ECONOMICS, CRITICALITY AND COMPLEXITY

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I'm new to the field of econophysics, but I know two things: time is relative, and the economy grows too slowly.

Therefore, I propose a simple relativistic econophysics project:

We take the economy, bring it near a black hole so it experiences infinite time, then return it to our reference frame. Bam! Infinite wealth in finite time.

$E = mc^2$

Are you aware that the "physics" in "econophysics" just means "we used math that wasn't calculus"?

That's not possible!
KEY FEATURES OF THE WORK OF HAYEK AND KEYNES

Emergence

Low level of predictability at a point in time

Limited cognition of individual agents

Multiple possible histories

KEYNES AND PSYCHOLOGY

Booms and slumps primarily driven by psychology

“waves of irrational psychology”

Business sentiment being generated as the “outcome of mass psychology of a large number of ignorant individuals”

“the essence of the situation is to be found in the collapse of animal spirits.... It is this, indeed, which renders the slump so intractable... the collapse in animal spirits may be so complete that no practicable reduction in the rate of interest will be enough”
“One thing that economists do know is that the study of economics is divided into two fields, “microeconomics” and “macroeconomics”. Micro is the study of individual behaviour, and macro is the study of how economies behave as a whole. That is, microeconomics concerns things that economists are specifically wrong about, while macroeconomics concerns things economists are wrong about generally.”

PJ O’Rourke Eat the Rich
TWO AREAS OF MAJOR ADVANCE IN SCIENTIFIC KNOWLEDGE IN 21ST CENTURY

**Network theory:** how behaviour/ideas either spread or are contained on networks

**Computer science:** mapping actual networks; identifying key nodes; identifying themes being discussed

Perhaps we can now make operational Keynes’s “animal spirits” and measure and control (?) the “waves of irrational psychology”
MAJOR CHALLENGES: COMING FULL CIRCLE

Business cycle
Growth
Inflation
Annual real GDP growth, US, 1871-2016, per cent
## Cumulative Size of Recessions, Per Cent Fall in Real GDP (Excl 1914-19 and 1939-47)

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
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<tbody>
<tr>
<td>Min</td>
<td>0.01</td>
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<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; quartile</td>
<td>0.79</td>
</tr>
<tr>
<td>Median</td>
<td>2.34</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; quartile</td>
<td>5.18</td>
</tr>
<tr>
<td>Max</td>
<td>29.59</td>
</tr>
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</table>
Histogram of US annual real GDP growth excl. 1914-19, 1939-47
**DURATION OF RECESSION, YEARS, I.E. NUMBER OF CONSECUTIVE YEARS IN WHICH REAL GDP GROWTH IS LESS THAN ZERO (EXCLUDING 1914-1919 AND 1939-47)**

<table>
<thead>
<tr>
<th>Years</th>
<th>Number</th>
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<tbody>
<tr>
<td>1 year</td>
<td>159</td>
</tr>
<tr>
<td>2 year</td>
<td>52</td>
</tr>
<tr>
<td>3 year</td>
<td>12</td>
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<td>4 year</td>
<td>3</td>
</tr>
<tr>
<td>5 year</td>
<td>2</td>
</tr>
<tr>
<td>6 year</td>
<td>1</td>
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A SIMPLE ‘ANIMAL SPIRITS’ MODEL OF THE CYCLE


Illustrative of what could be done by combining ‘emotion’ analysis and networks

The model is very simple and leaves out many things – even a monetary sector!

But it replicates key stylised facts about the cycle e.g.

- Structure of autocorrelation function of GDP growth
- Power spectrum of growth
- Non-Gaussian distribution of both size and duration of recessions
- Positive cross-correlations in output growth across sectors
US private sector debt as per cent of GDP 1952-2016
Actual Annualised Quarter on Quarter Third Estimate US GDP Growth, Per Cent, and Random Forest Predictions Made Six Quarters Previously, 1990Q2 – 2016Q2

Standard economics identifies innovation – the successful adoption of inventions – as the main source of growth

But it does not explain it!

Interesting work has been done on “fitness” of countries, relating this to the complexity of the products they produce

The analysis is based on the bipartite network of world trade flows


THE PHILLIPS CURVE


“The US Phillips curve is alive and well”

“The standard error of the residual in the relation is large, especially in comparison to the low level of inflation”

From the early 1990s into the 2000s, both inflation and unemployment fell
INFLATION REGIMES


Fuzzy clustering identifies 3 regimes in the leading capitalist economies 1871-2009

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Inflation</th>
<th>Unemployment</th>
<th>Observations</th>
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<tbody>
<tr>
<td>Steady</td>
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<td>5.1</td>
<td>85</td>
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<tr>
<td>Weak</td>
<td>1.7</td>
<td>14.2</td>
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<tr>
<td>Disruption</td>
<td>6.7</td>
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