

# Reca Daetwyler Sarfati

## Education

- Aug. 2020 - **Massachusetts Institute of Technology**, *Joint Ph.D., Economics and Statistics*.  
▶ National Science Foundation Graduate Research Fellowship, MIT Graduate Fellowship
- 2014 - 2018 **Brown University**, *Sc.B., Mathematics and Computer Science*.  
Phi Beta Kappa, Sigma Xi, magna cum laude  
▶ *Senior Capstone*: “Strategic Bidding and Value Querying in Ascending Combinatorial Auctions”  
*Advisor*: Professor Amy Greenwald, Computer Science
- 2018 - 2020 **New York University**, *Graduate Coursework in Mathematics and Economics*.

## Personal

- Citizenship United States, Switzerland.  
Interests Econometrics, Development, Industrial Organization, Trade, Market Design, Computation.

## Publications

- Sep. 2020 **Online Estimation of DSGE Models**, *The Econometrics Journal*, with Michael Cai, Marco Del Negro, Edward Herbst, Ethan Matlin, and Frank Schorfheide.

This paper illustrates the usefulness of sequential Monte Carlo (SMC) methods in approximating DSGE model posterior distributions. We show how the tempering schedule can be chosen adaptively, explore the benefits of an SMC variant we devise termed generalized tempering for “online” estimation, and provide examples of multimodal posteriors well-captured by SMC methods. We then use our online estimation technique to compute pseudo-out-of-sample density forecasts of DSGE models with and without financial frictions, documenting the benefits of conditioning DSGE model forecasts on nowcasts of macroeconomic variables and interest rate expectations.

- ▶ *Presented*: European Seminar on Bayesian Econometrics (St. Andrews, Scotland, Sep. 3-4, 2019), System Committee on Econometrics (Philly Fed, Sep. 25-26, 2019), Forecasting at Central Banks Conference (Bank of Canada, Oct. 3-4, 2019), Conference on Computational and Financial Econometrics (University of London, Dec. 14-16, 2019).

## Working Papers

- 2020 **Estimating HANK: Macro Time Series and Micro Moments**, with Sushant Acharya, Michael Cai, Marco Del Negro, Keshav Dogra, and Ethan Matlin.

We show how to use sequential Monte Carlo methods to estimate a heterogeneous agent New Keynesian (HANK) model featuring both nominal and real rigidities. We demonstrate how the posterior distribution may be specified as the product of the standard macro time series likelihood and a prior enforcing several steady state distributional moments, including the average marginal propensity to consume (MPC) and fraction of agents with zero liquid wealth. Using this framework, we ask whether there exists a tension between fitting macroeconomic time series and distributional moments of interest, ultimately finding there is none. For instance, even after relaxing the prior, the posterior based solely on macro time series features an MPC well below one, broadly in line with existing micro evidence.

- ▶ *Presented*: Society for Economic Dynamics 2020 (Barcelona, Spain, Jun. 21-23, 2021), The Econometric Society and Bocconi University World Congress (Virtual, Aug 17 - 21, 2020), 20th IWH Macroeconometric Workshop (Halle, Germany on Oct. 29-30, 2019), New York Fed/Hong Kong Monetary Authority Conference on “Monetary Policy and Heterogeneity” (Hong Kong, May 23-24, 2019).

- 2019 **Learning Correlated Equilibria in Extensive-Form Games**, with Amy Greenwald.

We formalize an efficient class of counterfactual regret minimization algorithms exploiting the “sequence form” to compute “ $\Phi$ -equilibria” – a generalized class of equilibrium concepts defined within general-sum extensive-form games of imperfect information. We develop increasingly strong notions of no-regret, mapping those notions directly onto concepts of interest, such as agent- and extensive-form correlated and coarse correlated equilibria.

- ▶ *Presented*: 34th AAAI Conference on Artificial Intelligence, *Reinforcement Learning in Games* (Feb. 8, 2020).

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## Conference Papers in Computer Science

Dec. 2021 **[Hindsight and Sequential Rationality of Correlated Play](#)**, *Proceedings of 35th AAAI Conference on Artificial Intelligence*, Dustin Morrill, Ryan D'Orazio, Reza Sarfati, Marc Lanctot, Michael Bowling, Amy Greenwald, James Wright.

Driven by recent successes in two-player, zero-sum game solving and playing, artificial intelligence work on games has increasingly focused on algorithms that produce equilibrium-based strategies. However, this approach has been less effective at producing competent players in general-sum games or those with more than two players. An appealing alternative is to consider adaptive algorithms that ensure strong performance in hindsight relative to what could have been achieved with modified behavior. This approach also leads to a game-theoretic analysis, but in the correlated play that arises from learning dynamics rather than factored equilibrium behavior. We develop and advocate for this hindsight rationality framing of learning in general sequential decision-making settings. To this end, we re-examine mediated equilibrium and deviation types in extensive-form games, thereby gaining a more complete understanding and resolving past misconceptions. We present a set of examples illustrating the distinct strengths and weaknesses of each type of equilibrium in the literature, and proving that none subsumes all others. This line of inquiry culminates in the definition of the deviation and equilibrium classes that correspond to algorithms in the counterfactual regret minimization (CFR) family, relating them to all others in the literature. Examining CFR in greater detail further leads to a new recursive definition of rationality in correlated play that extends sequential rationality in a way that naturally applies to hindsight evaluation.

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## Authored Software

Summer 2019 **Sequential Monte Carlo**, *Package (Julia)*.

Coauthored Julia-licensed package, [SMC.jl](#), implementing sequential Monte Carlo sampling methods for the approximation of posterior distributions. Optimized memory allocation to rival Fortran speeds for distributed computation.

Spring 2019 **Sparse Automatic Differentiation**, *Package (Julia)*.

Wrote extension to Julia package, [ForwardDiff.jl](#), to exploit sparsity of data structures during forward automatic differentiation (useful for differentiation of functions  $f : \mathbb{R}^n \rightarrow \mathbb{R}^m$  when  $n \ll m$ ). This modification more than halves the runtime of solution algorithms for various continuous-time HANK models.

Spring 2018 **Extensive-Form Games**, *Library (Python)*.

Developed library in Python for specification and conversion of games between normal, extensive, and sequence form representations. Implemented reinforcement learning algorithms to compute various correlated equilibrium concepts.

Summer 2017 **Tempered Particle Filter**, *Package (Julia)*.

Implemented self-tuning tempered particle filter from [Herbst and Schorfheide, \(2017\)](#) for likelihood evaluation of non-linear models with non-Gaussian innovations. Integrated code into the NY Fed's package of filtering and smoothing routines for state-space models, [StateSpaceRoutines.jl](#).

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## Research Assistance

2020 - 2022 **Research Assistant for Glenn and Sara Fisher Ellison**, *MIT Economics Department*.

2018 - 2020 **Research Assistant for Marco Del Negro & Andrea Tambalotti**, *Federal Reserve Bank of New York, Macroeconomic and Monetary Studies Section*.

Assisted the dynamic stochastic general equilibrium (DSGE) team with academic research, policy analysis, forecasting, and model development. Extended and maintained the [DSGE.jl](#) package (in the Julia programming language) for solving, estimating, and forecasting DSGE models. (Julia, MATLAB, Fortran, Stata)

2017 - 2020 **Research Assistant for Amy Greenwald**, *Brown University Computer Science Department*.

2017 - 2018 **Research Assistant for Jesse Shapiro**, *Brown University Economics Department*.

2016 - 2017 **Research Assistant for Louis Putterman**, *Brown University Social Science Experimental Laboratory*.

2015 **U.S. Consulate Guangzhou, China**, *Summer Analyst in Foreign Commercial Service, Consular Sections*.

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## Teaching Experience

Fall 2022 **Firms, Markets, Trade and Growth**, *Teaching Assistant*, MIT Economics Department.

[14.76/760](#) (*Master's in Development Policy*)

Fall 2022 **Estimation and Inference for Linear Causal and Structural Models**, *Teaching Assistant*, MIT Economics Department.

[14.381](#) (*PhD Core, Pt. II*)

- Fall 2022 **Economics and Society's Toughest Problems**, *Teaching Assistant*, MIT Economics Department.  
[14.009 \(Undergraduate\)](#)
- Fall 2017 **Design and Analysis of Algorithms**, *Teaching Assistant*, Brown Computer Science Department.  
[CSCI 1570 \(Undergraduate\)](#)
- Spring 2017 **Algorithms and Data Structures**, *Teaching Assistant*, Brown Computer Science Department.  
[CSCI 0160 \(Undergraduate\)](#)
- Summer 2016 **{Statistics, Economics} for Public Policy**, *Economics Tutor*, Brown Economics Department.  
[PLCY 2455, 2460 \(Master's in Public Affairs\)](#)

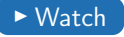
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## Honors and Grants

- 2020 - 2025 **National Science Foundation**, *Graduate Research Fellowship*.
- 2020 - 2025 **Massachusetts Institute of Technology (MIT)**, *Graduate Fellowship*.
- Mar. 2019 **National Science Foundation**, *XSEDE Research Allocation Grant, SES #190003*.  
▶ “Estimating Heterogeneous Agent Dynamic Stochastic General Equilibrium Models using Sequential Monte Carlo”
- Mar. 2019 **Vault Recognition Award**, *Federal Reserve Bank of New York*.
- 2016 - 2018 **JPMorgan Chase Research Assistantship Award for Research in Economics**, *Brown University*.
- Dec. 2017 **Women of Computer Science '84 Undergraduate Teaching Assistant Award**, *Brown University*.
- May 2018 **Phi Beta Kappa**, *Brown University*.
- May 2018 **Sigma Xi**, *Brown University*.
- May 2018 **Magna cum laude**, *Brown University*.

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## Speaking and Presentations

- Jun. 2019 **JuliaCon 2019**, *Heterogeneous Agent Dynamic Stochastic General Equilibrium (DSGE) Models in Julia at the Federal Reserve Bank of New York*, University of Maryland, Baltimore.  
 [▶ Watch](#)  
Invited and awarded full funding to present at annual conference for developers in the Julia programming language. Delivered 30-minute talk on my team's work implementing tools for the solution and estimation of heterogeneous agent models to an audience of academics and practitioners from a range of computational disciplines.
- Jul. 2019 **Federal Reserve Bank of New York**, *Intro to Git and Version Control; Intro to Database Management and SQL; Coding Best Practices; Intro to Julia*.

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## Articles/Blog Posts

- Jun. 19, 2020 **Liberty Street Economics**, [The New York Fed DSGE Model Forecast: June 2020](#), with William Chen, Marco Del Negro, and Ethan Matlin.
- Jun. 19, 2020 **Liberty Street Economics**, [The New York Fed DSGE Model Forecast: March 2020](#), with Ozge Akinci, William Chen, Marco Del Negro, and Ethan Matlin.
- Dec. 20, 2019 **Liberty Street Economics**, [The New York Fed DSGE Model Forecast: December 2019](#), with William Chen, Marco Del Negro, Ethan Matlin, and Andrea Tambalotti.
- Sep. 30, 2019 **Liberty Street Economics**, [The New York Fed DSGE Model Forecast: September 2019](#), with Ozge Akinci, William Chen, Marco Del Negro, and Ethan Matlin.
- Sep. 4, 2019 **Liberty Street Economics**, [Online Estimation of DSGE Models](#), with Michael Cai, Marco Del Negro, Ethan Matlin, and Frank Schorfheide.
- Jun. 21, 2019 **Liberty Street Economics**, [The New York Fed DSGE Model Forecast: June 2019](#), with Sushant Acharya, Michael Cai, Marco Del Negro, and Ethan Matlin.
- Feb. 8, 2019 **Liberty Street Economics**, [The New York Fed DSGE Model Forecast: January 2019](#), with Marco Del Negro, Michael Cai, and Ethan Matlin.
- Oct. 24, 2018 **Liberty Street Economics**, [The New York Fed DSGE Model Forecast: October 2018](#), with Marco Del Negro, Argia Sbordone, Michael Cai, and Ethan Matlin.

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## Other Activities

- 2022 - **MIT Graduate Economics Association (GEA)**, *Co-President*.
- 2022 - **MIT Graduate Student Union**, *Bargaining Committee Representative for Economics Department*.
- 2021 - 2022 **MIT Graduate Economics Association (GEA)**, *Treasurer*.
- 2020 - 2022 **Harvard College Debating Union**, *Debate Coach*.  
Coached top-ranked national collegiate debate team in American and British Parliamentary formats.
- May 2018 **4th Place, American Parliamentary Debate National Championships**, *Johns Hopkins University*.
- Jan. 2018 **Top 6% Speaker, World Universities Debating Championships**, *Mexico City, Mexico*.
- May 2017 **The Ratcliffe Hicks Prize for Excellence in Debate**, *Brown University*.
- 2014 - 2018 **Brown Debating Union**, *Vice President of Operations, Vice President of Finance, Varsity Debater*.  
Managed logistics and budget of over \$20,000 for 2nd-ranked (2016-2018) debating union in the nation.

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## Technical Skills

- **Programming Languages:** *Expert:* Julia, MATLAB, Python, Java, SQL, z-Tree. *Extensive Use:* C/C++, Fortran, R, Stata, Lisp, Racket. *Familiar:* EViews, Visual Basic, x86-64.
- **Scripting/Typesetting Languages:** Shell Script, JavaScript (incl. D3.js, Node.js), HTML, Pyret, Markdown, L<sup>A</sup>T<sub>E</sub>X.
- **Computing Skills:** Git, high performance distributed computing and parallel processing (MPI, SGE, Slurm), GPU programming, sparse numerical techniques.
- **Clusters:** NY Fed Research Access Network, UT Dallas BigTex, Bridges PSC, Indiana/TACC Jetstream (XSEDE).
- **Operating Systems/Software:** Linux, Mac OS, Windows, Maya, SolidWorks, CAD.

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## Personal

- **Endorphin Release:** Debate/oration, comics, oil painting, film, programming language design, biking, modernism, rugby.
- **Places I've Called Home:** Seoul, South Korea; Manila, Philippines; Vienna, Austria; Kingston, Jamaica; Düsseldorf, Germany; Guangzhou, China; Sydney, Australia.
- **Born:** Berkeley, CA.

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