Core models

Aki Lehtinen

Nankai University

Presentation at the 1st Colloquium of Economics Education

Kuala Lumpur, 11 December 2019

aki.lehtinen@helsinki.fi

The storyline

- Macroeconomics is dominated by a particular modelling framework: DSGE models

- These models are usually based on 'microfoundations' in that they assume rational expectations, a representative consumer, and they always assume intertemporal optimization.

- These assumptions are known to be seriously problematic.

The puzzle

- Blanchard 2016: DSGE models 'are based on seriously flawed assumptions, empirically estimated by means of unconvincing methods (with alternative methods having dramatic effects on the policy implications), and the normative implications that are crucial for policy advice are consequently implausible.'

- yet, the 'basic DSGE modelling choices are obviously the right ones', 'where else could one begin'

The storyline

- One justification for DSGE models is that they provide a coherent framework for analysis.

- When macroeconomists talk about 'core models', they appeal to this justification.

- A benign reading: having a core model allows solving Duhemian problems.

- The Duhem-Quine thesis: It is impossible to know which component in a complex and large model is (dis)confirmed with a piece of evidence

- More broadly, macroeconomists and central bankers need to know what causes what in the economy (and in the model).

The storyline

- Since having a core model is costly (Wren-Lewis 2018), and there are alternatives (agent-based macroeconomics), solving the Duhemian problems must be hugely important.

- I believe the other justifications (e.g., that DSGE models provide an adequate response to the Lucas critique) given to DSGE modelling are faulty or at least not sufficiently convincing to justify their dominant position.

The mainstream suspicions and qualms

- 'Some people have taken heterogeneity to the extreme of agent-based modelling, describing explicitly the behaviour of several, perhaps many, different agents, possibly disposing of other assumptions, such as rational expectations, in the process. While this buys descriptive realism, does it go too far in the direction of loosening restrictions on models and allowing them to fit any conceivable data?' (Driffill 2011)
- **Blanchard (2018): 'but agent based modellers have not provided a core model'**

The storyline

- This paper thus aims to see whether DSGE models are able to solve Duhemian problems in a convincing way.

- I will proceed by looking at the justifications provided in terms of 'core models' and microfoundations.

- Contrast: Agent-based macroeconomics

Agenda

- What are core models?
- Microfoundations
- Agent based macro

Blanchard 2017

- Foundational models
- Core models (incl. the DSGE benchmark)
- Policy models
- Toy models
- Forecasting models

Oxford Review of Economic Policy 2018

- Vines & Wills (the editors):

- What, if anything, is wrong with the current core model (=Smets & Wouters 2007, Christiano, Eichenbaum & Evans 2005), and what should be done about it?

Vines & Wills conclusions

- Consensus that the current core model is inadequate
- Suggested features of a new core model:
- Financial frictions
- Relax rational expectations
- Include heterogeneous agents (Kaplan et al. 2018, Ravn & Sterk 2018)
- Underpin the model and the new additions with more appropriate microfoundations.

What is a core model?

1) Bank of England 2005: the core is shielded from empirical testing. Empirical results only concern the non-core elements.

2) A simple enough model to be taught to graduate students (Blanchard 2018, Reis 2018)

3) A codification of what should be regarded as the most important characteristics of macroeconomies (Vines & Wills 2018, Blanchard 2017).

4) Whichever model a central bank uses as a starting point in its decision-making (Lindé 2018, Hendry & Muellbauer 2018)

5) A benchmark (Blanchard 2018, Lengnick 2013)

6) Smets & Wouters 2007, Christiano et al. 2005 (Vines & Wills: this is the existing core model)

The cost of having just one dominant model

- Trichet 2010: policymakers had to seek advice from history to figure out what to do, rather than macroeconomics.

- Krugman 2018: They actually went back to IS-LM

- Had top economics journals been more tolerant to different approaches, more intellectual resources would have been allocated to different approaches, and the crisis could have been handled better (Wren-Lewis 2018).

- This kind of failure cannot be prevented by agreeing on what features the next core model should include. It is rather prevented by not having a core model in the first place.

What does it mean to be a benchmark model?

- A structure which is known to all, which entails results that everybody knows.

- The point: modifying the benchmark or adding elements to it shows how various factors affect the economy. Model-results can only be evaluated with a whole class of models rather than just one.

- What is driving the results is seen from the comparisons

→ What is the role of microfoundations in this?

Microfoundations

- The official line: Lucas critique → the necessity of microfounded models and the injunction to derive the general equilibrium consequences of every proposed model-change.

- Microfoundations ensure 'clarity' and 'rigour', they 'help to keep the logic straight' (Yates, Eichengreen), microfounded models give a good 'feel' for what changes with policy changes and what doesn't (del Negro and Schorfheide 2013).

- Wren-Lewis (2011, 2018): internal consistency (with microeconomics)

- Strong and weak form microfoundations (Faust 2009)

Rationality

- What if people are not rational?
- Irrational behaviour is 'ad hoc' in that there is no single way in which it can be incorporated in a macromodel.
- In contrast, there is only one rational behaviour
- This is why microfoundations are taken to provide clarity, consistency and easy interpretation.
- The fear: a model that has rational and irrational elements is inconsistent. Hence the possibility of figuring out what depends on what is lost.
- Is this correct?

The problem

- Faust 2009:

'Indeed, a key problem in DSGE models has been that agents in the model seem to be too willing to substitute between current and future consumption when given a small incentive to do so. This problem explains why habit formation, adjustment costs, and persistent shocks to marginal conditions have been added to the core model.'

→ How can we be sure that despite these kinds of modelling tricks, the model is still able to reliably indicate what depends on what?

Heterogeneous agents

- Marcus Miller 2011 'But once one allows for heterogeneous agents together with asymmetric information, it is difficult to take fundamentals-driven, rational expectations seriously as a benchmark assumption.'

- Ravn & Sterk (2018), Kaplan, Moll & Violante (2018)

Where did confidence in a foundational assumption go?

- Christiano, Eichenbaum & Trabandt (2018, draft version)

'So why would anyone ever use the representative agent assumption? In practice analysts have used that assumption because they think that for many questions they get roughly the right answer. For example the answer that the standard DSGE model gives to monetary policy questions hinges on a key property: a policy induced cut in the interest rate leads to an increase in consumption.'

But

'the Euler equation is satisfied ... in all dates and states of nature...There is overwhelming empirical evidence against this perspective on how consumption decisions are made.'

Where did belief in the foundational assumption go?

- Christiano, Eichenbaum & Trabandt (2018, published version)
- 'Motivated by these observations, macroeconomists are exploring DSGE models where heterogeneous consumers face idiosyncratic shocks and binding borrowing constraints. Kaplan, Moll, and Violante (2018) and McKay, Nakamura, and Steinsson (2016)...'

Core models as benchmarks?

- It is commonly argued that most macromodels are not identified or that the identifying restrictions are implausible (e.g., Sala and Canova 2009).

- Did the previous core models (e.g., Smets & Wouters 2007) ever provide reliable comparisons between models?

- Perhaps…

Agent based models and microfoundations

- An obvious way to provide microfoundations without a representative consumer is with agent based simulations (Haldane & Turrell 2018 etc.).

- No equilibrium assumption. The models are solved by letting individual agents interact.

- Agent based models are particularly useful for studying heterogeneity.

The problem with AB models

- 'Animal spirits' allow us to generate the financial crisis in an agent-based model (e.g., de Grauwe 2011).

- But this is far too easy: Embarrassment of the riches, ABMs are too flexible

- It is difficult to see what exactly is responsible for the results.

- ABMs are too different from standard macromodels and too different from each other to allow comparisons.

- The econometric estimation is usually not done.

Flexibility and Duhemian problems

- Just about any assumption can be easily changed in an AB (as emphasised by Haldane & Turrell 2018).

- If this can be done one assumption at a time, we can see what depends on what.

- ABMs can thus be used to test the robustness of analytical models (Richiardi 2018).

A core AB macromodel?

- Lengnick (2013), and Caiani et al. (2016) name their models as 'baseline', and 'benchmark' respectively

Gobbi & Grazzini (2019): An agent based New Keynesian DSGE model

- The point: the model has all the properties of a standard NK-DSGE model (Woodford 2013) except that it is solved with agent interaction rather than assuming an equilibrium.

- The model almost perfectly replicates Woodford's results when it is forced to model Woodford's assumptions except the way in which the model is solved.

- This demonstrates that the assumption of a (general) equilibrium does not affect the results very much.

- Compares rational expectations with perturbed signals on aggregate productivity, showing that there is a difference.

Conclusions

- We need to know what depends on what, in reality and in the model.

- I believe the ABM community should follow Gobbi & Grazzini rather than Lengnick. Why? Because it could change the mainstream rather than provide yet another alternative.

- Is having a core model necessary for knowing what depends on what?

- Pairwise comparisons of assumptions can be conducted without a core model. The difficult question is how to construct models in such a way that one can be sure that the robustness results are not mainly driven by compensating errors.

- But if core models are not needed for providing a benchmark, are the other gains sufficient to explain the quest for having them?

- simple

- known to all

- agreement on the most important causal mechanisms?

- Why should graduate students around the world study the same core model?

Macroeconomics and methodology

- Some quotes:

- Hoover 2012: 'In effect, the new classic macroeconomists sleepwalked into their most characteristic methodological position'

- Solow 2010: the requirement of microfoundations is 'generally phony'

- 'It is completely useless to criticize the basic DSGE framework'

Does the core model provide microfoundations?

- A model with a representative consumer does not provide proper microfoundations - at least not microfoundations consistent with methodological individualism.

- It is an aggregate-level entity that faces aggregate-level constraints (e.g., Hoover, Wren-Lewis).

- It omits the aggregation mechanism from individuals to the macrolevel consequences.