Confidence Collapse in Macroeconomic Systems

M Benzaquen (with JP Bouchaud, F Morelli & M Tarzia)
CNRS, Ecole polytechnique, Capital Fund Management

Integrative Economics - NAEC OECD
5-6 March 2020
2 families of models
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- **Dynamic Stochastic General Equilibrium (DSGE)**

Rational expectations
Representative agents
Many analytical results

**DSGE**

Well defined equilibrium
Small exogenous fluctuations
Widely accepted & used by CBs
2 families of models

- Dynamic Stochastic General Equilibrium (DSGE)
- Agent Based Models (ABM)

**DSGE**
- Rational expectations
- Representative agents
- Well defined equilibrium
- Small exogenous fluctuations
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**ABM**
- Zero-intelligence
- Large heterogeneous populations
- Numerical simulations
- Out of equilibrium dynamics
- Endogenous dynamics/chocs
- Not taken seriously
In spite of their poor performance during the Global Financial Crisis (GFC), DSGE models still constitute the workhorse of monetary policy around the world.
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The DSGE Framework

- **Household**: Max Utility with a budget constraint
- **Firm**: Max Profits
- **Central Bank**: Sets interest rates according to inflation
- **Chocs on productivity**
The DSGE Framework

Household

Max Utility with a budget constraint

Household

Firm

Max Profits

Central Bank

Sets interest rates according to inflation

Central Bank

Chocs on productivity

...interacting to determine

- consumption
- production
- working hours
- wages
- inflation
- interest rates
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with the assumption that Markets will clear (consumption = production)
The DSGE Framework

- Household (Max Utility with a budget constraint)
- Firm (Max Profits)
- Central Bank (Sets interest rates according to inflation)

Chocs on productivity

- PH: (quite realistic but analytically solvable)
- CH: (exogenous fluctuations around a well defined equilibrium)

...interacting to determine

- consumption
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with the assumption that Markets will clear (consumption = production)

\[ C_t \]
So many things are wrong, DSGE is mathematically sound, but quite absurd from all other points of view (physical, behavioural, economical etc.)
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  The household maximises its utility, knowing the firm’s strategy, the firm maximises its profits (decides wage...), knowing the household's strategy, given that the market must clear!
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  - Linearised equations (only small exogenous fluctuation around a well defined equilibrium)
    - you are throwing the baby out with the bath water (no crises by construction)...

  "physically impossible (no causality)"
DSGE models are (...) over-simplified, they have to become less imperialistic and accept to share the scene with other approaches to modelisation.

O. Blanchard
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increasing function

consumption

labour

influence of the past consumption of $j$ on the confidence level of $i$

Utility of Household

\[ U_t^i = F\left( \sum_{j \neq i} J_{ij} c_t^{i,j} \right) \log(c_t^i) - \frac{\gamma}{2} (n_t^i)^2 \]

- Increasing function
- Consumption
- Labour
- Influence of the past consumption of j on the confidence level of i
Can we do anything?

Utility of Household

The sentiment of households at time $t$ is a function of the past realised consumption of others, “animal spirits”.

If household $i$ sees that other households have reduced their consumption, it interprets it as a sign that the economy may be degrading, which reduces its consumption propensity (and increases its precautionary savings).
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$$U_t^i = F\left(\sum_{j \neq i} J_{ij} c_{t-1}^j\right) \log(c_i^t) - \frac{\gamma}{2} (n_i^t)^2$$

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- Consumption
- Labour

**Mean field approximation:**

$$J_{ij} = \frac{J}{N}$$

Only the aggregate consumption matters, we neglect local network effects: $c_t^i = c_t \ \forall i$
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confidence threshold (the concavity of $G$ changes, $c > c_0$ tends to favour a high confidence state and $c < c_0$ a low confidence state.)
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Phase diagram

\[ \theta \]

\[ G(x) \]

\[ c_{\text{max}} \]

\[ c_{\text{min}} \]

\[ c_0 \]

\[ x \]

High output with short-lived recessions

Long-lived booms & recessions

Low output with short-lived spikes

High Output, No Crises

Confidence threshold \( c_0 \)

A

B+

B−

C

Phase diagram
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\[ t = c \cdot G(c_t) \]

- High Output, No Crises
- Short-lived recessions
- Long-lived booms & recessions
DSGE phenomenology

The feedback mechanism leads to excess volatility

High Output, No Crises
Short-lived recessions
Long-lived booms & recessions
A relatively mild drop of productivity can trigger large fluctuations of output (amplified by the self-referential “panic” effect).

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DSGE phenomenology
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Two stable solutions. Any, however small, amount of productivity fluctuations can induce transitions.

The economy can remain for a very long time in a high output state, until a self-fulfilling panic mechanism throws it in a crisis state where output is low.
Although quite parsimonious, the model is rich enough to generate a variety of realistic dynamical behaviour, including short-lived downturns and more prolonged recessions.

The 2008 GFC could correspond to a confidence collapse modelled by a sudden $c_\rightarrow c_\leftarrow$ transition.

[Phase diagram image]
The time needed for such transitions to take place is however exponentially long

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activation barrier
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Clearly, any small uncertainty about the parameters of the model (i.e. \( c_0, c_{\min}, c_{\max}, \theta \)) or for that matter the precise specification of the function \( G(c) \), or any other feature neglected in the model, will affect the precise value of \( W \).

The crisis probability is exponentially sensitive to the estimation error of the parameters of the model.
Unknown knowns
Precisely as the famous butterfly effect (the exponential sensitivity on initial conditions) forbids any deterministic description of chaotic systems, the exponential dependence of the crisis rate means that this rate is, for all practical purposes, unknowable.
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→ “Unknown knowns”  What may happen is known, but its probability is impossible to quantify.

*De facto impossibility to price extreme risks*
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$$ r_t = \Phi \pi_t - \log \beta $$

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Beyond adjusting interest rates and money supply, policy makers can use \textit{Narratives} to restore trust.

“What people say about the economy can set off a recession”

Robert J. Shiller, Sept. 12, 2019
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If the economy lies in the neighbourhood of the C/B+ phase boundary, a mild decrease of $c_0$, engineered by the Central Bank, can help putting back the system on an even keel.
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“The only thing we have to fear is fear itself”

Franklin Roosevelt, inaugural 1933 address