# Introduction to Perspectives on Computational Analysis (Autumn 2018)

**Dr. Richard W. Evans**

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# Evans, TA's, and You

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## Introduce yourselves

- Name
- Nationality
- Previous university
- field of emphasis

# Evans at UChicago

## My three hats at UChicago

- Senior Lecturer, MACSS program
- Director, Open Source Macroeconomics Laboratory
- Fellow, Becker Friedman Institute

**My research and policy focus**

- Macroeconomics, Public Economics, Computational Economics
- Research in large macroeconomic models of tax policy
- Open source fiscal modeling

# Long Winding Road

- Undergraduate Economics at Brigham Young University in Provo, Utah
- Research associate at economics consulting firm in Salt Lake City, Utah.
- M.A. in Public Policy from Brigham Young University
- R.A. for Booth Center for Population Economics
- R.A. on Joint Economic Committee of U.S. Congress
- PhD econ program at Univ. Texas at Austin
- Dissertation intern at Federal Reserve Bank of Dallas
- Assistant Professor, Brigham Young University
- Senior Lecturer, University of Chicago

# My Current Projects

- OG-USA: Large scale macroeconomic model of U.S. fiscal policy
- OG-ITA (European Commission): Large scale macroeconomic model of Italy
- OG-India: Large-scale macroeconomic model of India
- Tax-Calculator: microsimulation model of U.S. tax policy
- Connecticut tax simulator
- IRS Machine Learning to replicate human editing
- IRS synthetic data

# MACSS Program Overview

# Overview of Program by year

**2018-2019**

| | Perspectives | Elective | CS/Elective | Workshop |
|---|---|---|---|---|
| **Autumn** | Analysis | elective | 121/elective | Workshop |
| **Winter** | Modeling | elective | 122/elective | Workshop |
| **Spring** | Research | elective | 123/elective | Workshop |
| **Summer** | R.A./ internship | | | |

**2019-2020**

| | Elective | Elective | Thesis/elect | Workshop |
|---|---|---|---|---|
| **Autumn** | elective | elective | thesis | Workshop |
| **Winter** | elective | elective | thesis | Workshop |
| **Spring** | elective | elective | thesis | Workshop |
| **Summer** | Graduate | | | |

# What best students do

- Attend class
- Submit all assignments on time, regardless of completeness
- Visit TA and Instructor office hours
- Work in groups
- Take time to teach others
- Participate in workshop (not just attend)
- Look for other workshops to attend
- Cultivate relationships with other professors

# MACSS 30000: Perspectives on Computational Analysis (syllabus)

# Theme of Course

- Practical survey of approaches
- Tons of data (don't say "Big Data")
- Increased computation power
- Social Science theory advancing
- Put together data science and academic rigor

**Academic, Public, and Private Sectors**

This approach is new, somewhat unique, and is valuable in the Academic, Public, and Private sectors.

# Example: Wu, Wang, Evans 2018

Wu, Lingfei, Dashun Wang, and James A. Evans, "Large Teams Have Developed Science and Technology; Small Teams Have Disrupted It," working paper, 2018. [link here]

- Use network analysis
- Advanced language processing for scraping information from 50 million papers
- Large data methods

# Example: Wu, Wang, Evans 2018

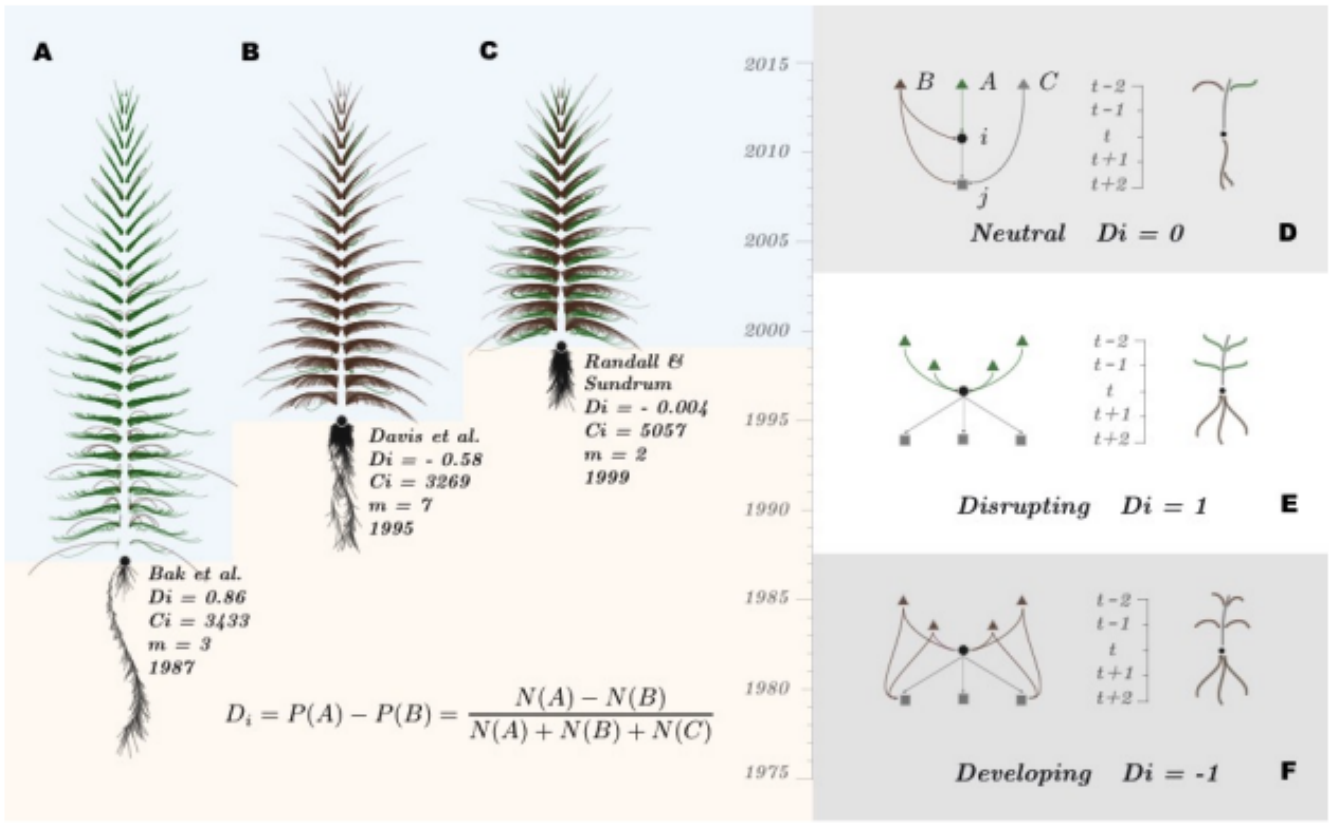



**Fig. 1. Disruptive and developmental papers. (A - C)** Three articles of the same impact scale $C_i$ represented as citation trees illustrate how disruption measure $D_i$ distinguishes different contributions to science and technology. "Self-organized criticality: An

# Example: Wu, Wang, Evans 2018

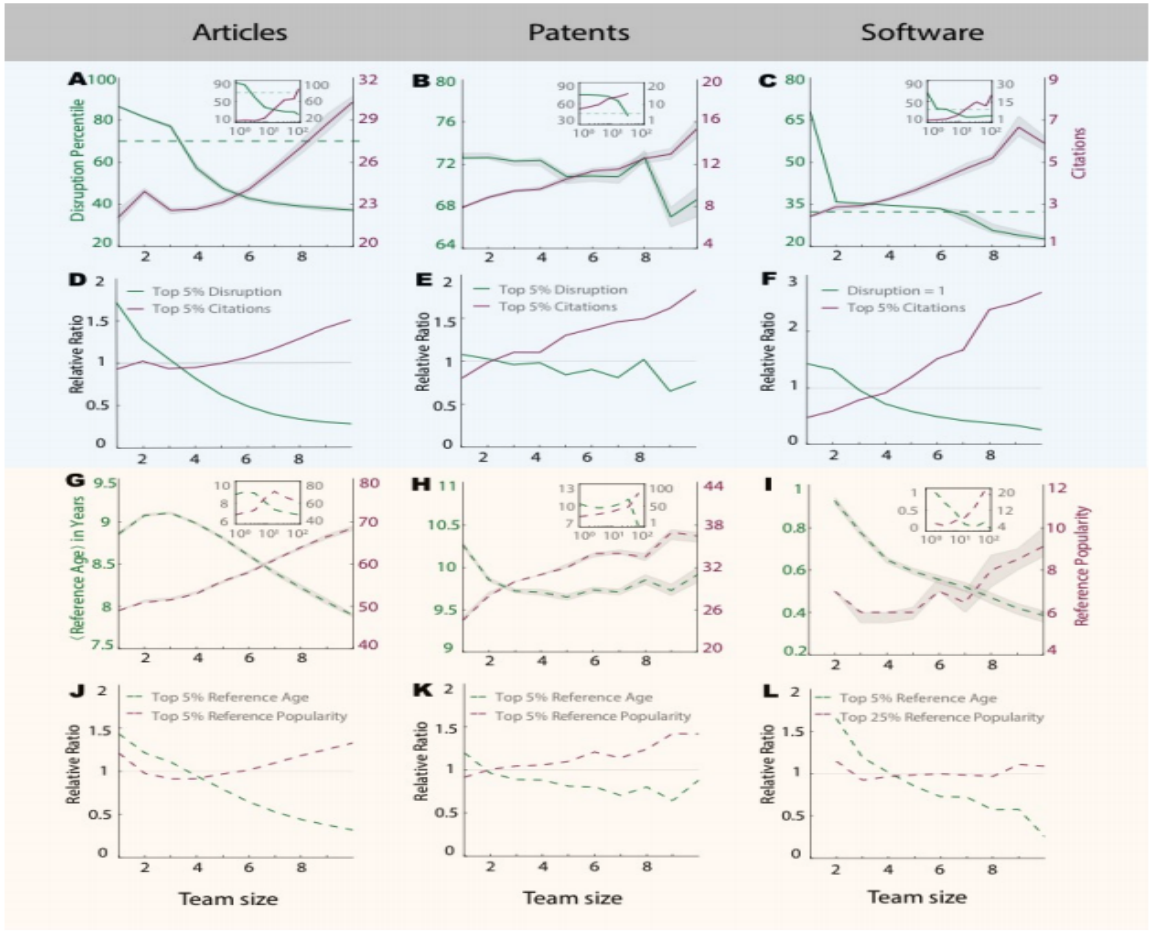
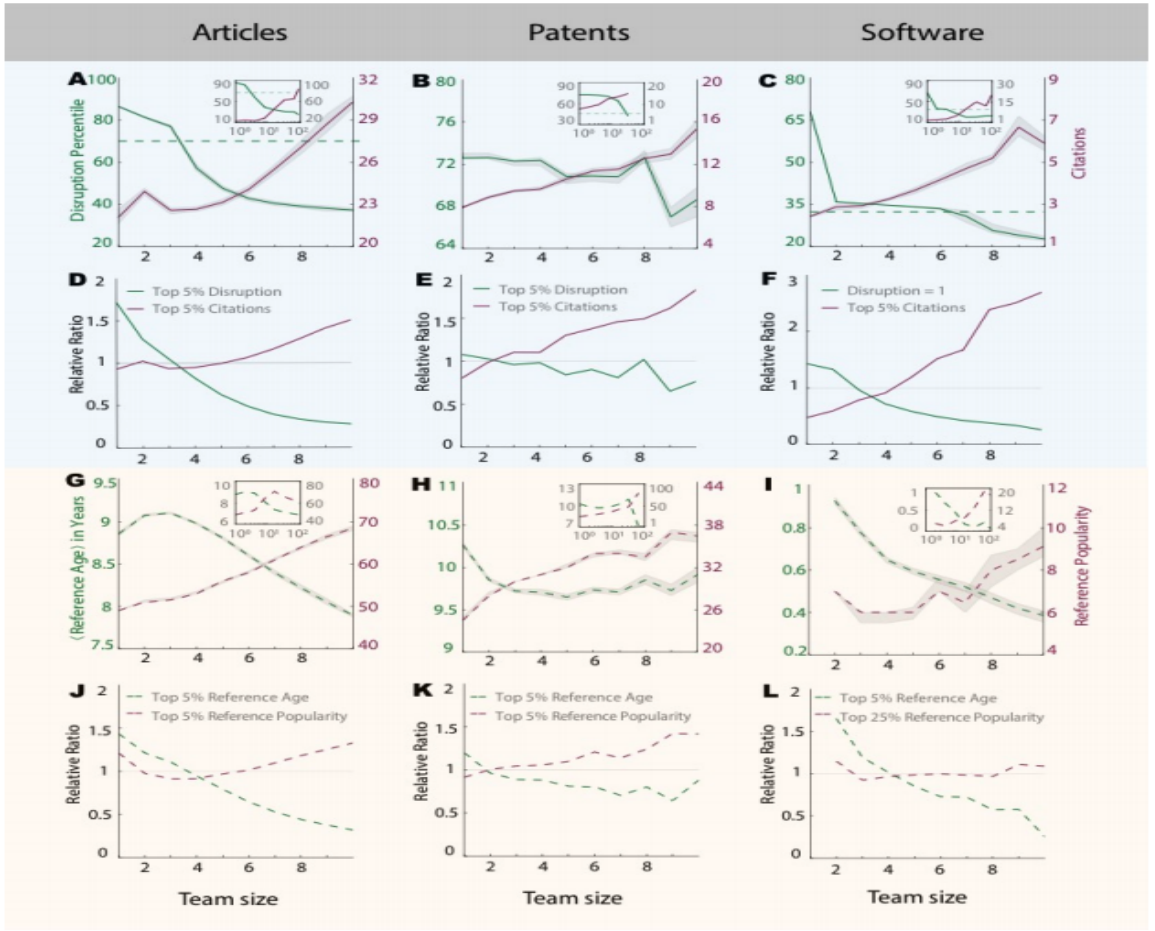



**Figure 2. Small teams disrupt, big teams develop.** (A - C) For research articles, patents, and software, average citations (red curves indexed by right y-axis) increase with

# Example: Wu, Wang, Evans 2018

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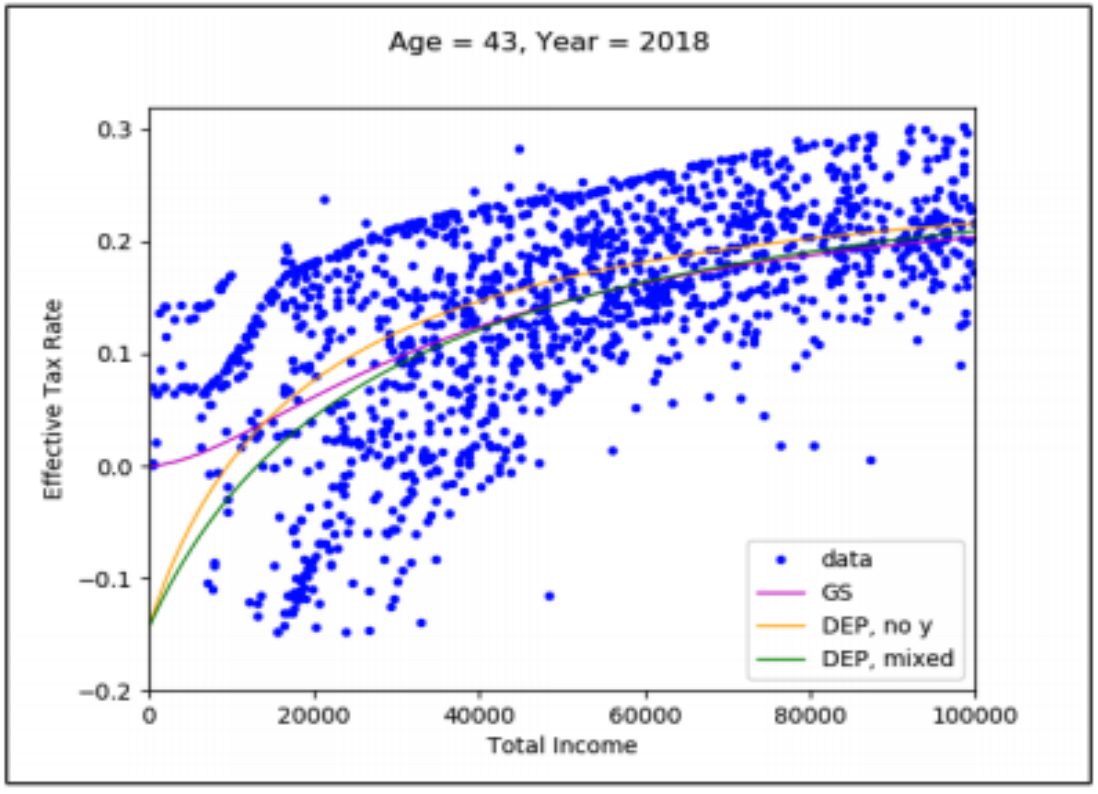
# Example: DeBacker, Evans, Phillips 2018

DeBacker, Jason and Richard W. Evans and Kerk L. Phillips, "Integrating Microsimulation Models of Tax Policy into a DGE Macroeconomics Framework," *Public Finance Review*, forthcoming. [link to paper]

- Use large loop over estimation routines to estimate 2,400 tax functions: 3 functions, 80 ages, 10 years
- Multi stage fixed point algorithm to solve large system of nonlinear dynamic equations
- Show that TCJA increase debt, cost the poor more than the rich, negative effects show up in 8 years

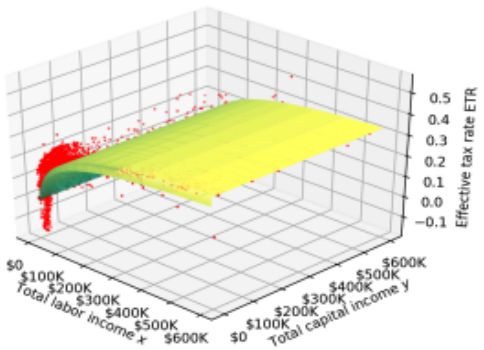
# Example: DeBacker, Evans, Phillips 2018

**Figure 4: Plot of estimated $ETR$ functions: $t = 2018$ and $s = 43$ under current law**

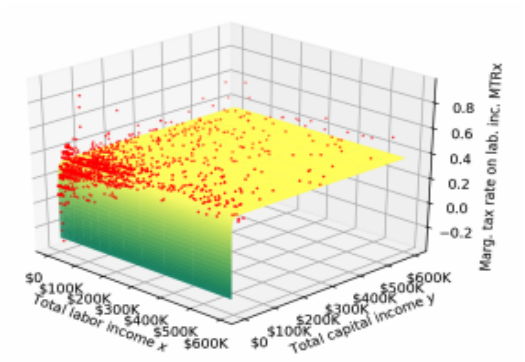


# Example: DeBacker, Evans, Phillips 2018

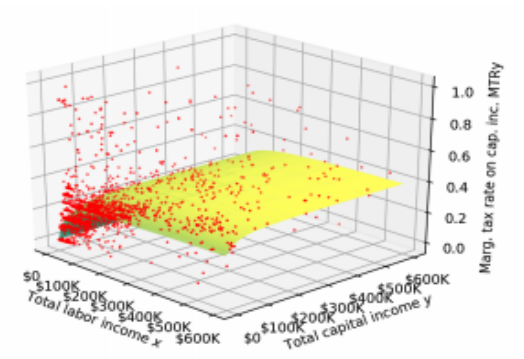
**Figure 3: Estimated tax rate functions of ETR, MTRx, MTRy, and histogram as functions of labor income and capital income from microsimulation model: $year = 2018$ and $age = 43$ under current law**



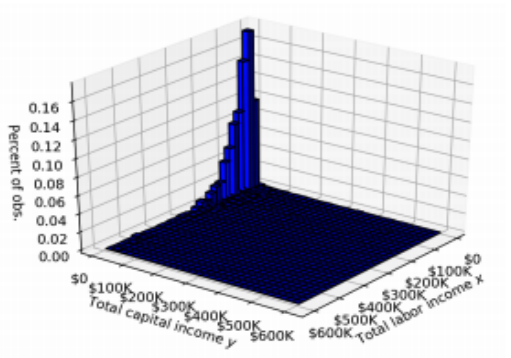

**(a)** Effective tax rates ($ETR$)




**(b)** Marginal tax rates on labor income ($MTRx$)




**(c)** Marginal tax rates on capital income ($MTRy$)




**(d)** Histogram

Note: The axes in the histogram in Figure 3d have been rotated relative to the other three plots in order to see the distribution more clearly.

# Example: Gopalan, 2018

Gopalan, Sushmita, "Predicting Infant Mortality: Minimizing False Negatives," working paper, 2018.

- Use statistical learning model to train algorithm to better predict infant mortality
- Increased predictive accuracy: false negative rate from 74% to 7%.