The Origin of Wealth

Eric Beinhocker

McKinsey Global Institute

HEEDNet Seminar
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“The ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed, the world is ruled by little else.”

John Maynard Keynes
Today’s discussion

• The three most stunning empirical facts in economics
• Characterizing the economy – what is it?
• The evolution of economic design
• What does it mean?
Today’s discussion

• The three most stunning empirical facts in economics
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Fact no. 1 – wealth has grown explosively

World GDP per capita, constant 1992 US$

2.5m BC to 2000 AD

15,000 BC to 2000 AD

1750 to 2000

Fact no. 2 – complexity has grown explosively

From . . .

10^2 SKU economy

To . . .

10^{10} SKU economy

- Wal-Mart 100,000 SKUs
- Cable TV 200+ channels
- 275 breakfast cereals
Fact no. 3 – no one is in charge
Today’s discussion

• The three most stunning empirical facts in economics

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• What does it mean?
Traditional economics cannot explain key characteristics of the economy

Economy viewed as an equilibrium system . . .

. . . but such a system cannot

• Grow explosively

• Create novelty

• Spontaneously self-organize
The accidental history of equilibrium in economics

Léon Walras

William Stanley Jevons
A different explanation – the economy is a ‘complex adaptive system’

Complex
Many interacting agents and organizations of agents

Adaptive
Designs and strategies evolve over time

System
Macro patterns emerge from micro behavior
Dynamics

Traditional – fixed point attractors

Complexity – dynamic attractors
Agents

Traditional – perfect rationality

- Deductive logic
- Self-interest
- Perfect information
- Infinite computational power
- No errors, biases
- No learning

Complexity – realistic rationality

- Inductive rules of thumb
- Strong reciprocity
- Imperfect information
- Finite computing power
- Errors, biases
- Learning over time
Networks

Traditional – networks don’t matter

• Interactions – only via markets
• Information – prices, quantities
• Institutions – Walrasian auctions

Complexity – network structures matter

• Interactions – via networks
• Information – anything
• Institutions – bilateral trade, posted prices, corporations, etc.
Emergence

Traditional – assumes linear additivity

- Representative “super agent”
- Individual agents
- Macroeconomic behavior

Complexity – non-linear interactions create emergent patterns
Evolution

Traditional – no endogenous theory of innovation

“Add successfully as many mail coaches as you please, you will never get a railway thereby”

Joseph Schumpeter

Complexity – innovation as evolutionary search
### A paradigm shift

<table>
<thead>
<tr>
<th>Dynamics</th>
<th>Traditional economics</th>
<th>Complexity economics</th>
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<tbody>
<tr>
<td></td>
<td>Economies are closed, static, linear systems in equilibrium</td>
<td>Economies are open, dynamic, non-linear systems far from equilibrium</td>
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<table>
<thead>
<tr>
<th>Agents</th>
<th>Homogeneous agents</th>
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<tbody>
<tr>
<td></td>
<td>• Only use rational deduction</td>
</tr>
<tr>
<td></td>
<td>• Make no mistakes and have no biases</td>
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<tr>
<td></td>
<td>• Are already perfect, so why learn?</td>
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<tr>
<td></td>
<td>Heterogeneous agents</td>
</tr>
<tr>
<td></td>
<td>• Mix deductive/inductive decision-making</td>
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<tr>
<td></td>
<td>• Subject to errors and biases</td>
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<td>• Learn and adapt over time</td>
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<tr>
<th>Networks</th>
<th>Assume agents only interact indirectly through market mechanisms</th>
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<td>Explicitly account for agent-to-agent interactions and relationships</td>
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<th>Emergence</th>
<th>Treats micro and macroeconomics as separate disciplines</th>
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<tr>
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<td>No distinction between micro- and macroeconomics; macro patterns emerge from micro behaviors and interactions</td>
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<tr>
<th>Evolution</th>
<th>Contains no endogenous mechanism for creating novelty or growth in order and complexity</th>
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<tr>
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<td>Evolutionary process creates novelty and growing order and complexity over time</td>
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• The evolution of economic design
• What does it mean?
Long history of evolutionary ideas in economics (and vice versa)

- 1838
  - Malthus
  - Darwin
  - Mandeville
  - Marx
  - Spencer
  - Marshall
  - Menger
  - Veblen
  - Schumpeter
  - Hayek
  - Nelson and Winter

- 1982

**Problem**

- Driven from a metaphor with biology
- Not built on a general computational view of evolution
We are accustomed to thinking of evolution in a biological context.
Evolution is a search algorithm for ‘fit designs’

Create a variety of experiments

Select designs that are ‘fit’

Amplify fit designs, de-amplify unfit designs

Variation

Selection

Amplification

Repeat
Evolution creates complexity from simplicity

Information World

Physical World

Order, complexity

Entropy

Design encoded in a schema

Interactor in an environment

1 0 1 1 0 0 1 0 0 0

Variation, selection, amplification

Feedback on fitness

Rendering of design
Who designed the modern bicycle?
The reality – evolution through ‘deductive-tinkering’
Technologies evolve
Economic evolution occurs in three ‘design spaces’

- Physical technologies
- Business plans
- Social technologies
Business plans are a form of economic ‘design’

- **Strategy**
  - High-end microprocessors
  - Integrated chip sets
  - Communications chips/components

- **Physical technologies**
  - Semiconductor design
  - Testing
  - Fabrication

- **Social technologies**
  - Innovation processes
  - Direct sales
  - Brand
  - Competitive culture
Business plan evolution works at three levels

Individual minds | Organizations | Markets

Independent booksellers

What would economic evolution look like?

• Bursts of innovation/punctuated equilibrium

• Spontaneous self organization

• Decreasing local entropy/increasing order
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• What does it mean?
The end of left vs. right?

Adam Smith

Karl Marx
## A new view of human nature

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<tr>
<th>Right</th>
<th>Left</th>
<th>Complexity</th>
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<tbody>
<tr>
<td>• Humans are inherently self-regarding</td>
<td>• Humans are inherently cooperative and altruistic</td>
<td>• Humans are conditional cooperators and altruistic punishers</td>
</tr>
<tr>
<td>• Markets channel this instinct to positive social ends</td>
<td>• Markets encourage greed, state can make society more just</td>
<td>• Institutions should mobilize strong reciprocity</td>
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<tr>
<td>• Hume, Locke, Hobbes</td>
<td>• Rousseau, Marx</td>
<td>• Bowles, Gintis, Fehr, Boyd</td>
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### A new view of markets vs. states

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| • Markets are most efficient mechanism for allocating resources  
• States distort market outcomes thus state interference should be minimized | • Markets may be a necessary evil, but do not produce just outcomes  
• States are an essential mechanism for ensuring social justice and protecting people from market failures | • Markets are not perfectly efficient at allocation, but are highly effective at evolutionary wealth creation  
• States create institutional conditions for economic evolution  
• Democratic societies have a right to use states to shape economic fitness function |
New approaches to public policy?

- Giving up the illusion of prediction and control
- Realistic view of human behavior
- Focus on creating institutional conditions for economic evolution
- Evolving portfolios of “policy experiments”?
- Emphasis on empiricism and data - do more of what works less of what doesn’t

**Example issues**

- Healthcare reform
- Environmental policy
- Pensions
- Tax policy
- Education
Final thought…

“Evolution is cleverer than we are”

Orgels’ second law
The Origin of Wealth
Evolution, Complexity and the Radical Remaking of Economics

Eric Beinhocker