

Introducing the Econ-ARK: Economics “Algorithmic Repository and toolKit”

Minicourse by Chris Carroll and Matt White at
Goethe University
SAFE

May 28-29, 2018

Goal: Tool like DYNARE for Models With Heterogeneity

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- 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

Who Has Produced It?

Name	TLA	Affiliation
<i>Christopher D Carroll</i>	CDC	JHU, CFPB
<i>David C Low</i>	DCL	CFPB
<i>Nathan M Palmer</i>	NMP	OFR
<i>Matthew N White</i>	MNW	UDel, CFPB
<i>Alex Kaufman</i>	ABK	CFPB → Princeton

Nothing herein may be interpreted as reflecting opinions of

- CFPB - United States Consumer Financial Protection Bureau
- JHU - Johns Hopkins University
- IMF - International Monetary Fund
- OFR - Office of Financial Research, U.S. Treasury
- UDel - University of Delaware

Just Received Big Grant from Alfred P. Sloan Foundation!

Three Years

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- Hire Programmers, RA's, Open Source Project Managers, etc etc

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- IO models with equilibrium between consumer agents and firm agents

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

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Run our demonstration notebooks using [MyBinder](#)

References I

- BLANCHARD, OLIVIER (2016): "Do DSGE Models Have a Future?," Discussion paper, Petersen Institute for International Economics, Available at <https://piie.com/system/files/documents/pb16-11.pdf>.
- COEURE, BENOIT (2013): "The relevance of household-level data for monetary policy and financial stability analysis," .
- HALDANE, ANDY (2016): "The Dappled World," Discussion paper, Bank of England, Available at <http://www.bankofengland.co.uk/publications/Pages/speeches/2016/937.aspx>.
- SUMMERS, LAWRENCE H. (2011): "Larry Summers and Martin Wolf on New Economic Thinking," *Financial Times interview*, <http://larrysummers.com/commentary/speeches/brenton-woods-speech/>.
- YELLEN, JANET (2016): "Macroeconomic Research After the Crisis," Available at <https://www.federalreserve.gov/newsevents/speech/yellen20161014a.htm>.