *Symposium on Forecasting Performance*, special issue of *IMF Staff Papers*, 49, 1-64, 2002.
- [4] *Forecasting and Empirical Methods in Finance and Macroeconomics*, special issue of *Journal of Econometrics*, 105, 2001, 1- 308. With K. West.
- [3] *Forecasting and Empirical Methods in Macroeconomics and Finance*, special issue of *Review of Economics and Statistics*, 81, 1999, 553-673. With J. Stock and K. West.
- [2] *Forecasting and Empirical Methods in Macroeconomics and Finance*, special issue of *International Economic Review*, 39, 1998, 811-1144. With K. West.
- [1] *Econometric Forecasting*, special issue of *Journal of Applied Econometrics*, 11, 453-594, 1996. With M. Watson.

Articles

- [107] "Commodity Connectedness," in E. Mendoza, D. Saravia and E. Pasten (eds.), *Monetary Policy and Global Spillovers: Mechanisms, Effects and Policy Measures*. Santiago: Bank of Chile Central Banking Series, Volume 21, in press. With L. Liu and K. Yilmaz.
- [106] "Estimating Global Bank Network Connectedness," *Journal of Applied Econometrics*, in press. With M. Demirer, L. Liu, and K. Yilmaz.
- [105] "Real-Time Forecast Evaluation of DSGE Models with Stochastic Volatility," *Journal of Econometrics*, in press. With F. Schorfheide and M. Shin.
- [104] "Assessing Point Forecast Accuracy by Stochastic Error Distance," *Econometric Reviews* (Special Issue in Honor of E. Maasoumi; P.C.B. Phillips and A. Ullah, eds.), 36, 588-598, 2017. With M. Shin.
- [103] "Consistent Scoring Functions, Choquet Representations, and Forecast Rankings: Comment on Ehm, Gneiting, Jordan and Krüger," *Journal of the Royal Statistical Society, Series B*, 2016, 544.
- [102] "Improving GDP Measurement: A Measurement-Error Perspective," *Journal of Econometrics*, 191, 384-397, 2016. With S.B. Aruoba, J. Nalewaik, F. Schorfheide and D. Song.
- [101] "Trans-Atlantic Equity Volatility Connectedness: U.S. and European Financial Institutions, 2004-2014," *Journal of Financial Econometrics*, 14, 81-127, 2016. With K. Yilmaz.
- [100] "Measuring the Dynamics of Global Business Cycle Connectedness," in S.J. Koopman and N. Shephard (eds.), *Unobserved Components and Time Series Econometrics: Essays in Honor of Andrew C. Harvey*, Oxford University Press, 2015, 45-89. With K. Yilmaz.

- [99] "Assessing Point Forecast Accuracy by Stochastic Loss Distance," *Economics Letters*, 130, 37-38, 2015. With M. Shin.
- [98] Diebold, F.X. (2015), "Comparing Predictive Accuracy, Twenty Years Later: A Personal Perspective on the Use and Abuse of Diebold-Mariano Tests" (with discussion), *Journal of Business and Economic Statistics*, 33, 1-24.
- [97] "On the Network Topology of Variance Decompositions: Measuring the Connectedness of Financial Firms," *Journal of Econometrics*, 182, 119-134, 2014. With K. Yilmaz.
- [96] "Financial Risk Measurement for Financial Risk Management," in G. Constantinides, M. Harris and R. Stulz (eds.), *Handbook of the Economics of Finance*, Volume 2, Part B, Elsevier, 1127-1220, 2013. With T. Andersen, T. Bollerslev and P. Christoffersen.
- [95] "On the Correlation Structure of Microstructure Noise: A Financial Economic Approach," *Review of Economic Studies*, 80, 1304-1337, 2013. With G. Strasser.
- [94] "A Markov-Switching Multi-Fractal Inter-Trade Duration Model, with Application to U.S. Equities," *Journal of Econometrics*, 177, 2013, 320-342. With F. Chen and F. Schorfheide.
- [93] "Improving GDP Measurement: A Forecast Combination Perspective," in X. Chen and N. Swanson (eds.), *Recent Advances and Future Directions in Causality, Prediction and Specification Analysis: Essays in Honor of Halbert L. White Jr.*, Springer, 1- 26, 2012. With B. Aruoba, J. Nalewaik, F. Schorfheide and D. Song.
- [92] "Better to Give than to Receive: Predictive Directional Measurement of Volatility Spillovers" (with discussion), *International Journal of Forecasting*, 28, 57-66, 2012. With K. Yilmaz.
- [91] "The Affine Arbitrage-Free Class of Nelson-Siegel Term Structure Models," *Journal of Econometrics*, 164, 4-20, 2011. With J. Christensen and G. Rudebusch.
- [90] "Globalization, the Business Cycle and Macroeconomic Monitoring" (with discussion), in R. Clarida and F. Giavazzi (eds.), *NBER International Seminar on Macroeconomics*. Chicago: University of Chicago Press, 2011, 245-302. With B. Aruoba, A. Kose and M. Terrones.
- [89] "Equity Market Spillovers in the Americas," in R. Alfaro (ed.) *Financial Stability, Monetary Policy, and Central Banking*. Santiago: Bank of Chile Central Banking Series, Volume 15, 199-214, 2011. With K. Yilmaz.
- (Spanish translation published as: "Efectos Errame en Los Mercados de Valores del Continente Americano," *Revista Economía Chilena*, 12, 55-65, 2009.)
- [88] "Real-Time Macroeconomic Monitoring: Real Activity, Inflation and Interactions," *American Economic Review*, 100, 20-24, 2010. With B. Aruoba.
- [87] "Parametric and Nonparametric Volatility Measurement," in L.P. Hansen and Y. Ait-Sahalia (eds.), *Handbook of Financial Econometrics*. Amsterdam: North-Holland, 2010, 67-138. With T.G. Andersen and T. Bollerslev.
- [86] "Macroeconomic Volatility and Stock Market Volatility, Worldwide," in T. Bollerslev, J. Russell and M. Watson (eds.), *Volatility and Time Series Econometrics: Essays in Honor of Robert F. Engle*. Oxford University Press, 2010, 97-116. With K. Yilmaz.
- [85] "An Arbitrage-Free Generalized Nelson-Siegel Term Structure Model," *Econometrics Journal*, 12, 33-64, 2009. With J. Christensen and G.D. Rudebusch.
- [84] "Real-Time Measurement of Business Conditions," *Journal of Business and Economic Statistics*, 27, 417-427, 2009. With S.B. Aruoba and C. Scotti.
- [83] "Measuring Financial Asset Return and Volatility Spillovers, With Application to Global Equity Markets," *Economic Journal*, 119, 158-171, 2009. With K. Yilmaz.

- [82] "Stock Returns and Expected Business Conditions: Half a Century of Direct Evidence," *Journal of Business and Economic Statistics*, 27, 266-278, 2009. With S. Campbell.
- [81] "Global Yield Curve Dynamics and Interactions: A Generalized Nelson-Siegel Approach," *Journal of Econometrics*, 146, 351-363, 2008. With C. Li and V. Yue.
- [80] "Roughing It Up: Including Jump Components in the Measurement, Modeling and Forecasting of Return Volatility," *Review of Economics and Statistics*, 89, 701-720, 2007. With T. Andersen and T. Bollerslev.
- [79] "Real-Time Price Discovery in Stock, Bond and Foreign Exchange Markets," *Journal of International Economics*, 73, 251-277, 2007. With T. Andersen, T. Bollerslev and C. Vega.
- [78] "Financial Asset Returns, Direction-of-Change Forecasting and Volatility Dynamics," *Management Science*, 52, 1273-1287, 2006. With P. Christoffersen.
- [77] "The Macroeconomy and the Yield Curve: A Dynamic Latent Factor Approach," *Journal of Econometrics*, 131, 309-338, 2006. With G. Rudebusch and B. Aruoba.
- [76] "Realized Beta: Persistence and Predictability," in T. Fomby and D. Terrell (eds.) *Advances in Econometrics: Econometric Analysis of Economic and Financial Time Series*, Volume B, 2006, 1-40. With T. Andersen, T. Bollerslev and G. Wu.
- [75] "Volatility and Correlation Forecasting," in G. Elliott, C.W.J. Granger and Allan Timmermann (eds.), *Handbook of Economic Forecasting*. Amsterdam: North-Holland, 2006, 778-878. With T. Andersen, T. Bollerslev and P. Christoffersen.
- [74] "Forecasting the Term Structure of Government Bond Yields," *Journal of Econometrics*, 130, 337-364, 2006. With C. Li. (Implemented in Matlab.)
- [73] "Practical Volatility and Correlation Modeling for Financial Market Risk Management," in M. Carey and R. Stulz (eds.), *Risks of Financial Institutions*, University of Chicago Press for NBER, 2006, 513-548. With T. Andersen, T. Bollerslev and P. Christoffersen.
- [72] "A No-Arbitrage Approach to Range-Based Estimation of Return Covariances and Correlations," *Journal of Business*, 79, 61-74, 2006. With M. Brandt.
- [71] "Weather Forecasting for Weather Derivatives," *Journal of the American Statistical Association*, 100, 6-16, 2005 (lead article for the year). With S. Campbell.
- [70] "A Framework for Exploring the Macroeconomic Determinants of Systematic Risk," *American Economic Review*, 95, 398-404, 2005. With T. Andersen, T. Bollerslev and J. Wu.
- [69] "Modeling Bond Yields in Finance and Macroeconomics," *American Economic Review*, 95, 415-420, 2005. With M. Piazzesi and G. Rudebusch.
- [68] "The Nobel Memorial Prize for Robert F. Engle," *Scandinavian Journal of Economics*, 106, 165-185, 2004.
- [67] "Modeling and Forecasting Realized Volatility," *Econometrica*, 71, 579-626, 2003. With T. Andersen, T. Bollerslev and P. Labys.
- [66] "Micro Effects of Macro Announcements: Real-Time Price Discovery in Foreign Exchange," *American Economic Review*, 93, 38-62, 2003. With T.G. Andersen, T. Bollerslev and C. Vega.
- [65] "The ET Interview: Professor Robert F. Engle," *Econometric Theory*, 19, 1159-1193, 2003.
- [64] "'Big Data' Dynamic Factor Models for Macroeconomic Measurement and Forecasting," in M. Dewatripont, L.P. Hansen and S. Turnovsky (eds.), *Advances in Economics and Econometrics: Theory and Applications*, Eighth World Congress of the Econometric Society. Cambridge University Press, 2003, 115-122.
- [63] "Range-Based Estimation of Stochastic Volatility Models," *Journal of Finance*, 57, 1047-1092, 2002 (lead article). With S. Alizadeh and M.W. Brandt.

- [62] "Ratings Migration and the Business Cycle, with Application to Credit Portfolio Stress Testing," *Journal of Banking and Finance*, 26, 445-474, 2002. With A. Bangia, A. Kronimus, C. Schagen and T. Schuermann.
- [61] "Measuring Predictability: Theory and Macroeconomic Applications," *Journal of Applied Econometrics*, 16, 657-669, 2001. With L. Kilian.
- [60] "Long Memory and Regime Switching," *Journal of Econometrics*, 105, 131-159, 2001. With A. Inoue.
- [59] "The Distribution of Realized Stock Return Volatility," *Journal of Financial Economics*, 61, 43-76, 2001. With T. Andersen, T. Bollerslev and H. Ebers.
- [58] "The Distribution of Realized Exchange Rate Volatility," *Journal of the American Statistical Association*, 96, 42-55, 2001. With T. Andersen, T. Bollerslev and P. Labys.
- [57] "Exchange Rate Returns Standardized by Realized Volatility are (Nearly) Gaussian," *Multinational Finance Journal*, 4, 159-179, 2000. With T. Andersen, T. Bollerslev and P. Labys.
- [56] "Unit Root Tests are Useful for Selecting Forecasting Models," *Journal of Business and Economic Statistics*, 18, 265-273, 2000. With L. Kilian.
- [55] "Great Realizations," *Risk*, 13, 105-108, March 2000. With T. Andersen, T. Bollerslev and P. Labys. (Abridged version of "Understanding, Optimizing, Using and Forecasting Realized Volatility and Correlation," Working Paper FIN-99-061, Department of Finance, Stern School of Business, New York University.)
- [54] "How Relevant is Volatility Forecasting for Financial Risk Management?," *Review of Economics and Statistics*, 82, 12-23, 2000. With P. Christoffersen.
- [53] "Exact Maximum Likelihood Estimation of Observation-Driven Econometric Models," in R.S. Mariano, M. Weeks and T. Schuermann (eds.), *Simulation-Based Inference in Econometrics: Methods and Applications*, 2000, 205-217. Cambridge University Press. With T. Schuermann.
- [52] "Multivariate Density Forecast Evaluation and Calibration in Financial Risk Management: High-Frequency Returns on Foreign Exchange," *Review of Economics and Statistics*, 81, 661-673, 1999. With J. Hahn and A. Tay.
- [51] "Evaluating Density Forecasts of Inflation: The Survey of Professional Forecasters," in R. Engle and H. White (eds.), *Cointegration, Causality and Forecasting: A Festschrift in Honor of Clive W.J. Granger*, 76-90, 1999. Oxford University Press. With A. Tay and K. Wallis.
- [50] "Dynamic Equilibrium Economies: A Framework for Comparing Models and Data," *Review of Economic Studies*, 65, 433-452, 1998. With L. Ohanian and J. Berkowitz.
- [49] "Pitfalls and Opportunities in the Use of Extreme Value Theory in Risk Management," in A.-P. N. Refenes, A.N. Burgess and J.D. Moody (eds.), *Decision Technologies for Computational Finance*, 3-12. Amsterdam: Kluwer Academic Publishers, 1998. With T. Schuermann and J. Stroughair.
- [48] "Evaluating Density Forecasts, With Applications to Financial Risk Management," *International Economic Review*, 39, 863-883, 1998. With T. Gunther and A. Tay.
- [47] "Cointegration and Long-Horizon Forecasting," *Journal of Business and Economic Statistics*, 16, 450-458, 1998. With P. Christoffersen.
- [46] "The Past, Present and Future of Macroeconomic Forecasting," *Journal of Economic Perspectives*, 12, 175-192, 1998.
- [45] "Bootstrapping Multivariate Spectra," *Review of Economics and Statistics*, 80, 664-666, 1998. With J. Berkowitz.
- [44] "Scale Models," *Risk*, 11, 104-107, 1998. With T. Schuermann, A. Hickman and A. Inoue. (Revised and abridged version of "Converting 1-Day Volatility to h-Day Volatility: Scaling by \sqrt{h} is Worse than You Think," Wharton Financial Institutions Center, Working Paper 97-34.)

- [43] "Horizon Problems and Extreme Events in Financial Risk Management," *Economic Policy Review*, Federal Reserve Bank of New York, October 1998, 109-118. With P. Christoffersen and T. Schuermann.
- [42] "Why are Estimates of Agricultural Supply Response so Variable?," *Journal of Econometrics*, 76, 357-373, 1997. With R. Lamb.
- [41] "Optimal Prediction Under Asymmetric Loss," *Econometric Theory*, 13, 808-817, 1997. With P. Christoffersen.
- [40] "Job Stability in the United States," *Journal of Labor Economics*, 15, 206-233, 1997. With D. Neumark and D. Polsky.
- [39] "Bounded Rationality and Strategic Complementarity in a Macroeconomic Model: Policy Effects, Persistence and Multipliers," *Economic Journal*, 107, 1358-1375, 1997. With A. Bomfim.
- [38] "Forecast Evaluation and Combination," in G.S. Maddala and C.R. Rao (eds.), *Handbook of Statistics*, 241-268, 1996. Amsterdam: North-Holland. With J. Lopez.
- [37] "Measuring Business Cycles: A Modern Perspective," *Review of Economics and Statistics*, 78, 67-77, 1996. With G.D. Rudebusch.
- [36] "Fractional Integration and Interval Prediction," *Economics Letters*, 50, 305-313, 1996. With P. Lindner.
- [35] "Testing Structural Stability With Endogenous Break Point: A Size Comparison of Analytic and Bootstrap Procedures," *Journal of Econometrics*, 70, 221-241, 1996. With C. Chen.
- [34] "The Uncertain Unit Root in Real GNP: Comment," *American Economic Review*, 86, 1291-1298, 1996. With A. Senhadji.
- [33] "Further Results on Forecasting and Model Selection Under Asymmetric Loss," *Journal of Applied Econometrics*, 11, 561-572, 1996. With P. Christoffersen.
- [32] "Comparing Predictive Accuracy," *Journal of Business and Economic Statistics*, 13, 253-265, 1995. With R.S. Mariano. (Implemented in MATLAB, EViews, Stata)
- [31] "Modeling Volatility Dynamics," in K. Hoover (ed.), *Macroeconometrics: Developments, Tensions and Prospects*, 427-472, Springer. With J. Lopez.
- [30] "Regime Switching with Time-Varying Transition Probabilities," in C. Hargreaves (ed.), *Nonstationary Time Series Analysis and Cointegration*. (*Advanced Texts in Econometrics*, C.W.J. Granger and G. Mizon, eds.), 283-302, 1994. Oxford University Press. With J.-H. Lee and G. Weinbach.
- [29] "Maximum Likelihood Estimation of Fractionally Integrated Noise with Unknown Mean," *Journal of Econometrics*, 62, 301-316, 1994. With Y.-W. Cheung.
- [28] "Cointegration and Exchange Rate Dynamics," *Journal of Finance*, 49, 727-735, 1994. With J. Gardeazabal and K. Yilmaz.
- [27] "Further Evidence on Business Cycle Duration Dependence" (with discussion), in J.H. Stock and M.W. Watson (eds.), *Business Cycles, Indicators and Forecasting*, 255-284, 1993. University of Chicago Press for NBER. With G.D. Rudebusch and D.E. Sichel.
- [26] "Are Long Expansions Followed by Short Contractions?," *Business Review*, Federal Reserve Bank of Philadelphia, July-August, 3-11, 1993.
- [25] "Have Postwar Economic Fluctuations Been Stabilized?," *American Economic Review*, 82, 993-1005, 1992. With G. Rudebusch.
- [24] "Real Exchange Rates Under the Gold Standard," *Journal of Political Economy*, 99, 1252-1271, 1991. With S. Husted and M. Rush.
- [23] "Forecasting Output with the Composite Leading Index: A Real-Time Analysis," *Journal of the American Statistical Association*, 86, 603-610, 1991. With G. Rudebusch.

- [22] "Turning point Prediction with the Composite Leading Index: An Ex Ante Analysis," in *Leading Economic Indicators: New Approaches and Forecasting Records* (Kajal Lahiri and Geoffrey H. Moore, eds.), 231-256, 1991. Cambridge: Cambridge University Press. With G. Rudebusch.
- [21] "A Note on Bayesian Forecast Combination Procedures," in P.Hackl and A. Westlund (eds.), *Economic Structural Change*, 225-232, 1991.
- [20] "On the Power of Dickey-Fuller Tests Against Fractional Alternatives," *Economics Letters*, 35, 155-160, 1991. With G. Rudebusch.
- [19] "Is Consumption too Smooth? Long Memory and the Deaton Paradox," *Review of Economics and Statistics*, 73, 1-9, 1991 (lead article). With G. Rudebusch.
- [18] "The Use of Prior Information in Forecast Combination," *International Journal of Forecasting*, 6, 503-508, 1990. With P. Pauly.
- [17] "Nonparametric Exchange Rate Prediction?," *Journal of International Economics*, 28, 315-332, 1990. With J. Nason.
- [16] "A Nonparametric Investigation of Duration Dependence in the American Business Cycle," *Journal of Political Economy*, 98, 596-616, 1990. With G. Rudebusch.
- [15] "Post-Deregulation Bank-Deposit-Rate Pricing: The Multivariate Dynamics," *Journal of Business and Economic Statistics*, 8, 281-291, 1990. With S. Sharpe.
- [14] "Forecast Combination and Encompassing: Reconciling two Divergent Literatures," *International Journal of Forecasting*, 5, 589-592, 1989.
- [13] "Long Memory and Persistence in Aggregate Output," *Journal of Monetary Economics*, 24, 189-209, 1989. With G. Rudebusch.
- [12] "Scoring the Leading Indicators," *Journal of Business*, 62, 369-392, 1989. With G. Rudebusch.
- [11] "The Dynamics of Exchange Rate Volatility: A Multivariate Latent-Factor ARCH Model," *Journal of Applied Econometrics*, 4, 1-22, 1989. With M. Nerlove.
- [10] "Random Walks vs. Fractional Integration: Power Comparisons of Scalar and Joint Tests of the Variance-Time Function," in Baldev Raj (ed.), *Advances in Econometrics and Modeling*, 29-45, 1989. *Advanced Studies in Theoretical and Applied Econometrics*, Volume 15. Boston: Kluwer Academic Publishers.
- [9] "Endogenous Risk in a Portfolio-Balance Rational-Expectations Model of the Deutschmark-Dollar Rate," *European Economic Review*, 32, 27-53, 1988. With P. Pauly.
- [8] "Has the EMS Reduced Member-Country Exchange Rate Volatility?," *Empirical Economics*, 13, 81-102, 1988. With P. Pauly.
- [7] "Testing for Bubbles, Reflecting Barriers and Other Anomalies," *Journal of Economic Dynamics and Control*, 12, 63-70, 1988.
- [6] "Serial Correlation and the Combination of Forecasts," *Journal of Business and Economic Statistics*, 6, 105-112, 1988.
- [5] "Structural Change and the Combination of Forecasts," *Journal of Forecasting*, 6, 21-40, 1987. With P. Pauly.
- [4] "Testing for Serial Correlation in the Presence of ARCH," *Proceedings of the American Statistical Association, Business and Economic Statistics Section*, 1986, 323-328. Washington, DC: American Statistical Association, 1987.
- [3] "Modeling the Persistence of Conditional Variances: A Comment," *Econometric Reviews*, 5, 51-56, 1986.

- [2] "The Exact Initial Covariance Matrix of the State Vector of a General MA(q) Process," *Economics Letters*, 22, 27-31, 1986.
- [1] "Exact Maximum-Likelihood Estimation of Autoregressive Models via the Kalman Filter," *Economics Letters*, 22, 197-201, 1986.

Ph.D. Dissertation Supervision (Main Advisor)

- [39] Paul Sangrey (in progress) (Other committee members Frank Schorfheide (Co-Main Advisor), Amir Yaron, Xu Cheng.)
- [38] Ross Askanasi (2017), "Applied Dynamic Factor Modeling in Finance". (Went to Cornerstone Research. Other committee members Xu Cheng, Frank DiTraglia.)
- [37] Jacob Warren (2017), "Essays in Nonlinear Econometrics". (Went to Stevens Capital Management. Other committee members Frank Schorfheide (Co-Main Advisor), Xu Cheng.)
- [36] Laura Liu (2017), "Point and Density Forecasts in Panel Data Models." (Went to Federal Reserve Board. Other committee members Frank Schorfheide (Co-Main Advisor), Xu Cheng.)
- [35] Minchul Shin (2015), "Bayesian GMM." (Went to University of Illinois. Other committee members Frank Schorfheide (Co-Main Advisor), Xu Cheng, Frank DiTraglia.)
- [34] Lorenzo Braccini (2015), "Essays in Dynamic Duration and Count Modeling." (Went to Bank of Italy. Other committee members Xu Cheng, Frank Schorfheide.)
- [33] Dongho Song (2014), "Essays on Risk Measurement and Modeling in Macroeconomics and Finance." (Went to Boston College. Other committee members Frank Schorfheide (Co-Main Advisor), Ivan Shaliastovich, Amir Yaron.)
- [32] Fei Chen (2011), "Multifractal Duration Modeling." (Went to Huazhong University of Science and Technology (HUST), China. Other committee members Frank Schorfheide, Kevin Song.)
- [31] Leonardo Melosi (2010), "Essays on the Macroeconomics of Incomplete Information." (Went to London Business School. Other committee members Frank Schorfheide (Co-Main Advisor), Jesus Fernandez-Villaverde, Dirk Krueger.)
- [30] Jian Hua (2010), "Essays in Financial Econometrics." (Went to Baruch College, City University of New York. Other committee members Aureo De Paula, David Musto.)
- [29] Georg Strasser (2008), "Essays in Applied Econometrics." (Went to Boston College. Other committee members Urban Jerman, Karen Lewis, Frank Schorfheide.)
- [28] Vivian Yue (2005), "Essays on Sovereign Default and Emerging Countries." (Went to New York University. Other committee members Urban Jerman, Dirk Krueger, Martin Uribe.)
- [27] Chiara Scotti (2005), "A Multivariate Bayesian Analysis of Policy Rates: Fed and ECB Timing and Level Decisions." (Went to Federal Reserve Board. Other committee members Jesus Fernandez-Villaverde, Frank Schorfheide.)
- [26] Jin (Ginger) Wu (2005), "Essays on Financial Economics and Econometrics." (Went to University of Georgia. Other committee members Gregory Kordas, Craig MacKinlay, Frank Schorfheide, Yihong Xia.)
- [25] Yansong (Bill) Lu (2005), "Modeling and Forecasting Daily Stock Return Volatility with Intra-day Price Fluctuation Information." (Went to Lehman Brothers. Other committee members Yuichi Kitamura, Frank Schorfheide.)
- [24] Lei Ji (2005), "Essays in Financial Economics and Econometrics." (Went to Lehman Brothers. Other committee members Gregory Kordas, Frank Schorfheide, Yihong Xia.)

- [23] Aruoba, Boragan (2004), "Data Uncertainty: Empirical Evidence, General Equilibrium Implications and Hedging Strategies." (Went to University of Maryland. Other committee members Jesus Fernandez-Villaverde, Dirk Krueger, Frank Schorfheide.)
- [22] Campbell, Sean (2002), "Regime Switching in Economics." (Went to Brown University. Other committee members Yuichi Kitamura, Roberto Mariano and Frank Schorfheide. Winner of the Hayes prize, awarded biennially for the best graduate student research contribution in a two-year interval.)
- [21] Vega, Clara (2002), "Public Information, Private Information and Microstructure Theory." (Went to University of Rochester. Other committee members Simone Gervais, Frank Schorfheide.)
- [20] Li, Canlin (2002), "Essays in Financial Economics and Econometrics." (Went to University of California, Riverside. Other committee members Michael Brandt, Frank Schorfheide.)
- [19] Labys, Paul (2001), "Essays on Microstructure and the Use of Information in Limit Order Markets." (Went to Charles River Associates. Other committee members Ken Kavajecz, Patrik Sandas, Frank Schorfheide.)
- [18] Cheng, Yingmei (2001), "Essays in Financial Economics and Applied Econometrics." (Went to Florida State University. Other committee members Gary Gorton, Craig MacKinlay, Petra Todd.)
- [17] Alizadeh, Sassan (1998), "Essays in Financial Econometrics." (Went to Bear Sterns. Other committee members Michael Brandt, Sanford Grossman.)
- [16] Inoue, Atsushi (1998), "Three Essays in Time Series Econometrics." (Went to North Carolina State University. Other committee members Valentina Corradi, Jinyong Hahn. Winner of Carey Prize for best dissertation.)
- [15] Altissimo, Filippo (1997), "Essays in Macroeconometrics." (Went to Bank of Italy. Other committee members Albert Ando, Valentina Corradi.)
- [14] Shapiro, Natalie (1997), "Civil and Political Liberties Over Space and Time: A Markov Model of Transition Dynamics." (Went to Massachusetts Financial Services. Other committee members Valentina Corradi, Roberto Mariano.)
- [13] Tay, Anthony (1997), "Density Forecast Evaluation: Theory and Applications." (Went to National University of Singapore. Other committee members Valentina Corradi, Jinyong Hahn.)
- [12] Kilian, Lutz (1996), "Small Sample Confidence Intervals for Impulse Response Estimates." (Went to University of Michigan. Other committee members Lee Ohanian, Robert Stine.)
- [11] Berkowitz, Jeremy (1996), "Estimating and Evaluating Economic Models Via Spectral Analysis." (Went to Board of Governors of the Federal Reserve System. Other committee members Valentina Corradi, Lee Ohanian.)
- [10] Christoffersen, Peter (1996), "Essays on Forecasting in Economics." (Went to McGill University. Other committee members Albert Ando, Roberto Mariano.)
- [9] Giorgianni, Lorenzo (1996), "On Expectations and Risk Premia in Foreign Exchange Markets: Evidence from Survey Data." (Went to International Monetary Fund. Other committee members Albert Ando, Richard Marston.)
- [8] Binder, Michael (1995), "Essays in Empirical Macroeconomics." (Went to University of Maryland. Other committee members Lee Ohanian, Victor Rios-Rull.)
- [7] Chauvet, Marcelle (1995), "An Econometric Characterization of Business Cycle Dynamics with Factor Structure and Regime Switching." (Went to University of California, Riverside. Other Committee members Roberto Mariano, Lee Ohanian.)
- [6] Lopez, Jose (1995), "Evaluating Forecasts of Exchange Rate Volatility." (Went to Federal Reserve Bank of New York. Other committee members Roberto Mariano, Lee Ohanian.)

- [5] Senhadji, Abdelhak (1994), "Adjustment of a Small Open Economy to External Shocks." (Went to Washington University in St. Louis. Other committee members Jere Berhman, Wilfred Ethier, Lee Ohanian.)
- [4] Mor, Nachiket (1994), "Essays on Nonlinearity in Exchange Rates." (Went to Corporation of India Limited (ICICI). Other committee members Sanford Grossman, Karen Lewis.)
- [3] Weinbach, Gretchen (1993), "Regime Switching with Time-Varying Transition Probabilities: Methodological Issues and Application to Exchange Rates." (Went to Federal Reserve Board. Other committee members Alan Auerbach, Fumio Hayashi.)
- [2] Chen, Celia (1993), "Tests for Structural Change With Endogenous Break Point and Their Finite Sample Properties." (Went to Regional Financial Associates, Philadelphia, now MoodysEconomy.com. Other committee members Fumio Hayashi, Roberto Mariano.)
- [1] Lindner, Peter (1991), "Interest Rates, Inflation and Risk: An Empirical Investigation." (Went to Lehman Brothers. Other committee members Roberto Mariano, Robert Stambaugh.)

Ph.D. Dissertation Supervision (Committee Member)

- [35] Katja Gisler (2016, University of St. Gallen Ph.D.), "Essays on the Economic Relevace of Volatility Spillovers." (Other committee members Matthias Fengler (St. Gallen), Francesco Audrino (St. Gallen), Daniel Buncic (St. Gallen).)
- [34] Molin Zhong (2015), "Essays on Bayesian Macroeconometrics." (Went to Federal Reserve Board. Other committee members Jesus Fernandez-Villaverde, Frank Schorfheide.)
- [33] Mark Bognanni (2013), "Essays in Empirical Macroeconomics." (Went to Federal Reserve Bank of Cleveland. Other committee members Frank Schorfheide, Jesus Fernandez-Villaverde.)
- [32] Han Chen (2013) "Essays on Unconventional Monetary Policy." (Went to Federal Reserve Board. Other committee members Frank Schorfheide, Harold Cole.)
- [31] Dalibor Stevonovic (2011, University of Montreal Ph.D.), "Factor Models, VARMA Processes and Parameter Instability with Applications in Macroeconomics." (Went to European University Institute and University of Quebec. Other committee members Jean-Marie Dufour (McGill), Jean Boivin (Bank of Canada), Benoît Perron (Montreal), Francisco Ruge-Murcia (Montreal).)
- [30] Edward Herbst (2011), "Essays on Bayesian Macroeconometrics." (Went to Federal Reserve Board. Other committee members Frank Schorfheide, Jesus Fernandez-Villaverde.)
- [29] Asyl Bakinova (2011, University of Lugano Ph.D.), "Futures Volatility in the Crude Oil Market." (Other committee members Giovanni Barone-Adessi (Lugano) and Patrick Gagliardini (Lugano).)
- [28] Edith Liu (2010), "On International Finance and Risk Sharing." (Went to Cornell University. Other committee members Karen Lewis and Craig MacKinlay.)
- [27] Christina Fuentes-Albero (2010), "Essays on Financial Frictions, Propagation of Shocks and Macroeconomic Volatility." (Went to Rutgers University. Other committee members Frank Schorfheide, Jesus Fernandez-Villaverde and Urban Jermann.)
- [26] Max Kryshko (2010), "Essays in Estimation of Dynamic Stochastic General Equilibrium Models." (Went to IMF. Other committee members Frank Schorfheide and Jesus Fernandez-Villaverde.)
- [25] Taeyoung Doh (2007), "Three essays on the estimation of dynamic macroeconomic models." (Went to Federal Reserve Bank of Kansas City. Other committee members F. Schorfheide, A. Yaron.)
- [24] Sungbae An (2006), "Essays on Bayesian Estimation of Dynamic Economies." (Went to Singapore Management University. Other committee members Frank Schorfheide, Jesus Fernandez-Villaverde.)

- [23] Jones, Christopher (1999), "Bayesian Investigation of Continuous Time Finance Models." (Went to University of Rochester. Other committee members Craig MacKinlay, Krishna Ramaswamy, Robert Stambaugh.)
- [22] Zhang, Jing (1998), "Model Selection and Some Extensions of Markov Switching Models." (Went to Moody's KMV.)
- [21] Gong, Faxiong (1995), "Essays on Several Contemporary Issues in Econometrics and Financial Economics." (Went to Federal Reserve Bank of New York. Other committee members Roberto Mariano and Joseph Gyourko.)
- [20] Hodges, Scott (1994), "Business Cycles in Historical Perspective." (Other committee members Daniel Raff and Christopher Hanes.)
- [19] Schuermann, Til (1993), "Simulation-Based Econometrics." (Went to Bell Labs. Other committee members Marc Nerlove, Roberto Mariano.)
- [18] Fornari, Ilaria (1993), "Quasi-Rational and Fully-Rational Expectations: An Application to Modeling U.S. Beef Cattle Supply." (Went to JP Morgan. Other committee members Roberto Mariano and Marc Nerlove.)
- [17] Ansotegui, Carmen (1993), "Stock Market and Real Activity Cointegration Analysis: Application to U.S. and Japan Markets." (Went to E.S.A.D.E. Business School, Barcelona, Spain. Other committee members Roberto Mariano and Craig MacKinlay.)
- [16] Bomfim, Antulio (1992, University of Maryland), "Strategic Complementarities and Business Cycles: Essays in Dynamic Macroeconomics." (Went to Federal Reserve Board. Other committee members John Haltiwanger, Allan Drazen, Martin Bailey, Martin Loeb, Michael Haliassos.)
- [15] Golub, John (1992), "The Equity Premium: Sensitivity to Consumption Misspecification and a Non-Expected Utility Resolution." (Went to Federal Reserve Bank of Kansas City. Other committee members Andrew Abel, Franklin Allen, Richard Kihlstrom.)
- [14] Bradley, Ralph (1992), "A Nonparametric Investigation Into the Health Care Crisis." (Went to Bureau of Labor Statistics. Other committee members Roberto Mariano and Peter Pauly.)
- [13] Tanizaki, Hisashi (1991), "Nonlinear Filters: Estimation and Applications." (Went to Kobe University, Japan. Other committee members Roberto Mariano and Marc Nerlove.)
- [12] Lee, Joon-Haeng (1991), "Nonstationary Markov-Switching Models of Exchange Rates." (Went to Korean Securities Research Institute, Seoul, Korea. Other committee members Roberto Mariano and Sandy Grossman.)
- [11] Gardeazabal, Javier (1991), "The Monetary Model of Exchange Rate Determination in the Light of Cointegration." (Went to University of the Basque Country, Spain, Department of Economics. Other committee members Roberto Mariano and Marc Nerlove.)
- [10] Regulez, Marta (1991), "Prediction With Cointegrated Systems: Theory and Applications." (Went to University of the Basque Country, Spain, Department of Economics. Other committee members Marc Nerlove and Roberto Mariano.)
- [9] Shen, Qi (1991), "Essays on Transaction Costs and their Impact on Financial Decisions." (Went to University of Michigan, Graduate School of Business.)
- [8] Lee, Jai-Seong (1990), "Transition of Economic Regime and Shift in Production Function: Estimation and Testing of Alternative Production Function Models on Nine Subsectors of Korean Industries, 1971-1987."
- [7] Willson, Douglas (1990, "Essays in Macroeconometrics and Financial Econometrics." (Went to Concordia University. Other committee members Roberto Mariano and Marc Nerlove.)

- [6] Belessakos, Elias D. (1990), "Exchange Rate Target Zones and the European Monetary System." (Went to Baruch College, City University of New York.)
- [5] Boldin, Michael (1990), "Business Cycles and Stock Market Volatility: Theory and Evidence of Animal Spirits." (Went to Federal Reserve Bank of New York. Other committee members F. Gerard Adams and Costas Azariadis.)
- [4] Cheung, Yin-Wong (1990), "Long Memory in Foreign Exchange Rates and Sampling Properties of Some Statistical Procedures Related to Long Memory Series." (Went to University of California, Santa Cruz. Other committee members Roberto Mariano and Marc Nerlove.)
- [3] Arvin-Rad, Hassan (1990), "Two Essays in Econometric Theory." (Went to Florida State University. Other committee members Roberto Mariano and Peter Pauly.)
- [2] Feyzioglu, Tarhan (1989), "Analysis of Nonlinear, Nonnormal Economic Time Series and Applications." (Went to Georgetown University. Other committee members Roberto Mariano and Marc Nerlove.)
- [1] Hassett, Kevin (1989), "Essays in Applied Econometrics." (Went to Columbia University. Other committee members Albert Ando and Alan Auerbach.)

Post-Doc and Visiting Scholar Supervision

- [13] Umut Akovali (2017-2018) (From Koc University, Istanbul.)
- [12] Daniel Borup (2017) (From Aarhus University.)
- [11] Sergey Nasekin (2016) (From Humboldt University, Berlin.)
- [10] Maria Grith (2015-2016) (From Humboldt University, Berlin.)
- [9] Ronald Indergand (2015-2016) (From University of Bern.)
- [8] Katja Gisler (2015-2016) (From University of St. Gallen.)
- [7] Chu Kin (Roy) Chan (2014-2015) (From City University of Hong Kong.)
- [6] Diego Eduardo Fresoli (2012) (From Universidad Carlos III de Madrid.)
- [5] Dalibor Stevonovic (2011) (From University of Montreal.)
- [4] Asyl Bakanova (2011) (From University of Lugano.)
- [3] Bernd Schlusche (2008) (From University of Bonn.)
- [2] Emanuel Moench (2007) (From Humboldt University Berlin.)
- [1] Peter Lildolt (2001) (From Aarhus University.)

Selected Service

Blog: *No Hesitations*, <http://fxdiebold.blogspot.com/>, 2013-present

Business Conditions Indicators Advisory Panel, The Conference Board, 2003-present

Chairman, Model Validation Council, U.S. Federal Reserve System, 2012-2013

Founding member, Oliver Wyman Institute, 1996-2012

Selected Grants Received

National Science Foundation (seven multi-year grants since 1990), Sloan Foundation, Guggenheim Foundation, Pew Foundation