

# Introducing the Computational Economics “Algorithmic Repository and toolKit” [github.com/econ-ark](https://github.com/econ-ark)

Presentation by Chris Carroll at Conference on  
Computation in Economics and Finance (CEF), Bordeaux

June, 2016

# What Is It?

State-of-the-art set of tools for:

# What Is It?

State-of-the-art set of tools for:

- 1 Simulating behavior of populations of agents

# What Is It?

State-of-the-art set of tools for:

- 1 Simulating behavior of populations of agents
- 2 Solving dynamic stochastic optimization problems

# What Is It?

State-of-the-art set of tools for:

- ① Simulating behavior of populations of agents
- ② Solving dynamic stochastic optimization problems
  - Particularly adapted for Bellman problems with 'kinks' and quirks

# What Is It Good For?

- Heterogeneous Agent Macro Models

# What Is It Good For?

- Heterogeneous Agent Macro Models
  - Original name: **H**eterogeneous **A**gent **R**esources and tool**K**it

# What Is It Good For?

- Heterogeneous Agent Macro Models
  - Original name: **H**eterogeneous **A**gent **R**esources and tool**K**it
  - HARK!



# 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)

# 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 optimizing consumers and firms

# 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 optimizing consumers and firms
- **N**ot **O**nly **A**bout **H**eterogeneous stuff ...

# 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 optimizing consumers and firms
- **N**ot **O**nly **A**bout **H**eterogeneous stuff ...
- ... **A**lgorithmic **R**esources and tool**K**it

# 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 optimizing consumers and firms
- **N**ot **O**nly **A**bout **H**eterogeneous stuff ...
- ... **A**lgorithmic **R**esources and tool**K**it
- :-)

# 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 optimizing consumers and firms
- **N**ot **O**nly **A**bout **H**eterogeneous stuff ...
- ... **A**lgorithmic **R**esources and tool**K**it
- :-)
  - Unlike Noah's, our ARK can hold more than two of each kind!

# 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 optimizing consumers and firms
- **N**ot **O**nly **A**bout **H**eterogeneous stuff ...
- ... **A**lgorithmic **R**esources and tool**K**it
- :-)
  - 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)

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are



# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- 2 [github.com/econ-ark](https://github.com/econ-ark/HARK)/HARK is a “public repo”

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- ① Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- ② [github.com/econ-ark](https://github.com/econ-ark)/HARK is a “public repo”
  - Contains all existing code

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- 2 [github.com/econ-ark](https://github.com/econ-ark)/HARK is a "public repo"
  - Contains all existing code
- 3 [github.com/econ-ark](https://github.com/econ-ark)/HARK/Documentation/NARK.pdf

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- 2 [github.com/econ-ark](https://github.com/econ-ark)/HARK is a "public repo"
  - Contains all existing code
- 3 [github.com/econ-ark](https://github.com/econ-ark)/HARK/Documentation/NARK.pdf
  - Describes variable naming conventions for easy workflow:

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- ① Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- ② [github.com/econ-ark](https://github.com/econ-ark)/HARK is a “public repo”
  - Contains all existing code
- ③ [github.com/econ-ark](https://github.com/econ-ark)/HARK/Documentation/NARK.pdf
  - Describes variable naming conventions for easy workflow:
  - LaTeX object definitions correspond to HARK definitions

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- 2 [github.com/econ-ark](https://github.com/econ-ark)/HARK is a “public repo”
  - Contains all existing code
- 3 [github.com/econ-ark](https://github.com/econ-ark)/HARK/Documentation/NARK.pdf
  - Describes variable naming conventions for easy workflow:
  - LaTeX object definitions correspond to HARK definitions
- 4 Similar structure will be used for future contributions



# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- ① Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- ② [github.com/econ-ark](https://github.com/econ-ark)/HARK is a “public repo”
  - Contains all existing code
- ③ [github.com/econ-ark](https://github.com/econ-ark)/HARK/Documentation/NARK.pdf
  - Describes variable naming conventions for easy workflow:
  - LaTeX object definitions correspond to HARK definitions
- ④ Similar structure will be used for future contributions
  - **A**gent **A**rchive **R**epository **D**eposit **V**ehicle for ARK?

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- 2 [github.com/econ-ark](https://github.com/econ-ark)/HARK is a "public repo"
  - Contains all existing code
- 3 [github.com/econ-ark](https://github.com/econ-ark/HARK/Documentation/NARK.pdf)/HARK/Documentation/NARK.pdf
  - Describes variable naming conventions for easy workflow:
  - LaTeX object definitions correspond to HARK definitions
- 4 Similar structure will be used for future contributions
  - **A**gent **A**rchive **R**epository **D**eposit **V**ehicle for ARK?
- 5 Instructions for cloning are in the README.txt

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- 2 [github.com/econ-ark](https://github.com/econ-ark)/HARK is a "public repo"
  - Contains all existing code
- 3 [github.com/econ-ark](https://github.com/econ-ark/HARK/Documentation/NARK.pdf)/HARK/Documentation/NARK.pdf
  - Describes variable naming conventions for easy workflow:
  - LaTeX object definitions correspond to HARK definitions
- 4 Similar structure will be used for future contributions
  - **A**gent **A**rchive **R**epository **D**eposit **V**ehicle for ARK?
- 5 Instructions for cloning are in the README.txt
- 6 You get the whole codebase under the Apache license

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- 1 Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- 2 [github.com/econ-ark](https://github.com/econ-ark)/HARK is a "public repo"
  - Contains all existing code
- 3 [github.com/econ-ark/HARK/Documentation/NARK.pdf](https://github.com/econ-ark/HARK/Documentation/NARK.pdf)
  - Describes variable naming conventions for easy workflow:
  - LaTeX object definitions correspond to HARK definitions
- 4 Similar structure will be used for future contributions
  - **A**gent **A**rchive **R**epository **D**eposit **V**ehicle for ARK?
- 5 Instructions for cloning are in the README.txt
- 6 You get the whole codebase under the Apache license
  - Basically, no limitations on use

# Where Is It?

[github.com/econ-ark](https://github.com/econ-ark) is the project's home

- ① Get a GitHub account. Then, options to access are
  - Install GitHub Desktop App
  - Install 'git' command-line tool (if you're hard-core)
- ② [github.com/econ-ark](https://github.com/econ-ark)/HARK is a “public repo”
  - Contains all existing code
- ③ [github.com/econ-ark](https://github.com/econ-ark/HARK/Documentation/NARK.pdf)/HARK/Documentation/NARK.pdf
  - Describes variable naming conventions for easy workflow:
  - LaTeX object definitions correspond to HARK definitions
- ④ Similar structure will be used for future contributions
  - **A**gent **A**rchive **R**epository **D**eposit **V**ehicle for ARK?
- ⑤ Instructions for cloning are in the README.txt
- ⑥ You get the whole codebase under the Apache license
  - Basically, no limitations on use
  - But, please credit us, and participate in discussions

# 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>	AMK	CFPB → ? (Alcatraz?)
<i>Jiaxiong Yao</i>	JXY	JHU → IMF

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

# Major credit goes to CFPB - a 21st Century Regulator!

- Hired CDC as Chief Economist with this as a key priority

# Major credit goes to CFPB - a 21st Century Regulator!

- Hired CDC as Chief Economist with this as a key priority
- Hired NMP as intern to get started



# Major credit goes to CFPB - a 21st Century Regulator!

- Hired CDC as Chief Economist with this as a key priority
- Hired NMP as intern to get started
- Hired MNW as Visiting Scholar to work on it

# Major credit goes to CFPB - a 21st Century Regulator!

- Hired CDC as Chief Economist with this as a key priority
- Hired NMP as intern to get started
- Hired MNW as Visiting Scholar to work on it
- Hired DCL as new economist last year

# Major credit goes to CFPB - a 21st Century Regulator!

- Hired CDC as Chief Economist with this as a key priority
- Hired NMP as intern to get started
- Hired MNW as Visiting Scholar to work on it
- Hired DCL as new economist last year
- Hired AMK as RA

# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

- Gatekeeper for Contributions

# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

- Gatekeeper for Contributions
- Responsible for Setting Out Tests A Module Should Pass

# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

- Gatekeeper for Contributions
- Responsible for Setting Out Tests A Module Should Pass
  - e.g. Special Cases With Analytical Solutions

# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

- Gatekeeper for Contributions
- Responsible for Setting Out Tests A Module Should Pass
  - e.g. Special Cases With Analytical Solutions
  - Metrics for “closeness” to “true” solution



# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

- Gatekeeper for Contributions
- Responsible for Setting Out Tests A Module Should Pass
  - e.g. Special Cases With Analytical Solutions
  - Metrics for “closeness” to “true” solution

# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

- Gatekeeper for Contributions
- Responsible for Setting Out Tests A Module Should Pass
  - e.g. Special Cases With Analytical Solutions
  - Metrics for “closeness” to “true” solution

Name	Topic	Affiliation
Serguei Maliar	Interpolation	Stanford
Lilia Maliar	Interpolation	Stanford

*We're Seeking Volunteers for Czars*

# Organization Going Forward

Standard Github tools, esp:

- Issue Tracker: If You See Something, Say Something

## Topic Czars

- Gatekeeper for Contributions
- Responsible for Setting Out Tests A Module Should Pass
  - e.g. Special Cases With Analytical Solutions
  - Metrics for “closeness” to “true” solution

Name	Topic	Affiliation
Serguei Maliar	Interpolation	Stanford
Lilia Maliar	Interpolation	Stanford

*We're Seeking Volunteers for Czars*

---

<a href="mailto:info@econ-ark.org">info@econ-ark.org</a>	-	General Purpose Questions
<a href="mailto:czars@econ-ark.org">czars@econ-ark.org</a>	-	Volunteer to be a Czar
<a href="mailto:ideas@econ-ark.org">ideas@econ-ark.org</a>	-	Ideas for Improvement

# Timeline

When	What	Lessons
2006-2013	<b>SolvingMicroDSOPs</b>	Surprisingly popular
2014-12	IMF-CFPB Workshop	Lots of enthusiasm
2015-12	CFPB-IMF Workshop	Not HARK, ARK!
		Testing, Replication, Feedback
2016-06	Hello!	None yet ...

- The version at <http://github.com/econ-ark> is our “public beta”

# Timeline

When	What	Lessons
2006-2013	<b>SolvingMicroDSOPs</b>	Surprisingly popular
2014-12	IMF-CFPB Workshop	Lots of enthusiasm
2015-12	CFPB-IMF Workshop	Not HARK, ARK!
		Testing, Replication, Feedback
2016-06	Hello!	None yet ...

- The version at <http://github.com/econ-ark> is our “public beta”
- So far as we know, everything works

# Timeline

When	What	Lessons
2006-2013	<b>SolvingMicroDSOPs</b>	Surprisingly popular
2014-12	IMF-CFPB Workshop	Lots of enthusiasm
2015-12	CFPB-IMF Workshop	Not HARK, ARK!
		Testing, Replication, Feedback
2016-06	Hello!	None yet ...

- The version at <http://github.com/econ-ark> is our “public beta”
- So far as we know, everything works
- First non-beta: Built-in tests for *everything*

# Timeline

When	What	Lessons
2006-2013	<b>SolvingMicroDSOPs</b>	Surprisingly popular
2014-12	IMF-CFPB Workshop	Lots of enthusiasm
2015-12	CFPB-IMF Workshop	Not HARK, ARK!
		Testing, Replication, Feedback
2016-06	Hello!	None yet ...

- The version at <http://github.com/econ-ark> is our “public beta”
- So far as we know, everything works
- First non-beta: Built-in tests for *everything*
  - Aim: This year

# Why Are Policy Institutions So Interested?

Participation: CFPB, OFR, IMF

Interest From: FRB, ECB, BLS

- Policymaking = Applied Theory. Options:



# Why Are Policy Institutions So Interested?

Participation: CFPB, OFR, IMF

Interest From: FRB, ECB, BLS

- Policymaking = Applied Theory. Options:
  - ① Informal, intuitive, “wetware” theory

# Why Are Policy Institutions So Interested?

Participation: CFPB, OFR, IMF

Interest From: FRB, ECB, BLS

- Policymaking = Applied Theory. Options:
  - ① Informal, intuitive, “wetware” theory
  - ② Formal, structural, “software” theory

# LATE is Antedeluvian

‘Local Average Treatment Effects’ results are

- **N**ot **E**ven **V**ery **E**mpirically **R**elevant ...

# LATE is Antedeluvian

‘Local Average Treatment Effects’ results are

- **N**ot **E**ven **V**ery **E**mpirically **R**elevant ...
- UNLESS used to estimate ‘structural’ parameters

# LATE is Antedeluvian

‘Local Average Treatment Effects’ results are

- **N**ot **E**ven **V**ery **E**mpirically **R**elevant ...
- UNLESS used to estimate ‘structural’ parameters
- Because the important question is

# LATE is Antedeluvian

‘Local Average Treatment Effects’ results are

- **N**ot **E**ven **V**ery **E**mpirically **R**elevant ...
- UNLESS used to estimate ‘structural’ parameters
- Because the important question is
  - What does world look like *non-locally* ...

‘Local Average Treatment Effects’ results are

- **N**ot **E**ven **V**ery **E**mpirically **R**elevant ...
- UNLESS used to estimate ‘structural’ parameters
- Because the important question is
  - What does world look like *non-locally* ...
  - ... = *after* the policy change

‘Local Average Treatment Effects’ results are

- **N**ot **E**ven **V**ery **E**mpirically **R**elevant ...
- UNLESS used to estimate ‘structural’ parameters
- Because the important question is
  - What does world look like *non-locally* ...
  - ... = *after* the policy change
  - and maybe not even just “on average”



‘Local Average Treatment Effects’ results are

- **N**ot **E**ven **V**ery **E**mpirically **R**elevant ...
- UNLESS used to estimate ‘structural’ parameters
- Because the important question is
  - What does world look like *non-locally* ...
  - ... = *after* the policy change
  - and maybe not even just “on average”
    - because distributional/targeted impact may be whole point

# Welfare Analysis With Heterogeneity

Sensible cost-benefit analysis requires:

- Estimates of distribution of heterogeneous outcomes

# Welfare Analysis With Heterogeneity

Sensible cost-benefit analysis requires:

- Estimates of distribution of heterogeneous outcomes
- Utility or other weighting of those outcomes

# Welfare Analysis With Heterogeneity

Sensible cost-benefit analysis requires:

- Estimates of distribution of heterogeneous outcomes
- Utility or other weighting of those outcomes
- → Structure

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...



# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...

Right explanation:

- Creation of community of scholars

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...

Right explanation:

- Creation of community of scholars
- ... whose methods and results were 'open source'

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...

Right explanation:

- Creation of community of scholars
- ... whose methods and results were 'open source'
- ... who criticized and improved and debugged each other

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...

Right explanation:

- Creation of community of scholars
- ... whose methods and results were 'open source'
- ... who criticized and improved and debugged each other

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...

Right explanation:

- Creation of community of scholars
- ... whose methods and results were 'open source'
- ... who criticized and improved and debugged each other

Alchemy → Chemistry

# *The Invention of Science* by David Wootton

Wrong explanations for the Scientific Revolution:

- Invention of 'the experiment'
- Invention of the printing press
- ...

Right explanation:

- Creation of community of scholars
- ... whose methods and results were 'open source'
- ... who criticized and improved and debugged each other

Alchemy → Chemistry

17th and 18th century version of [github.com](https://github.com)!

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code



# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'
- Options:

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'
- Options:

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'
- Options:
  - ① 'selfish' people study economics

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'
- Options:
  - 1 'selfish' people study economics
  - 2 Studying economics makes you selfish!

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'
- Options:
  - ① 'selfish' people study economics
  - ② Studying economics makes you selfish!
  - ③ Economics students are just more honest

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'
- Options:
  - ① 'selfish' people study economics
  - ② Studying economics makes you selfish!
  - ③ Economics students are just more honest

# Economists are People Too ...

- We are way behind many scientific fields in 'open source' code
- Surveys/Experiments: Economics students are more 'selfish.'
- Options:
  - ① 'selfish' people study economics
  - ② Studying economics makes you selfish!
  - ③ Economics students are just more honest

I prefer (3)!



# Lessons Learned from Other Fields About What Works

- Not taking the dewy-eyed view: “Build it and they will come”

# Lessons Learned from Other Fields About What Works

- Not taking the dewy-eyed view: “Build it and they will come”
- Empirical fact: Many other open source communities have succeeded

# Lessons Learned from Other Fields About What Works

- Not taking the dewy-eyed view: “Build it and they will come”
- Empirical fact: Many other open source communities have succeeded
- Economists can't be *that* different ...

# In Addition to Usual Github Tools

- Czars for specific topics

# In Addition to Usual Github Tools

- Czars for specific topics
- Bounties for Best Solution of Specific Problems

# In Addition to Usual Github Tools

- Czars for specific topics
- Bounties for Best Solution of Specific Problems
- Time-Stamped Public Mechanism for Staking a Claim to New Idea

# In Addition to Usual Github Tools

- Czars for specific topics
- Bounties for Best Solution of Specific Problems
- Time-Stamped Public Mechanism for Staking a Claim to New Idea
- Stack-Exchange-Like Q&A Forum

# In Addition to Usual Github Tools

- Czars for specific topics
- Bounties for Best Solution of Specific Problems
- Time-Stamped Public Mechanism for Staking a Claim to New Idea
- Stack-Exchange-Like Q&A Forum
- Mechanism for Easy Creation of Grad Student Problem Sets



# In Addition to Usual Github Tools

- Czars for specific topics
- Bounties for Best Solution of Specific Problems
- Time-Stamped Public Mechanism for Staking a Claim to New Idea
- Stack-Exchange-Like Q&A Forum
- Mechanism for Easy Creation of Grad Student Problem Sets
- Tool for Grad Student Replication Exercises

# In Addition to Usual Github Tools

- Czars for specific topics
- Bounties for Best Solution of Specific Problems
- Time-Stamped Public Mechanism for Staking a Claim to New Idea
- Stack-Exchange-Like Q&A Forum
- Mechanism for Easy Creation of Grad Student Problem Sets
- Tool for Grad Student Replication Exercises
- Eventually, a Journal?

# In Addition to Usual Github Tools

- Czars for specific topics
- Bounties for Best Solution of Specific Problems
- Time-Stamped Public Mechanism for Staking a Claim to New Idea
- Stack-Exchange-Like Q&A Forum
- Mechanism for Easy Creation of Grad Student Problem Sets
- Tool for Grad Student Replication Exercises
- Eventually, a Journal?
- ... Your Ideas? [ideas@econ-ark.org](mailto:ideas@econ-ark.org)

# Join our (Scientific) Revolution!

Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)

# Join our (Scientific) Revolution!

Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)
  - Add me to the newsletter/ mailing list

# Join our (Scientific) Revolution!

## Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)
  - Add me to the newsletter/ mailing list
- *Read the docs and slides* and absorb what exists now. Options:

# Join our (Scientific) Revolution!

## Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)
  - Add me to the newsletter/ mailing list
- *Read the docs and slides* and absorb what exists now. Options:
  - 1 Add an 'issue' that you want to tackle on [github.com/econ-ark](https://github.com/econ-ark)

# Join our (Scientific) Revolution!

## Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)
  - Add me to the newsletter/ mailing list
- *Read the docs and slides* and absorb what exists now. Options:
  - 1 Add an 'issue' that you want to tackle on [github.com/econ-ark](https://github.com/econ-ark)
  - 2 [letmehelpwith@econ-ark.org](mailto:letmehelpwith@econ-ark.org)



# Join our (Scientific) Revolution!

## Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)
  - Add me to the newsletter/ mailing list
- *Read the docs and slides* and absorb what exists now. Options:
  - 1 Add an 'issue' that you want to tackle on [github.com/econ-ark](https://github.com/econ-ark)
  - 2 [letmehelpwith@econ-ark.org](mailto:letmehelpwith@econ-ark.org)
    - 1 Define some area that you'd like to contribute to

# Join our (Scientific) Revolution!

## Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)
  - Add me to the newsletter/ mailing list
- *Read the docs and slides* and absorb what exists now. Options:
  - 1 Add an 'issue' that you want to tackle on [github.com/econ-ark](https://github.com/econ-ark)
  - 2 [letmehelpwith@econ-ark.org](mailto:letmehelpwith@econ-ark.org)
    - 1 Define some area that you'd like to contribute to
    - 2 email us at this address outlining what you propose to do

# Join our (Scientific) Revolution!

## Options:

- [subscribe@econ-ark.org](mailto:subscribe@econ-ark.org)
  - Add me to the newsletter/ mailing list
- *Read the docs and slides* and absorb what exists now. Options:
  - 1 Add an 'issue' that you want to tackle on [github.com/econ-ark](https://github.com/econ-ark)
  - 2 [letmehelpwith@econ-ark.org](mailto:letmehelpwith@econ-ark.org)
    - 1 Define some area that you'd like to contribute to
    - 2 email us at this address outlining what you propose to do
    - 3 We'll reply with some suggestions