NBER Proposal
Market Frictions and Financial Risks

Buybacks*

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May 22, 2024

Abstract

This is a proposal to investigate the extent to which buybacks can improve the liquidity of government securities markets and lower the net cost of funding fiscal needs. The work will include a theoretical model of intermediation of on-the-run and off-the-run securities, calibrated to empirical evidence on trading activity and transactions costs in the dealer-to-client (D2C) and off-the-run (OFR) segments of the US Treasury market. Although transaction costs in the dealer-to-client market are low, they increase over the life-span of a security. The proposed work will show how a program of buybacks can optimally account for the relative secondary-market intermediation costs of on-the-run and off-the-run securities, relative investor preference for on-the-run securities, and price-impact costs associated with reverse auctions of off-the-run securities and primary issuance auctions.

Keywords: Treasury market, transaction costs, liquidity
JEL codes: G01, G1, G12, G18, E58

*Although the principal investigator (PI) will collaborate with a team of other researchers, including researchers at the Federal Reserve Bank of New York (FRBNY), this NBER funding proposal is by the PI alone, and does not necessarily represent the views, or have the approval, of The Federal Reserve Bank of New York. Email: duffie@stanford.edu .

1 Introduction

A "buyback" is a secondary-market purchase of a security by its issuer. In the summer of 2024, the US Treasury Department will initiate a new program of buybacks of US Treasury securities. The proposed research will show the extent to which buybacks improve the liquidity of government securities markets and lower the net cost of funding fiscal shortfalls. The work will include an investigation the relative efficacy of alternative designs of a buyback program, including the optimal extent of buybacks as a fraction of original issuances.

The work will include a theoretical model of intermediation of on-the-run and off-the-run securities, calibrated to empirical evidence on trading activity and transactions costs in the on-the-run interdealer (D2D) and dealer-to-client (D2C) segments of the US Treasury market. Although transaction costs in the dealer-to-client market are currently low on normal trading days, they tend to increase over the life-span of a security. Buybacks can be designed to trade off the present value of secondary-market transactions costs against the costs of auctioning buybacks and new issuances. The work will show how the design of a buyback program influences the liquidity benefits of investors and costs to the government for funding its fiscal needs.

On May 8, 2024, Assistant Treasury Secretary Frost stated:[1]

> Treasury expects liquidity improvements resulting from buybacks to flow through three channels. First, dealers should feel more confident making markets in off-the-run securities, as they will have Treasury as a regular and predictable buyer. Second, Treasury buybacks are expected to be "liquidity events" around which additional trading activity is likely to take place. And third, dealers may use buyback operations to free up balance sheet allocated to less-liquid positions at a fair price.

In practice, Frost stated, the Treasury will aim to keep the residual tradable float of securities above some design thresholds:

> Treasury also recognizes that the total dollar amount trading in the market is important for liquidity. For this reason, we have applied an additional rule to our purchase limit calculation to ensure that the tradable float, in dollars, remains above $10 billion for nominal coupon securities and $5 billion for TIPS after any Treasury buyback operation is completed.

2 Related Literature

The literature on buybacks is sparse. The few papers that exist focus on the $67.5 billion debt buyback program that was conducted from March 2000 to April 2002. In that case, however, the decision to begin buying back Treasury debt stemmed from a steady narrowing of the federal budget deficit during the 1990s, leading to decline in Treasury financing needs.

[1] See https://home.treasury.gov/news/press-releases/jy2328. Additional details can be found in a recent presentation that Treasury made to TBAC that has been posted on the Treasury's quarterly refunding webpage.

Shrinking issue sizes began to threaten the liquidity of when-issued trading and trading in on-the-run securities in the late 1990s. Buybacks allowed the Treasury to increase the sizes of new issues.

Garbade and Rutherford (2007) evaluated the prospective use of buybacks for Treasury cash and debt management in the absence of a budget surplus. Han et al. (2007) analyze the program's outcomes for Treasury buyback costs, bond prices, and bond market liquidity, using intraday data from the Treasury bond market. Merrick (2005) highlight the unintended consequences in related markets, such as, those for the single-payment Treasury STRIPS securities. More recently, Connolly and Struby (2023) estimate the effects of the 2000-2002 Treasury Buyback program on Treasury returns and the Federal Reserve's System Open Market Account (SOMA) portfolio.

3 Proposed model structure

Here, we sketch the modeling framework, leaving out many details for brevity. The modeled bond market will have three types of participants: an issuer, $m > 2$ dealers, and non-dealer customers. Bonds are "on the run" from issuance until the subsequent issuance and then "off the run." Each dealer i has holdings (q_1^i, q_2^i) of on-the-run and off-the-run bonds, respectively. The total quantity of on-the-runs (off-the-runs) held by dealers is Q_1^* (Q_2^*). The total quantity of on-the-runs (off-the-runs) held by the market as a whole (both dealers and customers) is Q_1 (Q_2). The state variable for dealer i is $x^i = (q_1^i, q_2^i, Q_1^*, Q_2^*, Q_1, Q_2)$. Dealers and the issuing authority discount future cash flows at a common discount rate r.

For on-the-run and off-the-run bonds, there are three types of events:

- *Issuances and buybacks.* With mean frequency λ_1, an amount $Y_1 = \theta_0 + \theta_1 Q_2$ of new on-the-run notes are issued in a double auction involving all m dealers. Likewise, with mean frequency λ_2, an amount $Y_2 = \theta_2 Q_2$ of off-the-run notes are repurchased by the Treasury, in a double auction involving all dealers. With constant parameters and $\lambda_2\theta_2 > \lambda_1\theta_1$, the stationary mean supply of off-the-run bonds is

$$\frac{\lambda_1\theta_0}{\lambda_2\theta_2 - \lambda_1\theta_1}.$$

  The double auction captures two of the three channels outlined in Treasury thinking, namely that the Treasury will act as a regular buyer of off-the-run securities, and that buyback auctions will be "liquidity events" to promote further trade.

- *Customer-dealer trade.* For each given dealer i, with mean frequency λ_3^P (λ_4^P), customers sell a positive quantity of on-the-runs (off-the-runs) to that dealer. Likewise, with mean frequency λ_3^S (λ_4^S), customers buy a positive quantity of on-the-runs (off-the-runs) from dealer i. The quantity to be purchased or sold in each case is *iid* across transactions.

  All customer-to-dealer transactions are assumed to publicly announced, consistent with the proposed public dissemination of TRACE transaction data. Since these transactions are also occurring for other dealers and i's state tracks total dealer holdings

(Q_1^*, Q_2^*), whenever a customer sells a quantity y of on-the-runs to another dealer, the state of dealer i is modified so that x becomes $x_{-i}^+(y,3) = (q_1, q_2, Q_1^* + y, Q_2^*, Q_1, Q_2)$ for on-the-runs. Likewise if a customer sells a quantity y of off-the-runs to another dealer, x becomes $x_{-i}^+(y,4) = (q_1, q_2, Q_1^*, Q_2^* + y, Q_1, Q_2)$.

- *Inter-dealer trade.* With mean frequency λ_5 (λ_6), dealers trade on-the-runs (off-the-runs) among themselves in double auctions involving all dealers. We do not currently include this in the model.

A dealer holding an inventory (q_1, q_2) of on and off the runs, respectively, incurs holding costs at the rate $h(q_1 + q_2)^2$ per unit of time, for some constant $h > 0$. Dealer bidding strategies maximize the expected present value of future net cash flows, including bond coupon payments, issuance purchase costs, and net trading revenues.

The issuer's buyback design is determined by the parameters $\lambda_1, \lambda_2, \theta_0, \theta_1$ and θ_2.

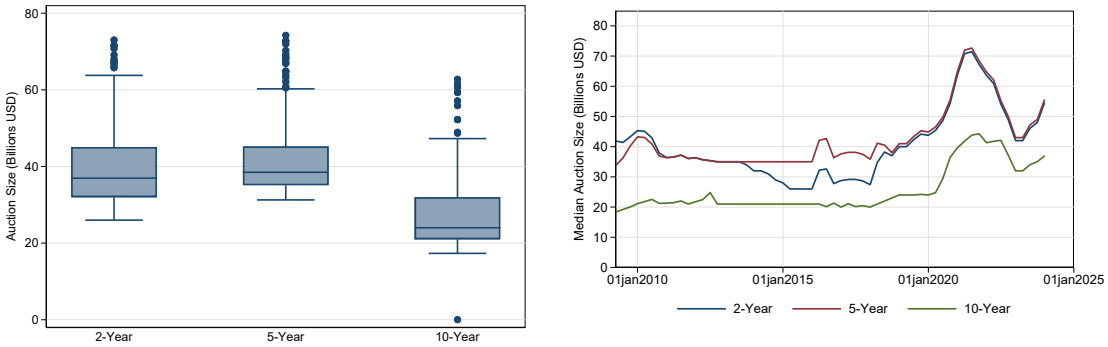
Anticipating a symmetric equilibrium, the continuation value function $V : \mathbb{R}^2 \to \mathbb{R}$ of any dealer satisfies Hamilton-Jacobi-Bellman equation

$$\begin{aligned} 0 = -rV(x) + q_1 + q_2 - \kappa(q_1 + q_2)^2 \\ + \sum_{k=1}^{2} \left[\sup_{\delta} \lambda_k \left[V(x^+(\delta, Y_k, k)) - V(x) - \Phi_k(\delta, x, Y_k)\delta \mid Y_k \right] \right] \\ + \sum_{k=3}^{4} \sum_{\ell=S,P} \lambda_k^\ell \left[V(x^+(Y_k^\ell, Y_k^\ell, k)) - V(x) - p_k(x, Y_k^\ell) Y_k^\ell \right] \\ + (m-1) \sum_{k=3}^{4} \sum_{\ell=S,P} \lambda_k^\ell \left[V(x_{-i}^+(Y_k^\ell, k)) - V(x) \right], \end{aligned}$$

where

- $q_1 + q_2$ is the rate of coupon income,
- k is the event type (and thus λ_k is the arrival rate for event type k);
- Y_k is a random variable with probability distribution of the total amount sold to dealers at event type k;
- when the immediately prior state is x, $x^+(\delta, y, k)$ is the new state vector for an event of type k that is determined by a dealer purchase of size δ, where y is the total quantity of the bond sold to dealers
- for $k = 1, 2$, $\Phi_k(d, x, y)$ is the equilibrium per-unit price in the auction, when the dealer makes a purchase of size d given state x and sale quantity y;
- for $k = 3, 4$, $p_k(x, y)$ is the per-unit price on a C2D transaction with dealer i of size y when the state of dealer i is x.

Figure 1. Auctions Size ($billions). Figure 1a shows the distribution of auctions' sizes. Figure 1b shows auction size for the 2-year, 5-year, and 10-year issuances, from 1Q2009 to 4Q2023.



(a) **(b)**

Table 1: Daily Trading Volume by Security Type and Market Segment This table reports the average daily trading volume in billions of U.S. dollars of par-value for different segments of the Treasury market including the dealer-to-client (D2C), dealer-to-dealer (D2D), interdealer broker electronic/automated (IDBE), and interdealer broker voice/manual screen (IDBV) segments. The sample period includes 1,338 trading days from July 7, 2017 to December 29, 2022 excluding SIFMA holidays and early closes.

	Total	D2C	D2D	IDBE	IDBV
Coupons	481.5	212.0	29.3	170.8	69.4
Bills	118.2	86.0	9.1	0.3	22.8
TIPS	14.6	10.5	0.3	0.0	3.8
FRNs	2.1	1.8	0.1	0.0	0.2
STRIPS	2.4	2.2	0.1	0.0	0.1
All	618.8	312.5	38.9	171.1	96.3

4 Data

The model will be calibrated to data bearing on issuance and secondary market trade in the 2-year, 5-year, and 10-year segments of US Treasury security markets.

Issuances. The auctions data will include the announcement date, auction date, issue date, offering amount, maturity date, and coupon, from Treasury Direct to calculate the average auction size. The proposed work will focus on auctions between January 2009 and December 2024. Figure 1b illustrates issuance sizes through 2023.

Secondary trade volumes and market price impact. The proposed work will exploit transactions data collected through TRACE system, which covers trades since July 2017. For a given trade, the data cover the security ID, whether the trade is D2D or D2C, and dealer IDs, the quantity, and the price. Table 1 summarizes secondary market activty.

5 Composition of the research team

In addition to the principal investigator, Duffie, the research team is comprised of Michael Fleming, Or Schachar, Peter Van Tassel, CV: https://www.newyorkfed.org/medialibrary/media/research/economists/vantassel/vantassel_cv.pdf and Sam Wycherly (who is proposed to receive research assistantship funding). Fleming, Shachar, and Van Tassel (all of whom have PhDs) are not university faculty are not co-proposing investigators, and are not requesting funding support.

6 Proposed funding

The proposed funding is:

- At least $15,000 in research assistantship support.
- $7,000 for other research costs such as conference travel.
- salary support for investigator(s): none.
- data funding: none.

The proposal includes no requested funding for data or faculty salary support (Duffie). The primary need for funding is for student research support. Stanford Economics PhD student Sam Wycherly will need funding to work with the PI on this project, and needs funding for summer quarter 2024 through fall quarter 2025. The suggested $15,000 funding for research assistant support would cover only about one quarter of project support from Wycherly, a small fraction of the needed support for this project, which will last for about six quarters. The PI therefore requests the highest possible funding for research assistantship support.

References

Connolly, M. and E. Struby (2023): "Treasury Buybacks, the Fed's Portfolio, and Changes in Local Supply," *Available at SSRN 4457207*.

Garbade, K. and M. Rutherford (2007): "Buybacks in Treasury cash and debt management," *FRB of New York Staff Report*.

Han, B., F. A. Longstaff, and C. Merrill (2007): "The US Treasury buyback auctions: The cost of retiring illiquid bonds," *The Journal of Finance*, 62, 2673–2693.

Merrick, J. J. (2005): "Tracking the US Treasury: Footprints from the Treasury's Debt Buy-Back Program," *Journal of Fixed Income*, 15, 37.

Conflicts of interest statement

NBER research proposal: Market Frictions and Financial Risks

Buybacks

Principal Investigator: Duffie

May, 2024

The sole principal investigator (Duffie) has no project-related actual or potential conflicts of interest. None of the remainder of the research team (Fleming, Shachar, Wycherly, Van Tassel) have actual or potential conflicts of interest, with the sole possible exception of Van Tassel, whose employer, Caption Partners LP, may or may not conduct trading of US Treasury securities. Caption Partners is not a primary dealer, and therefore could not participate in Treasury buybacks.

Statement of Public Policy Issue Informed by the Proposed Research

NBER research proposal: Market Frictions and Financial Risks

Buybacks

Principal Investigator: Duffie

May, 2024

The proposed research will show how the design of a buyback program influences the liquidity benefits of investors and costs to the government for funding its fiscal needs. Although transaction costs in the dealer-to-client market for US Treasury securities are currently low on normal trading days, they tend to increase over the life-span of a security and also during periods of intense demands by investors for liquidity, and especially in the off-the-run market, where buybacks can be most valuable from a public-policy perspective. This research will show how buybacks can trade off the present value of secondary-market transactions costs against the costs of reverse-auctioning (buybacks) and new issuances.

Curriculum Vitae of DARRELL DUFFIE

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EMPLOYMENT

1984-present: Stanford University, Adams Distinguished Professor of Management and Professor of Finance, Graduate School of Business; Professor, Department of Economics (by courtesy); Senior Fellow, Stanford Institute for Economic Policy Research; Senior Fellow (by courtesy) Hoover Institution.

Sabbatical positions: Mathematical Sciences Research Institute, University of California, Berkeley, 1985-1986; Université de Paris, Dauphine, 1998; University of Lausanne, 2007-2008; EPFL, 2015-2016, Federal Reserve Bank of New York, 2022-2023.

UNIVERSITY EDUCATION

Stanford University, Ph. D. (Engineering Economic Systems) (1984)

University of New England (Australia), Master of Economics (Economic Statistics) (1980)

University of New Brunswick (Canada), Bachelors of Science in Engineering (Civil Engineering) (1975)

AWARDS AND HONORS

1985-86 NSF Research Fellowship
1988-89 Batterymarch Fellowship
1990-92 NSF Research Grant
1992-93 Catalyst Institute Research Grant
1994-95 Q Group Research Award
1994-96 NSF Research Grant
Fellow, Econometric Society
1997 Smith-Breeden Distinguished Paper Prize, *Journal of Finance*
2001 Graham and Dodd Award, best paper, *Financial Analysts Journal*
2002 NYSE Prize for equity research, Western Finance Association
2003 Distinguished teacher award, Doctoral Program, Graduate School of Business, Stanford University
2003 Financial Engineer of the Year, International Association of Financial Engineering
2004 Clarendon Lectures in Finance, Oxford University.
2007 Princeton Lectures in Finance.
2007 Elected Fellow of the American Academy of Arts and Sciences.
2008 2011, Elected to the Council of the Econometric Society.
2008 Nash Lecture, Carnegie-Mellon University.
2009 Elected President of the American Finance Association.
2010 Tinbergen Institute Finance Lectures, Duisenberg Institute.
2011 Minerva Foundation Lectures, Columbia University.
2015 Ross Prize (with Jun Pan and Ken Singleton).
2015 Fisher-Shultz Lecture, World Congress, Econometric Society.
2016 AQR Prize (with Haoxiang Zhu).

2017 Baffi Lecture, Banca d'Italia.
2018 Amundi Smith Breeden Prize, best paper, Journal of Finance.
2021 Markov Lecture, INFORMS.
2022 Bies Lecture, Northwestern University.
2022 Ross Prize (with Nicolae Gârleanu and Lasse Heje Pedersen).
2023 Onassis Prize in Finance.
2024 Arthur Warga Award (with Michael Fleming, Frank Keane, Claire Nelson, and Or Shachar).
2024 Schwartz Lecture.

Research Areas

risk management; financial asset valuation; preferences under uncertainty; over-the-counter markets; credit risk; financial market infrastructure, central banking, financial market design, payment systems and digital currencies.

Books

Security Markets: Stochastic Models, Boston: Academic Press, 1988.

Futures Markets, Englewood Cliffs, New Jersey: Prentice-Hall, 1989. Japanese translation, Kinzai Publishing Company, 1994; Chinese translation, 1996.

Dynamic Asset Pricing Theory, Princeton University Press, 1992; Third Edition, 2001; French Translation, *Modelès Dynamiques d' Evaluation*, Paris: Presse Universitaire Française, 1993; Japanese Translation, Shinbun Press, 1998; portions appearing in Italian translation in *Il Principio di Arbitraggio*, edited by M. de Felice and E. F. Moriconi, Societá Editrice Il Mulino, Bologna, 1996.

Credit Risk: Pricing, Measurement, and Management, with Kenneth J. Singleton, Princeton University Press, 2003.

The Squam Lake Report: Fixing the Financial System, co-authored with the Squam Lake Group, Princeton University Press, 2010.

How Big Banks Fail — And What to Do About It, Princeton University Press, 2010.

Measuring Corporate Default Risk, Oxford University Press, 2011.

Dark Markets: Asset Pricing and Information Transmission in Over-The-Counter Markets, Princeton University Press, 2012.

Technology and Finance, with Thierry Foucault, Laura Veldkamp, and Xavier Vives, CEPR Press, 2022.

Digital Currencies: The US, China, And The World At A Crossroads, co-edited with Elizabeth Economy, Hoover Press, 2022.

Fragmenting Markets: Post-Crisis Bank Regulations and Financial Market Liquidity, de Gruyter, 2022.

Research publications

Research publications are shown at www.darrellduffie.com

Editorial

Management Science, 1986 to 1989.

Boards

Journal of Mathematical Economics, 1988 to 1996.
Advances in Futures and Options Research, 1989 to May 1991.
Annals of Applied Probability, 1989 to 1994.
Economic Theory, December, 1989 to 1996.
Journal of Economic Theory, 1986 to 1999.
Mathematical Finance, 1989 to 2001.
Econometrica, 1990 to 2014.
Asia Pacific Financial Markets, 1993 to 2006.
The Review of Derivatives Research, 1993 to 2007.
Finance and Stochastics, 1995 to 2002 (co-editor, 1998-2002).
Review of Finance, 1995 to 2012.
Journal of Computational Finance, 1997 to 2017.
Advances in Mathematical Economics, 1998 to 2023.
Stochastic Processes and Their Applications, 1999 to 2006.
Journal of Financial Economics. 2001 to 2021.
Journal of Bond Trading and Management. 2002 to 2003.
Journal of Banking and Finance. 2005 to 2008.
Mathematics and Financial Economics. 2007 to 2023.
AEJ: Microeconomics. 2007 to 2019.
International Journal of Central Banking. 2009 to 2019.
Stochastic Systems. 2009 to 2017.
Review of Asset Pricing Studies. 2010 to 2014.
Journal of Credit Risk. 2015 to present.
Quantitative Finance. 2015 to present.

Professional Service

National Bureau of Economic Research, Research Associate.
Hoover Institution, Senior Fellow, by courtesy.
Council, Bachelier Society, 1996 to 1999.
International Association of Financial Engineers, Governing Board (1997 to 2000), Senior Fellow from 2005.
External Advisory Board, Institute for Computational Finance, University of Texas, Austin, 1996 to 2005.
International Advisory Board, Centre for Financial Engineering, National University of Singapore.
Econometric Society, Fellow, Member of Council (2009-2012), Investments Committee (2009-2016).
NCCR FinRisk, International Scientific Council, Switzerland; 2005-2012.
Organizing Committee, Quantitative Developments in Finance, Newton Institute, Cambridge University, 2005.
American Finance Association, Executive Committee, 2007-2011; Vice-President, 2007-2008; President-Elect, 2008-2009; President, 2009-2010; Board of Directors, 2000-2003, 2007-2011.
Banff International Research Station, Scientific Advisory Board, 2005 to 2010.
The Chicago Mercantile Exchange-Mathematical Sciences Research Institute Prize Committee, 2005 to 2011, 2019-present.
The Federal Reserve Bank of New York, Financial Advisory Roundtable, 2006 to 2016.
Financial Economists Roundtable, 2007 to 2015.
Pacific Institute of Mathematical Sciences, Board of Directors, 2007 to 2018.
Stanford University, Working Group on Global Markets, Member, 2008 to present.

Squam Lake Working Group, Member.
Stanford Institute of Economic Policy Research (SIEPR), Senior Fellow, 2009 to present.
Society of Financial Econometrics (SoFiE), Council, 2009 to 2017.
Swiss Finance Institute, Scientific Council, 2010 to 2021.
Duisenberg Institute, Scientific Council, 2010 to 2015.
Initiative on Global Markets (IGM), University of Chicago, Experts Panel, 2010-present.
Stanford University, Financial Institutions Resolution Group, 2009-2020.
SWIFT Institute Advisory Council, 2012-2016.
American Academy of Arts and Sciences, Fellow. 2010-present.
Asian Bureau of Finance and Economics Research, Senior Academic Fellow.
Bureau of Finance and Economics Research, Senior Academic Fellow.
Member, World Economic Forum Global Agenda Council on the Global Financial System (2010-2017).
World Economic Forum, The Role of Financial Services in Society, Steering Committee (2010-2017).
Market Participants Group on Reference Rate Reform, Chair, Financial Stability Board, 2014-2017.
P.R.I.M.E. Finance Foundation, Panel of Recognized International Market Experts in Finance, 2014-present.
Institute for Global Finance, University of New South Wales, Senior Fellow, 2014-present.
Vox China, Advisory Board, 2016-present.
Risk Advisory Council, Global Risk Institute, Canada, 2014-present.
Shanghai Institute of Finance for the Real Economy, Advisory board. 2018-present.
Barcelona Graduate School of Economics, Scientific Committee, 2019-present.
Systemic Risk Council, Member, 2019-2021.
Fanhai International School of Finance, Fudan University, International Advisory Board, 2019-present.
Carlo Alberto Medal Selection Committee, 2019-present.
Luohan Academy, Distinguished Fellow, 2020-present.
Future of Digital Currency Initiative, Stanford, Advisory Council, 2019-present.
Barcelona School of Economics, Scientific Committee, 2019-present.
Working Group on the Global Implications of China's Central Bank Digital Currency, Co-Director, Hoover Institution, Stanford, 2021-present.
King Center on Global Development, Stanford University, Faculty Affiliate, 2021-present.
Creative Destruction Lab, Oxford University, Member Scientist, 2021-present.
International Advisory Panel of Risk Management Institute, National University of Singapore, Chair, 2021-present.
Institute for Mathematical and Statistical Innovation (IMSI), member of the Board of Advisors, July 2022 to present.
President's Council of Advisors on Science and Technology (PCAST) study on Extreme Weather and Financial Risk, Working Group Member, May 2022 to present.

BOARDS

iShares Funds and Trusts, San Francisco, 2008-2011.
Moody's Corporation, New York, 2008-2018.
TNB Inc., Connecticut, 2018-present (uncompensated and not currently active).

Dimensional Funds, Austin, 2019-present.

Other	Bank One and I.R.S., Chicago (expert testimony, valuation of swaps).
	Board of Directors, Affinium Fund, London.
Compensated	International Monetary Fund, Washington, D.C. (credit risk).
	Citigroup, New York (economic capital).
Activities	Merrill Lynch, New York (risk management).
	Paloma Partners, Greenwich CT (risk management).
2003-2024	Ixis, Paris (credit markets).
	Schering-Plough, Kenilworth NJ (asset valuation).
	MBIA, New York (credit risk management).
	Bombardier, Toronto (corporate debt valuation).
	Moody's, Academic Research and Advisory Committee, New York.
	Credit Suisse, New York (financial markets and risk management), New York.
	Quinn Emanuel, New York, (consulting and expert witness testimony, credit risk corporate debt valuation, credit derivatives, interest-rate swaps).
	New York State Tax Authority (repurchase agreements), New York.
	Cantor Fitzgerald (inter-dealer broker markets), New York.
	Independent Health Care Trusts for UAW Retirees of General Motors Corporation and of Ford Motor Corporation, (exercise of equity options), Detroit.
	State Street Bank (speech to investor conference), Boston.
	PayNet Inc. (estimation of default probabilities), Chicago.
	Matterhorn Investment Management (global capital markets), London.
	Cantor Fitzgerald (interdealer brokerage of treasuries), New York.
	Public Prosecutor of Milan (valuation of swap agreements), Milan Italy.
	Federal Reserve Bank of Chicago (central clearing counterparties), Chicago.
	Kepos Capital (academic advisory board), New York.
	Lehman Estate (consultation on bankruptcy-related issues), New York.
	Incisive Media (public speaking).
	Rothwell, Figg, Ernst & Manbeck (consultation on intellectual property rights), Washington DC,
	Sansome Capital (consultation on global capital markets), San Francisco.
	Och-Ziff Management LP (consultation on hedge fund risk management), New York.
	Government of Canada, Department of Justice (Capital Markets Stability Act), Ottawa.
	Zurich Financial Services (economic risk), Zurich.
	Municipal Securities Rulemaking Board (financial benchmarks), Washington DC.
	Banque Lombard Odier (asset management), Geneva.
	GMLX (webinars on bond markets) New York.
	Federal Reserve Bank of New York (resident scholar), New York.
	Keystone Strategy (corporate debt valuation), New York.

This curriculum vitae is current as of May 2024.

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EDUCATION

Harvard University, *Ph.D. in Business Economics*, Cambridge, MA, November 1994.

- Dissertation title: "Three Essays on Corporate Governance."
- National Doctoral Fellowship in Business and Management.

Colby College, *B.A. in Economics*, Waterville, ME, May 1988.

- Magna Cum Laude, Honors in Economics, Phi Beta Kappa, Breckenridge Prize.

EMPLOYMENT

Federal Reserve Bank of New York, New York, NY, September 1994 - present.

- Current position: Vice President and Head of Capital Markets Function.

New York University, Stern School of Business, New York, NY, fall 2007.

- Adjunct Associate Professor, Debt Instruments and Markets (MBA elective).

Harvard University, Cambridge, MA, 1992 - 1993.

- Teaching Fellow, capital markets, corporate finance, econometrics, and statistics.

BayBanks, Inc., Cost Analyst**,** Boston, MA, September 1988 - August 1989.

RESEARCH INTERESTS

Market Microstructure, Financial Intermediation, Monetary Policy.

PUBLISHED PAPERS

- "Intraday Market Making with Overnight Inventory Costs" (with Tobias Adrian, Agostino Capponi, Erik Vogt, and Hongzhong Zhang). ***Journal of Financial Markets,*** *forthcoming*.
- "Liquidity and Volatility in the U.S. Treasury Market" (with Robert Engle, Eric Ghysels, and Giang Nguyen). ***Journal of Econometrics***, Vol. 217, No. 2, August 2020, pp. 207-29.
- "Price and Size Discovery in Financial Markets: Evidence from the U.S. Treasury Securities Market" (with Giang Nguyen). ***Review of Asset Pricing Studies****,* Vol. 9, No. 2, December 2019, pp. 256–95*. 2014 FMA Annual Meeting Award, Best Paper in Market Microstructure.*
- "The Microstructure of a U.S. Treasury ECN: The BrokerTec Platform" (with Bruce Mizrach and Giang Nguyen). ***Journal of Financial Markets****,* Vol. 40, September 2018, pp. 2-22*.*
- "Market Liquidity After the Financial Crisis" (with Tobias Adrian, Or Shachar, and Erik Vogt). ***Annual Review of Financial Economics***, Vol. 9, 2017, pp. 43-83*.*

- "Dealer Financial Conditions and Lender-of-Last-Resort Facilities" (with Viral Acharya, Warren B. Hrung, and Asani Sarkar). ***Journal of Financial Economics,*** Vol. 123, No. 1, January 2017, pp. 81-107.
- "The Failure Resolution of Lehman Brothers" (with Asani Sarkar). Federal Reserve Bank of New York ***Economic Policy Review,*** Vol. 20, No. 2, March 2014.
- "Trading Activity and Price Transparency in the Inflation Swap Market" (with John R. Sporn). Federal Reserve Bank of New York ***Economic Policy Review,*** Vol. 19, No. 1, May 2013, pp. 45-57
- "Federal Reserve Liquidity Provision during the Financial Crisis of 2007-2009." ***Annual Review of Financial Economics***, Vol. 4, 2012, pp. 161-77.
- "The Microstructure of the TIPS Market" (with Neel Krishnan). Federal Reserve Bank of New York ***Economic Policy Review***, Vol. 18, No. 1, March 2012, pp. 27-45.
- "Income Effects of Federal Reserve Liquidity Facilities" (with Nicholas J. Klagge). Federal Reserve Bank of New York ***Current Issues in Economics and Finance***, Vol. 17, No. 1, 2011.
- "Repo Market Effects of the Term Securities Lending Facility" (with Warren B. Hrung and Frank M. Keane). ***American Economic Review: Papers & Proceedings***, Vol. 100, May 2010, pp. 591-6.
- "The Federal Reserve's Foreign Exchange Swap Lines" (with Nicholas J. Klagge). Federal Reserve Bank of New York ***Current Issues in Economics and Finance***, Vol. 16, No. 4, April 2010.
- "The Term Securities Lending Facility: Origin, Design, and Effects" (with Warren B. Hrung and Frank M. Keane). Federal Reserve Bank of New York ***Current Issues in Economics and Finance***, Vol. 15, No. 2, February 2009.
- "Dealer Behavior in the Specials Market for U.S. Treasury Securities" (with Kenneth D. Garbade). ***Journal of Financial Intermediation***, Vol. 16, No. 2, April 2007, pp. 204-28.
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- "Anomalous Bidding in Short-Term Treasury Bill Auctions" (with Kenneth D. Garbade and Frank Keane). ***Journal of Financial Research***, Vol. 28, No. 2, Summer 2005, pp.165-76.
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- "Repurchase Agreements with Negative Interest Rates" (with Kenneth D. Garbade). Federal Reserve Bank of New York ***Current Issues in Economics and Finance***, Vol. 10, No. 5, April 2004.
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- "The Repurchase Agreement Refined: GCF Repo" (with Kenneth D. Garbade). Federal Reserve Bank of New York ***Current Issues in Economics and Finance***, Vol. 9, No. 6, June 2003.

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- "What Moves Bond Prices?" (with Eli M. Remolona). ***Journal of Portfolio Management***, Vol. 25, Summer 1999, No. 4, pp. 28-38.
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- "What Moves the Bond Market?" (with Eli M. Remolona). Federal Reserve Bank of New York ***Economic Policy Review***, Vol. 3, No. 4, December 1997, pp. 31-50.
- "The Round-the-Clock Market for U.S. Treasury Securities." Federal Reserve Bank of New York ***Economic Policy Review***, Vol. 3, No. 2, July 1997, pp. 9-32.

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- "An Index of Treasury Market Liquidity: 1991-2017" (with Tobias Adrian and Erik Vogt). Federal Reserve Bank of New York *Staff Report* No. 827, November 2017.
- "Trading Activity in the Indian Government Bond Market" (with Seema Saggar and Samita Sareen). Federal Reserve Bank of New York *Staff Report* No. 785, August 2016.
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BOOK CHAPTERS

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- "Treasury Market Liquidity and the Federal Reserve during the COVID-19 Pandemic" Federal Reserve Bank of New York *Liberty Street Economics*, May 2020.
- "Treasury Market Liquidity during the COVID-19 Crisis" (with Francisco Ruela). Federal Reserve Bank of New York *Liberty Street Economics*, April 2020.
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- "At the New York Fed: Fifth Annual Conference on the U.S. Treasury Market" (with Peter Johansson, Frank M. Keane, and Justin Meyer). Federal Reserve Bank of New York *Liberty Street Economics,* November 2019.
- "From the Vault: A Look Back at the October 15, 2014, Flash Rally" (with Peter Johansson, Frank M. Keane, and Justin Meyer). Federal Reserve Bank of New York *Liberty Street Economics,* October 2019.
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- "Customer and Employee Losses in Lehman's Bankruptcy" (with Erin Denison and Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* January 2019.
- "The Indirect Costs of Lehman's Bankruptcy" (with Erin Denison and Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* January 2019.
- "Lehman's Bankruptcy Expenses" (with Erin Denison and Asani Sarkar*).* Federal Reserve Bank of New York *Liberty Street Economics,* January 2019.
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- "How Much Value Was Destroyed by the Lehman Bankruptcy?" (with Erin Denison and Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* January 2019.
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- "Breaking Down TRACE Volumes Further" (with Doug Brain, Michiel DePooter, Dobrislav Dobrev, Peter Johansson, Frank M. Keane, Michael Puglia, Tony Rodrigues, and Or Shachar). Federal Reserve Bank of New York *Liberty Street Economics,* November 2018.
- "U.S. Treasury Market Action on Election Night 2016." Federal Reserve Bank of New York *Liberty Street Economics,* October 2018.
- "Unlocking the Treasury Market through TRACE" (with Doug Brain, Michiel DePooter, Dobrislav Dobrev, Peter Johansson, Collin Jones, Frank M. Keane, Michael Puglia, Liza Reiderman, Tony Rodrigues, and Or Shachar). Federal Reserve Bank of New York *Liberty Street Economics*, September 2018.
- "Do You Know How Your Treasury Trades Are Cleared and Settled?" (with Adam Copeland, Frank M. Keane, and Radhika Mithal). Federal Reserve Bank of New York *Liberty Street Economics*, September 2018.
- "Dealer Trading and Positioning in Floating Rate Notes" (with Amanda Wahlers). Federal Reserve Bank of New York *Liberty Street Economics,* March 2018.
- "Dealer Participation in the TSLF Options Program" (with Erin Denison, Warren B. Hrung, and Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* February 2018.
- "Options of Last Resort" (with Erin Denison, Warren B. Hrung, and Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* February 2018.
- "Just Released: Updated SOMA Portfolio and Income Projections" (with Gabriel Herman, Deborah Leonard, Dave Na, and Lisa Stowe). Federal Reserve Bank of New York *Liberty Street Economics,* July 2017.
- "Market Liquidity after the Financial Crisis" (with Tobias Adrian and Or Shachar). Federal Reserve Bank of New York *Liberty Street Economics,* June 2017.
- "Which Dealers Borrowed from the Fed's Lender-of-Last-Resort Facilities?" (with Viral V. Acharya, Warren B. Hrung, and Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* May 2017.
- "Advent of Trade Reporting for U.S. Treasury Securities." Federal Reserve Bank of New York *Liberty Street Economics,* January 2017.

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- "A Closer Look at the Federal Reserve's Securities Lending Program" (with Frank Keane, Jake Schurmeier, and Emma Weiss). Federal Reserve Bank of New York *Liberty Street Economics,* August 2016.
- "What's behind the March Spike in Treasury Fails?" (with Frank Keane). Federal Reserve Bank of New York *Liberty Street Economics,* April 2016.
- "Did Third Avenue's Liquidation Reduce Corporate Bond Market Liquidity?" (with Tobias Adrian, Erik Vogt, and Zachary Wojtowicz). Federal Reserve Bank of New York *Liberty Street Economics,* February 2016.
- "Primary Dealer Participation in the Secondary U.S. Treasury Market" (with Frank Keane and Ernst Schaumburg). Federal Reserve Bank of New York *Liberty Street Economics,* February 2016.
- "Is Treasury Market Liquidity Becoming More Concentrated?" Federal Reserve Bank of New York *Liberty Street Economics,* February 2016.
- "Further Analysis of Corporate Bond Market Liquidity" (with Tobias Adrian, Erik Vogt, and Zachary Wojtowicz). Federal Reserve Bank of New York *Liberty Street Economics,* February 2016.
- "Corporate Bond Market Liquidity Redux: More Price-Based Evidence" (with Tobias Adrian, Erik Vogt, and Zachary Wojtowicz). Federal Reserve Bank of New York *Liberty Street Economics,* February 2016.
- "Has MBS Market Liquidity Deteriorated?" (with Rich Podjasek, Linsey Molloy, and Andreas Fuster). Federal Reserve Bank of New York *Liberty Street Economics,* February 2016.
- "Continuing the Conversation on Liquidity" (with Tobias Adrian, and Ernst Schaumburg). Federal Reserve Bank of New York *Liberty Street Economics,* February 2016
- "Characterizing the Rising Settlement Fails in Seasoned Treasury Securities," (with Frank Keane). Federal Reserve Bank of New York *Liberty Street Economics,* January 2016.
- "Dealer Positioning and Expected Returns" (with Tobias Adrian and Erik Vogt). Federal Reserve Bank of New York *Liberty Street Economics,* December 2015.
- "At the New York Fed: Conference on the Evolving Structure of the U.S. Treasury Market" (with Frank Keane, Michael McMorrow, Ernst Schaumburg, and Nathaniel Wuerffel). Federal Reserve Bank of New York *Liberty Street Economics,* December 2015.
- "Dealers' Positions and the Auction Cycle" (with Collin Jones). Federal Reserve Bank of New York *Liberty Street Economics,* October 2015.
- "Redemption Risk of Bond Mutual Funds and Dealer Positioning" (with Tobias Adrian, Or Shachar, and Erik Vogt). Federal Reserve Bank of New York *Liberty Street Economics,* October 2015.
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- "Has Liquidity Risk in the Treasury and Equity Markets Increased?" (with Tobias Adrian, Daniel Stackman, and Erik Vogt). Federal Reserve Bank of New York *Liberty Street Economics,* October 2015.

- "Has Liquidity Risk in the Corporate Bond Market Increased?" (with Tobias Adrian, Or Shachar, and Erik Vogt). Federal Reserve Bank of New York *Liberty Street Economics,* October 2015.
- "Has U.S. Corporate Bond Market Liquidity Deteriorated?" (with Tobias Adrian, Or Shachar, and Erik Vogt). Federal Reserve Bank of New York *Liberty Street Economics,* October 2015.
- "Introduction to a Series on Market Liquidity: Part 2" (with Tobias Adrian and Ernst Schaumburg). Federal Reserve Bank of New York *Liberty Street Economics,* October 2015.
- "What's Driving Dealer Balance Sheet Stagnation? (with Tobias Adrian, Daniel Stackman, and Erik Vogt). Federal Reserve Bank of New York *Liberty Street Economics,* August 2015.
- "The Evolution of Workups in the U.S. Treasury Securities Market" (with Ernst Schaumburg, and Ron Yang). Federal Reserve Bank of New York *Liberty Street Economics,* August 2015.
- "Has U.S. Treasury Market Liquidity Deteriorated? (with Tobias Adrian, Daniel Stackman, and Erik Vogt). Federal Reserve Bank of New York *Liberty Street Economics,* August 2015.
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- "Just Released: The U.S. Treasury Market on October 15, 2014" (with Nashrah Ahmed, Alain Chaboud, Dobrislav Dobrev, Joseph Fiorica, Frank Keane, Michael McMorrow, Suraj Prasanna, Ernst Schaumburg, Nathaniel Wuerffel, and Ron Yang). Federal Reserve Bank of New York *Liberty Street Economics,* July 2015.
- "What Explains the June Spike in Treasury Settlement Fails?" (with Frank Keane, Antoine Martin, and Michael McMorrow). Federal Reserve Bank of New York *Liberty Street Economics*, September 2014.
- "Measuring Settlement Fails" (with Frank Keane, Antoine Martin, and Michael McMorrow). Federal Reserve Bank of New York *Liberty Street Economics*, September 2014.
- "At the N.Y. Fed: Workshop on the Risks of Wholesale Funding" (with Dong Beom Choi, Patrick de Fontnouvelle, and Thomas Eisenbach). Federal Reserve Bank of New York *Liberty Street Economics*, September 2014.
- "Just Released: The 2013 SOMA Annual Report in a Historical Context" (with Alyssa Cambron, Deborah Leonard, Grant Long, and Julie Remache). Federal Reserve Bank of New York *Liberty Street Economics,* April 2014.
- "The Failure Resolution of Lehman Brothers" (with Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* April 2014.
- "Dealer Balance Sheet Capacity and Market Liquidity during the 2013 Selloff in Fixed-Income Markets" (with Tobias Adrian, Jonathan Goldberg, Morgan Lewis, Fabio Natalucci, and Jason Wu). Federal Reserve Bank of New York *Liberty Street Economics,* October 2013.
- "Information on Dealer Activity in Specific Treasury Issues Now Available." Federal Reserve Bank of New York *Liberty Street Economics,* August 2013.
- "Transparency and Sources of Information on the Federal Reserve's Operations, Income, and Balance Sheet" (with Deborah Leonard). Federal Reserve Bank of New York *Liberty Street Economics,* August 2013.

- "What If? A Counterfactual SOMA Portfolio" (with Deborah Leonard, Grant Long, and Julie Remache). Federal Reserve Bank of New York *Liberty Street Economics,* August 2013.
- "The SOMA Portfolio through Time" (with Meryam Bukhari, Alyssa Cambron, Jonathan McCarthy, and Julie Remache). Federal Reserve Bank of New York *Liberty Street Economics,* August 2013.
- "The Recent Bond Market Selloff in Historical Perspective" (with Tobias Adrian). Federal Reserve Bank of New York *Liberty Street Economics,* August 2013.
- "How Liquid Is the Inflation Swap Market?" (with John Sporn). Federal Reserve Bank of New York *Liberty Street Economics*, April 2013.
- "Primary Dealers' Waning Role in Treasury Auctions" (with Sean Myers). Federal Reserve Bank of New York *Liberty Street Economics*, February 2013
- "Federal Reserve Liquidity Facilities Gross $22 Billion for U.S. Taxpayers." Federal Reserve Bank of New York *Liberty Street Economics,* November 2012.
- "The Impact of Trade Reporting on the Interest Rate Derivatives Market" (with John Jackson, Ada Li, Asani Sarkar, and Patricia Zobel). Federal Reserve Bank of New York *Liberty Street Economics,* April 2012.
- "Failure Is No Longer a (Free) Option for Agency Debt and Mortgage-Backed Securities." Federal Reserve Bank of New York *Liberty Street Economics,* March 2012.
- "How Might Increased Transparency Affect the CDS Market? (with Kathryn Chen, John Jackson, Ada Li and Asani Sarkar). Federal Reserve Bank of New York *Liberty Street Economics,* November 2011.

PRESENTATIONS

2018: Federal Reserve Bank of Atlanta Summer Financial Policy Conference (August), Norges Bank (May), University of Zurich (May), 5th International Conference on Sovereign Bond Markets (April), Wilfrid Laurier University (April), Macro Financial Modeling Winter Meeting (January).

2017: FTG Summer School (August), Federal Reserve Bank of Atlanta Summer Financial Policy Conference (August), Sacred Heart University (May), Commodity Futures Trading Commission (April), Financial Stability Board Workshop (February), New York University (February).

2016: NYU Stern Risk Management Symposium (September), Fixed Income Analysts Society (May).

2015: FINRA/Columbia Conference on Corporate Debt Market Structure, Liquidity and Volatility (November), Board of Governors of the Federal Reserve System (October), Bank of Thailand (February), Bank for International Settlements (February), AFA Annual Meeting (January).

2014: Financial Management Association Annual Meeting (October), 10th Annual Central Bank Workshop on the Microstructure of Financial Markets (October), Centre for Advanced Financial Research and Learning (July), First International Conference on Sovereign Bond Markets (June), Bank of Japan (June), Financial Management Association Applied Finance Conference (May).

2013: Darla Moore School of Business Fixed Income Conference (April).

2012: CFTC Research Conference (November), Board of Governors of the Federal Reserve System (May), Darla Moore School of Business Fixed Income Conference (April), AEA Annual Meeting (January).

2010: Federal Reserve Bank of New York auctions workshop (November), 6th Annual Central Bank Workshop on the Microstructure of Financial Markets (October), Bridgewater Associates (June), AEA Annual Meeting (January).

2009: Central Bank of Ireland (October), Cass Business School (October), Brandeis University (March), Federal Reserve Bank of New York conference on Inflation-Indexed Securities and Inflation Risk Management (February), Federal Reserve Bank of New York conference on Central Bank Liquidity Tools (February), ASSA Annual Meetings (January).

2008: Queens University Belfast (April), AFA Annual Meeting (January), Federal Reserve System Conference on Financial Markets & Institutions (January).

2007: ECB workshop on Analysis of the Money Market (November), Financial Management Association Annual Meeting (October), 3rd Annual Central Bank Workshop on the Microstructure of Financial Markets (September), Bank of Canada (May), University of Cambridge conference on High Frequency Dynamics and Bond Markets (April), Board of Governors of the Federal Reserve System (April), Federal Reserve Bank of Atlanta System Finance Conference (March), ASSA Annual Meetings (January).

2006: University of Kansas (December), NBER Market Microstructure Meeting (May), Bank of Canada Conference on Fixed Income Markets (May), Dauphine Workshop on Financial Market Quality (March).

2005: Danmarks Nationalbank Workshop on Bond Lending (November), SUERF/Bank of Finland conference on Open Market Operations and the Financial Markets (September), Vrije Universiteit Amsterdam (September).

2004: Federal Reserve Bank of San Francisco (April).

2003: University of Piraeus & Athens Derivatives Exchange (November), Third Workshop of the ECB-CFS Research Network on Capital Markets and Financial Integration in Europe (November), Rutgers University (October), Federal Reserve System Conference on Financial Structure and Regulation (September).

2002: Bank for International Settlements (September), Federal Reserve System Conference on Financial Structure and Regulation (September), Bank of Canada (May), University of Kentucky (February).

2001: Berkeley Program in Finance (October), Federal Reserve Bank of Cleveland and *Journal of Money, Credit, and Banking* Conference on Declining Treasury Debt (October), University of Aarhus Conference on Market Microstructure and High-Frequency Data in Finance (August), ABN AMRO Global Central Bankers Conference (June), ALMA Group Annual Meeting (May), Bank for International Settlements (March), Federal Reserve Bank of Boston (February), CBOE, CBOT and CME Risk Management Conference (February), European Central Bank (January).

2000: Brookings Panel on Economic Activity (September), Board of Governors of the Federal Reserve System (July), European Financial Management Association Annual Meeting (June).

1999: Federal Reserve Bank of New York conference on Fiscal Policy in an Era of Surpluses: Economic & Financial Implications (December), Goldman, Sachs & Co. (August).

1998: Bank of Japan (November), Joint Central Bank Research Conference on Risk Management & Systemic Risk (November), Financial Management Association Annual Meeting (October), ERISA U.S. Department of Labor Advisory Council (September), Eastern Economic Association Annual Meeting (February).

1997: NBER Market Microstructure Meeting (December), UCSD conference on Time Series Analysis of High Frequency Financial Data (April).

1996: Financial Management Association Annual Meeting (October).

1995: Financial Management Association Annual Meeting (October).

DISCUSSIONS

2019: NBER Conference on Big Data: Long-Term Implications for Financial Markets and Firms (March).

2018: Columbia Business School Transparency Conference: At What Speed and Cost? (panel discussion; June), NBER Long-Term Asset Management Conference (panel discussion; May).

2017: Euromoney Electronic Bond Trading Forum (roundtable discussion; June).

2016: The Evolving Structure of the U.S. Treasury Market: Second Annual Conference (panel discussion; October), Inaugural India Research Conference (May), Third International Conference on Sovereign Bond Markets (April).

2015: Conference on the Evolving Structure of the U.S. Treasury Market (panel discussion; October), Federal Reserve System "Day-Ahead" Conference on Financial Markets and Institutions (January).

2014: First International Conference on Sovereign Bond Markets (panel discussion; June), AFA Annual Meeting (January).

2012: Econometric Society Annual Meeting (January).

2011: Quantitative Easing Conference (June), WFA Annual Meeting (June), SFS Finance Cavalcade (May), Stern Microstructure Meeting (May).

2010: Financial Management Association Annual Meeting (October).

2009: 5th Annual Central Bank Workshop on the Microstructure of Financial Markets (October), Yale/RFS Financial Crisis Conference (July).

2008: AEA Annual Meeting (January).

2007: Financial Management Association Annual Meeting (October).

2006: NBER Market Microstructure Meeting (October), Dauphine Workshop on Financial Market Quality (March).

2004: NBER Market Microstructure Meeting (July).

2003: MTS Conference on Financial Markets (June).

1998: Joint Central Bank Research Conference on Risk Management & Systemic Risk (Nov.)

1996: Financial Management Association Annual Meeting (October).

1995: Financial Management Association Annual Meeting (October).

PROGRAM COMMITTEES

2020: 16th Annual Central Bank Conference on the Microstructure of Financial Markets (cancelled), 7th International Conference on Sovereign Bond Markets (postponed/TBD).

2019: 15th Annual Central Bank Conference on the Microstructure of Financial Markets (November), 6th International Conference on Sovereign Bond Markets (April).

2018: 14th Annual Central Bank Conference on the Microstructure of Financial Markets (November), 5th International Conference on Sovereign Bond Markets (April).

2017: 13th Annual Central Bank Conference on the Microstructure of Financial Markets (September), 4th International Conference on Sovereign Bond Markets (April).

2016: 12th Annual Central Bank Conference on the Microstructure of Financial Markets (September), 3rd International Conference on Sovereign Bond Markets (April).

2015: 11th Annual Central Bank Conference on the Microstructure of Financial Markets (October), 2nd International Conference on Sovereign Bond Markets (March).

2014: 10th Annual Central Bank Conference on the Microstructure of Financial Markets (October), Workshop on the Risks of Wholesale Funding (August), 1st International Conference on Sovereign Bond Markets (June).

2013: 9th Annual Central Bank Conference on the Microstructure of Financial Markets (Sept.).

2012: 8th Annual Central Bank Conference on the Microstructure of Financial Markets (Oct.).

2011: 7th Annual Central Bank Conference on the Microstructure of Financial Markets (Oct.).

2010: 6th Annual Central Bank Conference on the Microstructure of Financial Markets (Oct.).

2009: 5th Annual Central Bank Conference on the Microstructure of Financial Markets (Oct.).

2008: 4th Annual Central Bank Conference on the Microstructure of Financial Markets (Sept.).

2007: 3rd Annual Central Bank Conference on the Microstructure of Financial Markets (Sept.).

REFEREE WORK

American Economic Review, Economic Journal, Economics Letters, European Economic Review, Finance Research Letters, Financial Management, Financial Review, International Finance, International Journal of Central Banking, Journal of Applied Econometrics, Journal of Applied Finance, Journal of Banking and Finance, Journal of Economics and Business, Journal of Empirical Finance, Journal of the European Economic Association, Journal of Finance, Journal of Financial Economics, Journal of Financial Intermediation, Journal of Financial Markets, Journal of Financial and Quantitative Analysis, Journal of Financial Research, Journal of Financial Services Research, Journal of Futures Markets, Journal of International Economics, Journal of International Money and Finance, Journal of Monetary Economics, Journal of Money, Credit, and Banking, Journal of Political Economy, Journal of Portfolio Management, Management Science, National Tax Journal, Pacific-Basin Finance Journal, Quantitative Economics, Quantitative Finance, Quarterly Journal of Finance, Review of Economic Studies, Review of Finance, Review of Financial Economics, Review of Financial Studies, Swiss Journal of Economics and Statistics.

MEDIA COVERAGE

Asian Wall Street Journal, Associated Press, Barron's, Bloomberg, BondWeek, BridgeNews, CFO.com, Credit Union Regulatory Insider, Dow Jones, eRisks.com, Euromoney, Futures, Investment Dealers' Digest, Market News International, Reuters, Swaps Monitor, Wall Street Journal, Wall Street Journal Europe.

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Current Appointment

Financial Research Advisor, Research and Statistics Group, Federal Reserve Bank of New York

Previous: Senior Economist (2020-2022), Economist A (2017-2020), EconomistB (2012-2017)

Education

Ph.D. in Finance 2013
Leonard N. Stern School of Business, New York University

M.Sc. in Financial Mathematics 2006
Bar-Ilan University, Ramat-Gan, Israel

B.Sc. in Mathematics and Computer Science 2004
Bar-Ilan University, Ramat-Gan, Israel

Research Interests

Over-the-counter markets, credit risk and credit derivatives, financial frictions

Publications

1. "Non-Standard Errors", with Menkveld, Albert J., Anna Dreber, Felix Holzmeister, Juergen Huber, Magnus Johannesson, Michael Kirchler, Sebastian Neusss, Michael Razen, Utz Weitzel, and #FinCap Team, Journal of Finance Forthcoming.

2. "Liquidity regulations, bank lending and fire-sale risk", with Daniel Roberts and Asani Sarkar, Journal of Banking & Finance, 156 (2023): 107007.

3. "It's What You Say and What You Buy: A Holistic Evaluation of the Corporate Credit Facilities", with Nina Boyarchenko and Anna Kovner, Journal of Financial Economics 144, no. 3 (2022): 695-731.

4. "COVID Response: The Primary and Secondary Corporate Credit Facilities", with Nina Boyarchenko, Caren Cox, Richard Crump, Andrew Danzig, Anna Kovner, and Patrick Steiner, Economic Policy Review, 28, no. 1 (2022): 1-34.

5. "COVID Response: The Municipal Liquidity Facility", with Andrew F. Haughwout and Ben Hyman, forthcoming Economic Policy Review.

6. "Dealer Balance Sheets and Bond Liquidity Provision", with Tobias Adrian and Nina Boyarchenko, Journal of Monetary Economics, Volume 89, August 2017, pp 92-109.

7. "The Long and Short of It: The Post-Crisis Corporate CDS Market", with Nina Boyarchenko and Anna M. Costello, Economic Policy Review, 26:3, 2020.

8. "Dealer Liquidity Provision and the Breakdown of the Law of One Price: Evidence from the CDS-Bond Basis", with Jaewon Choi and Sean Seunghun Shin, Management Science 65, no. 9 (2019): 4100-4122.

    Top Journal Paper Award 2013, Korea-America Finance Association.

9. "Market Liquidity After the Financial Crisis", with Tobias Adrian, Michael Fleming, and Erik Vogt, Annual Review of Financial Economics 9, no. 1, 2017.

10. "Why Do Closed-End Bond Funds Exist? An Additional Explanation for the Growth in Domestic Closed-End Bond Funds", with Edwin J. Elton, Martin J. Gruber, Christopher R. Blake, Journal of Financial and Quantitative Analysis, Volume 48, Issue 2, 2013, pp 405-425.

11. "Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance, Chapter 13: Regulating OTC Derivatives", with Viral V. Acharya and Marti Subrahmanyam, edited by V. V. Acharya, T. Cooley, M. Richardson and I. Walter, John Wiley & Sons, November 2010.

Working Papers

1. "Dealer Capacity and U.S. Treasury Market Functionality", with Darrell Duffie, Michael J. Fleming, Frank M. Keane, Claire Nelson, and Peter Van Tassel, Federal Reserve Bank of New York Staff Reports 1070, October 2023.

    Arthur Warga Award for Best Paper in Fixed Income at SFS Cavalcade North America

2. "The Option Value of Municipal Liquidity: Evidence from Federal Lending Cutoffs during COVID-19", with Andrew F. Haughwout and Ben Hyman, Federal Reserve Bank of New York Staff Reports 988, October 2022.

    R&R AEJ Economic Policy

    Coverage: New York Times, Wall Street Journal, The Bond Buyer, Brookings

3. "The Netting Efficiencies of Marketwide Central Clearing", with Michael J. Fleming and Frank M. Keane, Federal Reserve Bank of New York Staff Reports 964, April 2021.

4. "Measuring Corporate Bond Market Dislocations", with Nina Boyarchenko, Richard K. Crump, and Anna Kovner, Federal Reserve Bank of New York Staff Reports 957, December 2022.

    R&R, Journal of Monetary Economics

5. "Alternative Trading Systems in the Corporate Bond Market", with Matthew Kozora, Bruce Mizrach, Matthew Peppe, and Jonathan Sokobin, Federal Reserve Bank of New York Staff Reports 938, August 2020.

6. "Flighty Liquidity", with Nina Boyarchenko and Domenico Giannone, Federal Reserve Bank of New York Staff Reports 870, October 2018, Revised March 2019.

7. "Credit Market Choice", with Nina Boyarchenko and Anna M. Costello, Federal Reserve Bank of New York Staff Reports 863, August 2018.

8. "Bank-Intermediated Arbitrage", with Nina Boyarchenko, Thomas M. Eisenbach, Pooja Gupta, and Peter Van Tassel, Federal Reserve Bank of New York Staff Reports 858, June 2018, Revised July 2020.

9. "Exposing The Exposed: Intermediation Capacity in the Credit Default Swap Market", December 2014.

Honors and Scholarships

Best Paper Prize, 2012 Current Topics in Financial Regulation Conference, hosted by the Mendoza College of Business, University of Notre Dame, First Runner-Up	2012
Morgan Stanley Prize for Excellence in Financial Markets, Second Runner-Up	2011
Paul Willensky Doctoral Fellowship, NYU Stern School of Business	2011-2012
Doctoral Fellowship, NYU Stern School of Business	2007-2011
Student Travel Grant, AFA	2010
Rector's Prize, Top 1% of the Mathematics Department, Bar-Ilan University	2003

Professional Experience

Oscar Gruss & Son, New York, NY 2005-2007
Research Analyst

Oscar Gruss & Son, Tel-Aviv, Israel 2004-2005
Research Associate

Bank Hapoalim, Tel-Aviv, Israel 2002
OTC and Custodian Transactions

Teaching Experience

Instructor, Foundations of Financial Markets (Undergraduate)
Leonard N. Stern School of Business, New York University. Summer 2010.
Overall Teaching Rating: 6.1 out of 7.0, Commendation for teaching excellence.

Teaching Assistant, Credit Risk (MBA and EMBA), Prof. Viral Acharya
Leonard N. Stern School of Business, New York University. Spring 2010, Spring 2011.

Instructor, Probability & Statistics (Undergraduate)
Department of Mathematics, Bar-Ilan University. Fall 2004.

Teaching Assistant, Numerical Analysis (Undergraduate), Prof. Jeremy Schiff
Department of Mathematics, Bar-Ilan University. Spring 2003.

Invited Presentations (excluding presentations by co-authors) & Discussions

2024: ASSA 2024 (Jan, discussion), NBER Financial Market Frictions and Systemic Risks (March), SFS 2024 (May), FIRS 2024 (expected, May), WFA 2024 (expected, June)
2023: Women in Market Microstructure 2023 (June, short presentation), 2023 Annual Bank of Canada Macro-Finance Conference (June, discussion)
2022: Women in Market Microstructure 2022 (June, discussion)
2021: 3rd Future of Financial Information Conference (May, discussion), FIRS 2021 (June, discussion), WFA 2021 (June, discussion), CICF 2021 (July, discussion), NBER Summer Institute (Jul), Conference on Implications of Federal Reserve Actions in Response to the COVID-19 Pandemic (Sep), FMA 2021 (Oct, discussion), Bank of England Research Workshop (Nov, discussion), CFE 2021 (Dec)
2019: NBER Summer Institute (Jul), EFA (Aug), 2nd Endless Summer Conference on Financial Intermediation and Corporate Finance (Sep)
2018: Financial Networks Conference at Columbia University (Feb), Manhattan College (Mar)
2017: London Quantitative Finance Seminar (May), FIRS (Jun), FSB AGV Workshop (June 2017), EFA 2017 (Aug), Workshop on Measurement and Control Systemic Risks in the Financial Sector (Sep), 13th Annual Central Bank Conference of the Microstructure of Financial Markets (Oct)
2016: NYU Marti G. Subrahmanyam Festschrift, Systemic risk in Derivatives Markets at LSE (Oct), Carnegie-Rochester-NYU Conference (Nov)
2015: Standard &Poor's Analytical Education Seminar
2014: FIRS 2014, WFA 2014, EFA 2014, 2014 Fixed Income Conference, CREDIT Conference 2014
2013: Copenhagen Business School; Early Career Women in Finance; AFA 2013 (discussion)
2012: Fisher College of Business, Ohio State University; W. P. Carey School of Business, Arizona State University; Robert H. Smith School of Business, University of Maryland; Board of Governors of the Federal Reserve System; U.S. Commodity Futures Trading Commission; College of Business, University of Illinois at Urbana-Champaign; Federal Reserve Bank of Chicago; Federal Reserve Bank of New York; Bendheim Center for Finance, Princeton University; The 2012 Current Topics in Financial Regulation Conference; Western Finance Association 2013; Queen Mary, University of London; Bank of England.

Refereeing

Journal of Finance, Journal of Financial Economics, Journal of Financial and Quantitative Analysis, Review of Finance, Review of Financial Studies, Journal of Banking and Finance

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Peter Van Tassel

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EXPERIENCE

Federal Reserve Bank of New York — New York, NY
- Financial Research Economist, Capital Markets — 2015 - 2023
- Visiting Scholar, Wharton School of Business, University of Pennsylvania — Fall 2020
- Visiting Scholar, Fuqua School of Business, Duke University — Fall 2016

• Research on financial economics and limits-to-arbitrage including option pricing, term-structure modeling, market microstructure and liquidity analysis, cost of capital estimation, and fixed income arbitrage; Policy analysis focusing on the U.S. Treasury and MBS markets

Goldman Sachs — New York, NY
- Analyst, Securities Division, Fixed Income Trading — 2008 - 2010
- Summer Analyst, Securities Division, Rotational Program — 2007

• Analyst program on the Emerging Markets trading desk and internship experience on the Interest Rate Products, Equity Structured Products, and Emerging Markets trading desks

EDUCATION

Princeton University — Princeton, NJ
- PH.D. in Economics — 2010 - 2015
- Honors: Princeton University Graduate Fellowship and Summer Fellowship

• Financial economics and econometrics; Dissertation on option pricing for merger and acquisition targets with applications for merger arbitrage, high frequency machine-readable news and stock return predictability, and high frequency econometric tests of asset pricing factor models

• Teaching assistant for Bendheim Center Masters in Finance classes on Fixed Income, Financial Derivatives, and Asian Capital Markets and math instructor for graduate students at the School of Public and International Affairs

Duke University — Durham, NC
- B.S. in Economics and Mathematics — 2004 - 2008
- Honors: *summa cum laude*, Phi Beta Kappa, Graduation with High Distinction in Economics

• Coursework on multivariate calculus, linear algebra, probability theory, ODEs, abstract algebra, real analysis (PhD), linear models (PhD), econometrics, mathematical finance, financial accounting; Dissertation on intraday patterns in volatility and high frequency jump statistics; Study abroad at the London School of Economics and Duke in Madrid

SELECTED RESEARCH

Dealer Capacity and U.S. Treasury Market Functionality, *FRBNY Staff Report*, August 2023
Risk-Free Rates and Convenience Yields Around the World, *FRBNY Staff Report*, 2023
Short-Dated Term Premia and the Level of Inflation, *LSE Blog*, 2022
Equity Volatility Term Premia, *FRBNY Staff Report*, 2022
Evaluating Regulatory Reform: Banks' Cost of Capital and Lending, *JMCB*, 2021
The Law of One Price in Equity Volatility Markets, *FRBNY Staff Report*, 2020
Treasury Market When-Issued Trading Activity, *LSE Blog*, 2020
The COVID-19 Pandemic and the Fed's Response, *LSE Blog*, 2020
Bank-Intermediated Arbitrage, *FRBNY Staff Report*, 2020
The Low Volatility Puzzle: Are Investors Complacent?, *LSE Blog*, 2017
Global Variance Term Premia and Intermediary Risk Appetite, *FRBNY Staff Report*, 2016
Merger Options and Risk Arbitrage, *FRBNY Staff Report*, 2016
Essays on Financial Economics, *PH.D. Dissertation*, September 2015

TECHNICAL SKILLS

Matlab, Python, Stata, SAS, SQL, R, Mathematica, LaTeX, MS Office

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EDUCATION

Stanford University *2022-present*
Department of Economics
PhD student

University of Cambridge *2022*
Christ's College, Cambridge
MPhil in Economic Research (Distinction)

University of Oxford *2020*
Corpus Christi College, Oxford
BA in Philosophy, Politics and Economics (First)

WORKING PAPERS

"Cointegration with Occasionally Binding Constraints" (with James A. Duffy and Sophocles Mavroeidis). July 2023.
Arxiv link: https://arxiv.org/abs/2211.09604

"Stationarity with Occasionally Binding Constraints" (with James A. Duffy and Sophocles Mavroeidis). July 2023.
Arxiv link: https://arxiv.org/abs/2307.06190

AWARDS AND SCHOLARSHIPS

George Webb Medley undergraduate thesis prize. University of Oxford Department of Economics. 2020.

Scholarship. Corpus Christi College, Oxford. 2018.