# Introducing the Computational Economics "Algorithmic Repository and toolKit"

github.com/econ-ark

Generic Presentation

May 4, 2018

# Goal: Tool like DYNARE for Models With Heterogeneity

Provide state-of-the-art set of tools for:

1. Solving dynamic stochastic optimization problems
   - 'Hard' Bellman problems with uncertainty, 'kinks,' nonconvexities
2. Simulate behavior of populations of agents
3. Finding equilibria for markets/economies populated by such agents

# What Is It Good For?

- Heterogeneous Agent Macro Models
  - Original name: **H**eterogeneous **A**gent **R**esources and tool**K**it
  - HARK!
- Structural Micro Models (e.g., labor, health)
- IO models with equilibrim between consumer agents and firm agents
  - Unlike Noah's, our ARK can hold more than two of each kind!
  - Ultimate goal: Get examples on the ARK of all types of animal (model)

# Why Have We Created It?

Micro Structural Modeling 2017 $\approx$ Econometrics circa 1970

- Lots of theoretical results
- Actual applications must be hand crafted at enormous cost
  - 1970 econometrics: Write your own matrix inversion package!
  - 2017 structural: Write your own numerical convergence alogrithms
- Lots of reinventing of the wheel
- Progress is very slow

# Goals

Make it *much* easier:

- To get started doing structural Heterogeneous Agent modeling
- To teach (with hands-on, problem-set-assignable exercises)
- To *compare* models to each other
- To add new capabilities
- To mix-and-match components/modules/agent types

Remove the excuse 'Structural model was not worth the effort'

# How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
  - AstroPy
  - Statistics: 'R' and the Journal of Statistical Software
  - Many open-source resources in other sci/tech fields

# Now: HA Structural Modeling Is Alchemy Not Chemistry

... for outsiders: Magic

- This is unfair: Alchemists *tried* to hide their methods

Need to make it 'normal science':

- Transparent, reproducible
- *easy* (not hard) to 'stand on the shoulder of giants'

# Github=Gutenberg

Suite of powerful modern tools developed by software engineers:

- Almost-Automatic Integrated Documentation
- Robust Built-In Testing
- Continuous Integration
- Version Control
- Object-Oriented Programming (Python!)
- Integrated Development Environments
- Apache License
- ...

# Will We Succeed?

A *lot* of enthusiasm from deep-pocketed policy institutions

- CFPB - Lion's Share of the Credit For Getting Here
  - Hired CDC As Chief Economist
    - On Specific Premise that Toolkit Would Be Priority
  - Hired MNW (leave of absence from UDel) To Create It
- Central Banks
  - So far: Fed (Board and Banks), ECB, BoE, RBA, RBNZ
- IMF
- OFR

# References I

Carroll, Christopher D., Jiri Slacalek, Kiichi Tokuoka, and Matthew N. White (2017): "The Distribution of Wealth and the Marginal Propensity to Consume," *Quantitative Economics*, 8, 977–1020, At http://econ.jhu.edu/people/ccarroll/papers/cstwMPC.