Serhiy Kozak

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ACADEMIC APPOINTMENTS

University of Maryland, Robert H. Smith School of Business   2024 – present
Associate Professor of Finance

University of Maryland, Robert H. Smith School of Business   2019 – 2024
Assistant Professor of Finance

University of Michigan, Ross School of Business   2013 – 2019
Assistant Professor of Finance

EDUCATION

University of Chicago, Booth School of Business and Dept. of Economics   2008 – 2013
Ph.D. in Financial Economics, M.B.A.

CERGE-EI, Charles University, Prague, Czech Republic   2006 – 2008
M.A. in Economics

Lviv University, Ukraine   2000 – 2005
B.Sc., M.Sc. in Applied Mathematics and Computer Science

RESEARCH INTERESTS

Empirical and theoretical asset pricing, machine learning.

PUBLICATIONS

Interpreting Factor Models (with Stefan Nagel and Shrihari Santosh)
Journal of Finance, June 2018, 73(3), 1183-1223.

We argue that tests of reduced-form factor models and horse races between "characteristics" and "covariances" cannot discriminate between alternative models of investor beliefs. Since asset returns have substantial commonality, absence of near-arbitrage opportunities implies that the SDF can be represented as a function of a few dominant sources of return variation. As long as some arbitrageurs are present, this conclusion applies even in an economy in which all cross-sectional variation in expected returns is caused by sentiment. Sentiment-investor demand results in substantial mispricing only if arbitrageurs are exposed to factor risk when taking the other side of these trades.

Shrinking the Cross Section (with Stefan Nagel and Shrihari Santosh)
Journal of Financial Economics, February 2020, 135(2), 271-292, **Lead Article**.
Fama-DFA Prize for the Best Paper Published in the Journal of Financial Economics in the Areas of Capital Markets and Asset Pricing, 2020.

We construct a robust stochastic discount factor (SDF) summarizing the joint explanatory power of a large number of cross-sectional stock return predictors. Our method achieves robust out-of-sample performance in this high-dimensional setting by imposing an economically motivated prior on SDF coefficients that shrinks contributions of low-variance principal components of the candidate characteristics-based factors. We find that characteristics-sparse SDFs formed from a few such factors—e.g., the four- or five-factor models in the recent literature—cannot adequately summarize the cross-section of expected stock returns. However, an SDF formed from a small number of principal components performs well.

Factor Timing (with Valentin Haddad and Shrihari Santosh)

Review of Financial Studies, May 2020, 33(5), 1980-2018.

2018 Q-Group Jack Treynor Prize

The optimal factor timing portfolio is equivalent to the stochastic discount factor. We propose and implement a method to characterize both empirically. Our approach imposes restrictions on the dynamics of expected returns, leading to an economically plausible SDF. Market-neutral equity factors are strongly and robustly predictable. Exploiting this predictability leads to substantial improvement in portfolio performance relative to static factor investing. The variance of the corresponding SDF is larger, is more variable over time, and exhibits different cyclical behavior than estimates ignoring this fact. These results pose new challenges for theories that aim to match the cross-section of stock returns.

Why Do Discount Rates Vary? (with Shrihari Santosh)

Journal of Financial Economics, September 2020, 137(3), 740-751.

The price of discount rate risk reveals whether increases in equity risk premia represent good or bad news to rational investors. Employing a new empirical methodology, we find that the price is negative, which suggests that discount rates are high during times of high marginal utility of wealth. Our approach relies on using future realized market returns to consistently estimate covariances of asset returns with the market risk premium. Covariances drive observed patterns in a broad cross section of stock and bond expected returns.

Dynamics of Bond and Stock Returns

Journal of Monetary Economics, March 2022, 126, 188-209.

A production-based equilibrium model jointly prices bond and stock returns and produces time-varying correlation between stock and real treasury returns that changes in both magnitude and sign. The term premium is time-varying and changes sign. The model incorporates time-varying risk aversion and two physical technologies with different cash-flow risks. Bonds hedge risk-aversion shocks and command negative term premium through this channel. Cash-flow shocks produce co-movement of bond and stock returns and positive term premium. Relative strength of these two mechanisms varies over time. The correlation is a powerful predictor of relative bond-stock and long-short equity returns in the data.

Equity Term Structures without Dividend Strips Data (with Stefano Giglio and Bryan Kelly)

Journal of Finance, December 2024, 79(6), 4143-4196.

We use a large cross-section of equity returns to estimate a rich affine model of equity prices, dividends, returns and their dynamics. Our model prices dividend strips of the market and equity portfolios without using strips data in the estimation. Yet, model-implied equity yields closely match yields on traded strips. Our model extends equity term-structure data over time (to the 1970s) and across maturities, and generates term structures for various equity portfolios. The novel cross-section of term structures from our model covers 45 years and includes several recessions, providing a novel set of empirical moments to discipline asset pricing models.

WORKING PAPERS

When do Cross-Sectional Asset Pricing Factors Span the Stochastic Discount Factor? (with Stefan Nagel)

When expected returns are linear in asset characteristics, the stochastic discount factor (SDF) that prices individual stocks can be represented as a factor model with GLS cross-sectional regression slope factors. Factors constructed heuristically by aggregating individual stocks into characteristics-based factor portfolios using sorting, characteristics-weighting, or OLS cross-sectional regression slopes do not span this SDF unless the covariance matrix of stock returns has a specific structure. These conditions are more likely satisfied when researchers use large numbers of characteristics simultaneously. Methods to hedge unpriced components of heuristic factor returns allow partial relaxation of these conditions. We also show the conditions that must hold for dimension reduction to a number of factors smaller than the number of characteristics to be possible without having to invert a large covariance matrix. Under these conditions, instrumented and projected principal components analysis methods can be implemented as simple PCA on characteristics-based portfolios.

Kernel Trick for the Cross Section

Characteristics-based asset pricing implicitly assumes that factor betas or risk prices are linear functions of pre-specified characteristics. Present-value identities, such as Campbell-Shiller or clean-surplus accounting, however, clearly predict that expected returns are highly non-linear functions of all characteristics. While basic non-linearities can be easily accommodated by adding non-linear functions to the set of characteristics, the problem quickly becomes infeasible once interactions of characteristics are considered. I propose a method which uses economically-driven regularization to construct a stochastic discount factor (SDF) when the set of characteristics is extended to an arbitrary—potentially infinitely-dimensional—set of non-linear functions of original characteristics. The method borrows ideas from a machine learning technique known as the "kernel trick" to circumvent the curse of dimensionality. I find that allowing for interactions and non-linearities of characteristics leads to substantially more efficient SDFs; out-of-sample Sharpe ratios for the implied MVE portfolio double.

Multiple Imputation of Missing Financial Information: A Bayesian Tensor Approach (with Jiantao Huang)

> We develop a Bayesian tensor model to impute missing or infrequently observed financial or economic data. The main conceptual building blocks are: (i) multiple imputation – we estimate a probability distribution over missing data to aid with inference, (ii) joint modeling of historical and cross-sectional dependencies, and (iii) low-dimensional tensor representation to help reduce the number of parameter estimates and model's robustness. We impute missing firm characteristics in Global Compustat data in the US and other countries. We document that firms with missing or "unusual" characteristic values exhibit abnormal expected returns. Overall, recovering missing and upsampling infrequently observed financial information enhances our understanding of the risk-return tradeoff.

Access to Credit and Stock Market Participation (with Denis Sosyura)

> We exploit staggered removals of interstate banking restrictions to identify the causal effect of access to credit on households' stock market participation and asset allocation. Using micro data on retail brokerage accounts and proprietary data on personal credit histories, we document two effects of the loosening of credit constraints on households' financial decisions. First, households enter the stock market by opening new brokerage accounts. Second, households increase their asset allocation to risky assets and reduce their allocation to cash, consistent with a lower need for precautionary savings. The effects are stronger for younger and more credit constrained investors. Overall, we establish one of the first direct links between access to credit and households' investment decisions.

TEACHING

Machine Learning in Finance, Maryland MSF and MQF core	2019 – 2024
Financial Data Analytics, Maryland MSF and MQF core	2019 – 2024
Artificial Intelligence and Machine Learning for Business Leaders, Exec. Ed.	2021 – 2024
Empirical Asset Pricing, Michigan PhD	2018 – 2019
Capital Markets and Investment Strategy, Michigan BBA	2016 – 2019
Fixed Income Securities and Markets, Michigan MBA	2016 – 2018
Fixed Income Securities and Markets, Michigan BBA	2016 – 2018
Financial Management, Michigan BBA core	2013 – 2015

PROFESSIONAL SERVICE

Referee: Econometrica, Journal of Econometrics, Journal of Empirical Finance, Journal of Finance, Journal of Financial Econometrics, Journal of Financial and Quantitative Analysis, Journal of Financial Economics, Journal of Financial Markets, Journal of Monetary Economics, Journal of Political Economy, Management Science, Review of Finance, Review of Financial Studies.

Organizer: AI & Big Data in Finance Research Forum.

Dissertation committee: Koustav De (University of Kentucky, 2018), Zhen Yan (Cornerstone Research, 2019), Bingkuan Cao (University of Nebraska, 2022), Tianchen Zhao.

NON-ACADEMIC EXPERIENCE

Eleks, Lviv, Ukraine	2000 – 2006
Software Engineer	

PROGRAMMING LANGUAGES AND PLATFORMS

Python, C++, SQL, JAX, TensorFlow, CUDA, Julia, Matlab, SAS, React, Mathematica, R, GAMS, Stata.

AWARDS AND HONORS

2024: **University of Maryland** Allen J. Krowe Award for Teaching Excellence.

2020: **Fama-DFA Prize** for the Best Paper Published in the Journal of Financial Economics in the Areas of Capital Markets and Asset Pricing.

2018: **Q-Group Jack Treynor Prize** for the Best Paper on Investment Management and Financial Markets.

2012: **Stevanovich Center for Financial Mathematics at the University of Chicago** Fellowship in Quantitative Finance.

2009: **Center for Research in Security Prices** CRSP Summer Paper Award.

2008: **University of Chicago** Presidential Fellowship.

CONFERENCE AND SEMINAR PRESENTATIONS

2024: American Finance Association Meetings (discussion, session chair), Baruch College, BI-SHoF Conference, INSEAD.

2023: American Finance Association Meetings (presentation, session chair), Stanford University, NBER Big Data and Securities Markets (Spring; discussion) Tulane University, University of North Carolina at Chapel Hill, UCLA Backus Memorial Conference (presentation), AI & Big Data Research Forum (presentation), Johns Hopkins University, Red Rock Finance conference (discussion), GSU-RFS Fintech Conference (discussion), NBER Big Data and Securities Markets (Fall; discussion).

2022: City University of Hong Kong, Goethe University Frankfurt, Louisiana State University, Atlanta Fed, Swiss Finance Institute (Lugano).

2021: American Finance Association Meetings (2x discussions), ASU Sonoran Finance Conference (discussion), University of Massachusetts at Amherst, University of Gothenburg, Temple University, Stockholm Business School, Western Finance Association Meetings, Red Rock Finance Conference (discussion).

2020: American Finance Association Meetings (discussion, session chair), RCFS/RAPS Winter Conference (discussion), Duke/UNC Asset Pricing Conference, Tilburg University, SFS Finance Cavalcade (presentation, session chair), Western Finance Association Meetings (session chair), University of Hong Kong, Tsinghua University PBC School of Finance.

2019: ASSA Econometric Society Meetings, Emory University, University of California San Diego Rady, Chicago Booth Asset Pricing Conference.

2018: American Finance Association Meetings, ASU Sonoran Winter Finance Conference (discussion), UBC Winter Finance Conference, Financial Intermediation Research Society Conference, Western Finance Association Meetings, NBER Summer Institute Asset Pricing Meetings, Stanford Institute for Theoretical Economics (SITE) Asset Pricing Theory and Computation Workshop, Red Rock Finance Conference, New Methods for the Cross Section of Returns Conference, London School of Economics, University of Washington, Minnesota Finance Department Junior Conference, University of Maryland, NBER Asset Pricing Meetings (discussion), Tel Aviv University, IDC Herzliya.

2017: American Finance Association Meetings, NBER Asset Pricing Meetings, City University of Hong Kong, Hong Kong University of Science and Technology, Arizona State University, Dartmouth College, Stockholm School of Economics, Imperial College Business School Conference on Advances of Hedge Fund Strategies, Colorado Finance Summit.

2016: American Finance Association Meetings (presentation and discussion), Finance Down Under Conference, UCLA Anderson, SFS Finance Cavalcade (presentation and discussion), MoFiR Workshop on Banking.

2015: American Finance Association Meetings, NBER Summer Institute Asset Pricing Meetings, MIT Sloan, European Finance Association Meetings (presentation and discussion), TAU Finance Conference, Florida State University SunTrust Beach Conference (discussion), Finance Down Under Conference, Washington University Corporate Finance Conference, FDIC Banking Research Conference, Chicago Financial Institutions Conference, HKUST Corporate Finance Symposium.