

Introducing the Computational Economics “Algorithmic Repository and toolKit” github.com/econ-ark

Presentation by Chris Carroll and Matthew White at
CESifo Conference, Venice

June 13, 2017

What Is It?

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

What Is It?

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

- 1 Solving dynamic stochastic optimization problems

What Is It?

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

- ① Solving dynamic stochastic optimization problems
 - Particularly adapted for Bellman problems with 'kinks' and quirks

What Is It?

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

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

What Is It?

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

- ① Solving dynamic stochastic optimization problems
 - Particularly adapted for Bellman problems with 'kinks' and quirks
- ② Simulating behavior of populations of agents
 - Whether or not they are solving DSOP

What Is It?

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

- ① Solving dynamic stochastic optimization problems
 - Particularly adapted for Bellman problems with 'kinks' and quirks
- ② Simulating behavior of populations of agents
 - Whether or not they are solving DSOP
- ③ Finding market equilibrium for market with such agents

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 equilibrium between consumer agents and firm agents

Why Have We Created It?

Micro Structural Modeling 2017 \approx Econometrics circa 1970

- Lots of theoretical results

Goals: Want to make it *much* easier:

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

Goals: Want to make it *much* easier:

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!

Goals: Want to make it *much* easier:

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 algorithms

Goals: Want to make it *much* easier:

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 algorithms
- Lots of reinventing of the wheel

Goals: Want to make it *much* easier:

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 algorithms
- Lots of reinventing of the wheel
- Progress is very slow

Goals: Want to make it *much* easier:

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 algorithms
- Lots of reinventing of the wheel
- Progress is very slow

Goals: Want to make it *much* easier:

- To get started doing structural micro modeling

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 algorithms
- Lots of reinventing of the wheel
- Progress is very slow

Goals: Want to make it *much* easier:

- To get started doing structural micro modeling
- To teach (with hands-on, problem-set-assignable exercises)

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 algorithms
- Lots of reinventing of the wheel
- Progress is very slow

Goals: Want to make it *much* easier:

- To get started doing structural micro modeling
- To teach (with hands-on, problem-set-assignable exercises)
- To *compare* models to each other

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 algorithms
- Lots of reinventing of the wheel
- Progress is very slow

Goals: Want to make it *much* easier:

- To get started doing structural micro modeling
- To teach (with hands-on, problem-set-assignable exercises)
- To *compare* models to each other
- To add new capabilities

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 algorithms
- Lots of reinventing of the wheel
- Progress is very slow

Goals: Want to make it *much* easier:

- To get started doing structural micro 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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields

Powerful modern tools has been developed by software engineers:

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy

Powerful modern tools has been developed by software engineers:

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software

Powerful modern tools has been developed by software engineers:

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration
- Version Control

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration
- Version Control
- Object-Oriented Programming

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration
- Version Control
- Object-Oriented Programming
- Integrated Development Environments

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

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration
- Version Control
- Object-Oriented Programming
- Integrated Development Environments

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

- Central Banks

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration
- Version Control
- Object-Oriented Programming
- Integrated Development Environments

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

- Central Banks
- IMF

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration
- Version Control
- Object-Oriented Programming
- Integrated Development Environments

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

- Central Banks
- IMF
- CFPB

How Do We Expect To Do This?

- Has been done already in many other scientific/technical fields
 - AstroPy
 - Journal of Statistical Software
 - Many open-source resources in other fields

Powerful modern tools has been developed by software engineers:

- Automatic Documentation
- Continuous Integration
- Version Control
- Object-Oriented Programming
- Integrated Development Environments

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

- Central Banks
- IMF
- CFPB
- OFR

Where Is It?

github.com/econ-ark is the project's home

- ① github.com/econ-ark/HARK is a “public repo”

Where Is It?

github.com/econ-ark is the project's home

- ① github.com/econ-ark/HARK is a “public repo”
 - Contains all existing code

Where Is It?

github.com/econ-ark is the project's home

- 1 github.com/econ-ark/HARK is a “public repo”
 - Contains all existing code
- 2 Instructions for cloning are in the README.txt

Where Is It?

github.com/econ-ark is the project's home

- 1 github.com/econ-ark/HARK is a “public repo”
 - Contains all existing code
- 2 Instructions for cloning are in the README.txt
- 3 You get the whole codebase under the Apache license

Where Is It?

github.com/econ-ark is the project's home

- 1 github.com/econ-ark/HARK is a “public repo”
 - Contains all existing code
- 2 Instructions for cloning are in the README.txt
- 3 You get the whole codebase under the Apache license
 - Basically, no limitations on use

Where Is It?

github.com/econ-ark is the project's home

- ① github.com/econ-ark/HARK is a “public repo”
 - Contains all existing code
- ② Instructions for cloning are in the README.txt
- ③ 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 → ? (Timbuktu?)
<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 to CFPB - a 21st Century Regulator!

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

Major credit 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 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 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 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

info@econ-ark.org	-	General Purpose Questions
czars@econ-ark.org	-	Volunteer to be a Czar
ideas@econ-ark.org	-	Ideas for Improvement

Timeline

When	What	Lessons
2006-2013	SolvingMicroDSOPs	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	SolvingMicroDSOPs	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	SolvingMicroDSOPs	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	SolvingMicroDSOPs	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* ...

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* ...
 - ... = *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!

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

Join our (Scientific) Revolution!

Options:

- subscribe@econ-ark.org

Join our (Scientific) Revolution!

Options:

- subscribe@econ-ark.org
 - Add me to the newsletter/ mailing list

Join our (Scientific) Revolution!

Options:

- 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
 - 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

Join our (Scientific) Revolution!

Options:

- 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
 - 2 letmehelpwith@econ-ark.org

Join our (Scientific) Revolution!

Options:

- 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
 - 2 letmehelpwith@econ-ark.org
 - 1 Define some area that you'd like to contribute to

Join our (Scientific) Revolution!

Options:

- 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
 - 2 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
 - 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
 - 2 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