

Vítor Constâncio: Developing models for policy analysis in central banks

Opening speech by Mr Vítor Constâncio, Vice-President of the European Central Bank, at the Annual Research Conference, Frankfurt am Main, 25 September 2017.

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I am pleased to welcome you to the second Annual Research Conference of the European Central Bank. Every year this aims to be our flagship research event, bringing together academics and central bank researchers working at the cutting edge of economics.

We value research because it contributes to shape the intellectual framework that we use to understand economic developments and to take policy decisions. We are especially keen to keep abreast of new developments in the research frontier because they are on top of the new challenges to understand the economy's behaviour which is vital for devising appropriate policies. In the words of Christiano, the Great Recession was a macroeconomics earthquake¹ to which the field is still adjusting. Christiano highlights mainly three aspects: the need to recuperate the Keynesian view that demand shocks and the paradox-of-thrift can be important for economic performance, the notion that economy is not quickly self-correcting and requires public policies intervention and, finally, that the financial sector can endogenously generate imbalances with significant consequences for the real economy. With hindsight, it is surprising how these points were neglected by mainstream economics for so long. Many other aspects can be usefully added to that list.

First, that stabilisation policies are crucial and that not only growth counts as significant fluctuations leave behind permanent losses. Related to this, is the the notion that demand shocks can affect the supply side via hysteresis effects in labour supply and the capital stock via investment deceleration. The distinction between short- and long-term is necessary for theorising and teaching, but often is not useful for policy analysis models.

Second, the heterogeneity of agents, particularly of consumers, is important to understand aggregate behaviour, in view of indebtedness, credit restrictions and income and wealth composition.

Third, behavioural economics has also cast doubt on the full rational expectations paradigm as a too demanding hypothesis about the cognitive powers of economic agents, especially for long horizons. In this context, the myopic assumption explored by Gabaix (2017)² is a welcomed development.

Fourth, agents' heterogeneity relates to the issue of distribution that had been neglected but which, with the use of Heterogenous Agents New Keynesian (HANK) models, helped bring to the fore as exemplified by the recent contribution of Ahn et al. (2017) at the NBER Macroeconomics Annual Conference.³ It shows how significant the feedback loop is and how models with realistic household heterogeneity fit empirical consumption dynamics better.

Fifth, the assumption of a unique steady state is now challenged by the consideration of multiple equilibria, particularly some without full employment as seen in the work by Farmer and collaborators⁴. The idea of abandoning the notion of an aprioristic theoretical equilibria in favour of the pure interaction of heterogeneous agents with behaviour rules in ABMs (Agent Based Models) is more controversial.

A final point refers to the question whether conventional monetary policy is as powerful as portrayed in mainstream DSGE models via Euler equations. The protracted recovery seems to give ground to the old view of monetary policy effectiveness being asymmetric and weaker in

recessions. There is justification for rethinking a more active role for fiscal policy, following the recent papers by Auerbach and Gorodnichenko (2017)⁵. A reconsideration of the effectiveness of both macro policies has become even more necessary in view of the two major problems that central banks are now confronted with: first, the lingering low inflation associated with flatter Phillips curves that impairs the policy transmission and, second, the need for policy instruments to deal with the next recession, even if a mild one.

The various points I just listed are some of the relevant aspects of the on-going revision of macroeconomics and justify the point recently made by Blanchard that we need different types of models to understand, forecast and analyse the economy and the policies necessary to address its shortcomings. In that spirit, I will concentrate my remaining remarks on some on-going developments in the specification of macroeconomic models at the ECB.

Desirable properties of policy models

Macroeconomic models can be used for a variety of purposes in central banks. They are helpful to articulate relationships between certain variables of interest in a systematic fashion, while ensuring that resource constraints are respected. They provide input to the complex process of macroeconomic forecasting. And they can be helpful to conduct scenario analyses and study policy counterfactuals.

To perform these tasks effectively, a model should satisfy two simple criteria. First, since many policy questions are inherently quantitative in nature, a useful model must fit the data reasonably well and should be able to produce effective economic forecasts. Model-based counterfactual analyses will only serve as a credible benchmark for policy discussion, if the results are quantitatively plausible. In practice, this criterion has two implications. On the one hand, the model should incorporate realistic elasticities. For example, the dynamic effects of changes in monetary policy interest rates should be consistent with available reduced-form evidence. In the euro area, the model should provide a reasonably good account of the inflationary impact of national fiscal expansions, or of developments in national wage negotiations. On the other hand, the model should provide a credible narrative for observed economic developments.

The second criterion is really an implication of the first. Partly due to new research findings, partly as a result of puzzling economic developments, we constantly update our beliefs on the key economic mechanisms that are necessary to fit the data. The model should be reasonably flexible to be able to adapt to a changing economic and policy environment and to speak to current policy questions. The financial crisis is a case in point. The macroeconomic models maintained by central banks in the early 2000s were not equipped to speak to all the questions arising in the aftermath of the crisis without further adjustments. From today's standpoint, these adjustments are simply inescapable. We would like the model to provide a reasonable account of the dynamic effects of non-standard monetary policy measures. With policy rates at the effective lower bound, we really need the model to provide realistic implications on the impact of forward guidance. For me as a policymaker, it is of key importance that our models can be adapted fast enough to address newly emerging questions in a timely manner. Of course, in order to reap the benefits of a flexible modelling framework, it is equally important to have expert staff using and enhancing the models in a practical and innovative manner.

The new ECB multi-country model: ECB-MC

These considerations played an important role at the ECB, when we were just recently faced with the decision of enhancing the multi-country (MC) model of the euro area. Which paradigm should we adopt?

One option was to remain within the DSGE framework. For over 10 years, DSGE models have been the key tool used for policy analysis exercises in many central banks. This has also been

the case at the ECB, where the initial development of estimated DSGE models has taken place.⁶ DSGE models are typically estimated and thus consistent with the data. They often reproduce the dynamic effects of changes in monetary policy interest rates that are observed in identified Variable Autoregression Models (VARs.) This is also the case for the DSGE model developed in the Directorate General Research, the New Area-Wide Model, is regularly used for counterfactual policy analysis.⁷

At the same time, a good fit of the data is to some extent accomplished by DSGE models through persistent shock processes, which questions the empirical validity of the model's intrinsic propagation mechanisms. More importantly, DSGE models do not always provide a plausible story for observed economic developments. For example, so-called "technology shocks" tend to play an overwhelmingly important role in accounting for the evolution of GDP, even when external data do not show any evidence of technological innovations. Moreover, DSGE models can only slowly be adapted to a new policy environment. The requirement of full internal consistency makes the incorporation of new features—be it a more granular financial sector, household heterogeneity or stronger nonlinearities—often very demanding. Enhancements come with long gestation periods, sometimes limiting the ability of DSGE models to speak to newly emerging policy questions, in a timely manner.

In designing the new ECB-MC we have therefore started from the premise that, in the words of Olivier Blanchard, "policy models" cannot be expected to have the same tight structure as "theory models".⁸ We have decided to adopt a semi-structural approach inspired by two guidelines: 1) include financial frictions or financial mechanisms that could allow monetary policy shocks to be transmitted via channels that were absent before the crisis; 2) adopt a more flexible and empirically-driven approach.

The emphasis is on equation-by-equation fit, while the cross-equation constraints are mostly ignored because they do not impinge on the model's ability to provide sound quantitative predictions. When introducing financial frictions, we have relied on a reduced form representation that is consistent with different theoretical micro-foundations. This more flexible, semi-structural approach allows us to model a wide range of banking and financial variables, going from bank lending spreads to term premia, without taking a stance on the exact theoretical mechanism linking them to the macroeconomy.

At its core, the new ECB-MC model is designed along the lines of the Federal Reserve's FRB/US model.⁹ The behavioural decision rules of private agents are based on optimisation and in the long run the model boils down to a neoclassical growth model. In the short run, however, it is assumed that agents face adjustment costs which imply staggered adjustment of the actual to the desired levels.

Challenges ahead

I believe the design of the ECB- MC model will increase the robustness of our model-based policy analyses and strengthen our capability to address newly emerging policy questions in a timely manner. The model development, which has been led by the Directorate General Research, is a joint effort of economists from a wide-range of policy areas inside the ECB, colleagues from national central banks and academic consultants. I am confident it will soon be part of the ECB toolkit. However, it is easy to forecast that further refinements will prove to be necessary in the future, for the model to continue being a valuable policy tool. I specifically see four areas where significant progress has already been made, but further improvements are likely to be necessary.

The first area is related to the modelling of aggregate consumption. I share the concern of Muellbauer that the standard DSGE framework imposes unrealistic micro-foundations for the behaviour of households as embodied in the 'rational expectations permanent income' model of

consumption.¹⁰ In typical representative-agent models, consumption behaviour is captured by an Euler equation, an inter-temporal optimality condition that links today's level of consumption to expected consumption in the next period and further into the future. In its linearised form, it does neither envisage that consumers face idiosyncratic (household-specific) and uninsurable income uncertainty, nor that uncertainty interacts with credit or liquidity constraints. This is in stark contrast to recent research that emphasises the importance of precautionary saving, liquidity constraints, leverage and of heterogeneity, including heterogeneity in marginal propensities to consume.¹¹ Compared to simple representative-agent models, the ECB-MC clearly marks an improvement. The consumption function is explicitly affected by agents' wealth holdings.¹² Agents have shorter average horizons than presumed under the text-book permanent income hypothesis and the model further allows for the presence of agents that do not optimize but rather exhibit 'hand-to-mouth' behaviour. Last, but not least, risk aversion and income uncertainty also play a role for consumption behaviour. This setup, for example, allows quantifying how larger income uncertainty reduces the power of forward guidance. All in all, I think that we are moving in the right direction. Nevertheless, the modelling of aggregate consumption is an area in which research is currently developing fast and we should be ready to learn from new findings.

The second area of improvement concerns the modelling of expectations. As Sargent (1993) emphasizes, rational expectations can be a meaningful characterisation of the long-run equilibrium, but the transition to a new steady state might display non-rational behaviour.¹³ An increasing body of research aims to explore the implications of alternative types of departures from rational expectations for business cycle dynamics in general, and the transmission of monetary policy in particular, as in the papers by Garcia-Schmidt and Woodford (2015), Gabaix (2017) or Fahri and Werning.¹⁴ Once again, the ECB-MC goes in the right direction. The model can be simulated under two expectation setups: (i) in a model consistent manner, and (ii) under the assumption of bounded rationality where agents form expectations with a small-scale VAR model. Other expectation formation mechanisms, such as learning or the use of market expectations, are also easily implementable. As was shown by Blanchard and co-authors in a recent study on the macroeconomic effects of changes in the expectations of long-run productivity growth, different assumptions on the expectation formation mechanism can lead to considerably different outcomes.¹⁵ Assessing the most realistic way of treating expectations in policy models remains a crucial area for further work.

The third area of improvement has to do with the nexus between inflation, wages and the real economy. When modelled through the expectations-augmented Phillips curve, the nexus seems to have become weaker after the financial crisis.¹⁶ Commentators have repeatedly talked about a "missing disinflation" at the trough of the Great Recession, and about "missing inflation" in more recent years.¹⁷ Recent studies have come up with alternative explanations for these phenomena. For instance, the "missing disinflation" has been argued to be the consequence of either the presence of well-anchored inflation expectations¹⁸, increased downward wage rigidities in recessions¹⁹, or a fall in total factor productivity and increased costs of working capital²⁰. Understanding the underlying sources of this apparent structural change will be important for monetary policy. The semi-reduced-form nature of the ECB-MC makes it ill-equipped to address this deep question, but studying structural changes is challenging for all current models built to study cyclical developments.

The fourth and final area where further improvements are necessary is macro-financial linkages. I have already mentioned that the ECB-MC incorporates such linkages. Nevertheless, the exact way in which they affect the monetary policy transmission mechanism remains imperfectly understood, even if the empirical literature is making important advances.²¹ These linkages are also relevant for financial stability and may evolve in response to the recent reforms in the regulatory environment. This is why at the ECB we are also making parallel progress on this front

within the DSGE paradigm, through the 3D model. The 3D model has been developed under the macroprudential research (MaRS) network, and can be used to assess the macroeconomic benefits and costs of macroprudential policies. “3D” alludes to the fact that, contrary to previous models, it captures the distinct benefits of capital requirements through reductions in default risk in the economy, not only for banks but also for borrowers, i.e. non-financial firms and households.²²

Concluding remarks

To conclude, building models for policy analysis is associated with trade-offs. This is an important reason for central banks to not rely on a single model and a single modelling paradigm, but to make use of a suite of models based on different paradigms. I could not agree more with Blanchard who recently expressed his view that also other types of general equilibrium models beyond DSGEs are useful policy tools.²³ I am pleased this view has been getting more traction lately, as alternative types of models will continue to be part of central banks’ toolbox. Development of those models can greatly benefit from insights from academic research, so I am very much looking forward to the contributions to be presented at this conference.

Thank you for your attention.

¹ Christiano, L. (2017), [“The Great Recession: a macroeconomics earthquake”](#), *Minneapolis FED Policy Paper 17–01*.

² Gabaix, X. (2017), [“A Behavioral New Keynesian Model”](#), mimeo.

³ Ahn, S., G. Kaplan, B. Moll, T. Winberry and C. Wolf (2017), “When inequality matters for Macro and Macro matters for Inequality”, *NBER Macroeconomics Annual*.

⁴ See, e.g. Famer, R. and K. Platonov (2017), [“Animal spirits in a monetary model”](#).

⁵ Auerbach, A. and Y. Gorodnichenko (2017), “Fiscal stimulus and fiscal sustainability”, paper presented at the *Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming*.

⁶ See, e.g. Coenen, G., R. Motto, M. Rostagno, S. Schmidt, and F. Smets (2017), “DSGE models and counterfactual analysis”, in “DSGE Models in the Conduct of Policy. Use as intended” (eds. R. Gürkaynak and C. Tille), *VoxEU.org Book, CEPR Press*.

⁷ See Christoffel, K., G. Coenen, and A. Warne (2008), “The New Area-Wide Model of the Euro Area: A Micro-Founded Open-Economy Model for Forecasting and Policy Analysis”, *ECB Working Paper Series No. 944*.

⁸ See Blanchard, O. “The Need for Different Classes of Macroeconomic Models”, *PIIE RealTime Economic Issues Watch, January 12, 2017*.

⁹ Brayton, F. and P.A. Tinsley (1996), “A guide to FRB/US: a macroeconomic model of the United States”, *Finance and Economics Discussion Series 96–42, Board of Governors of the Federal Reserve System (U.S.)*.

¹⁰ Muellbauer, J. (2016), [“Macroeconomics and consumption: Why central bank models failed and how to repair them”](#), *VOXEU*. See also Muellbauer, J. (2016), “Consumption and macroeconomics”, *CEPR Discussion Paper No 11588*.

¹¹ See, e.g., Kaplan, G., and G. L. Violante (2014), “A Model of the Consumption Response to Fiscal Stimulus Payments”, *Econometrica*, 82(4), 1199–1239; and Man, A., K. Rao, and A. Sufi (2013), “Household Balance Sheets, Consumption, and the Economic Slump”, *Quarterly Journal of Economics*, 128 (4): 1687–1726.

¹² Muellbauer, J. and R. Lattimore (1995), “The Consumption Function: A Theoretical and Empirical Overview,” in *Handbook of Applied Econometrics Macroeconomics*, eds. M. H. Pesaran and M. Wickens (Oxford, K.: Blackwell, 1995), 221–311.

¹³ Sargent, T. J. (1993), “Bounded Rationality in Economics”, (Oxford: Clarendon).

- ¹⁴ See, for instance, García-Schmidt, M. and M. Woodford (2015), “Are Low Interest Rates Deflationary? A Paradox of Perfect-Foresight Analysis”, *NBER Working Paper No. 21614*; Gabaix, X. (2016), “A Behavioral New Keynesian Model”, *NBER Working Paper No. 22954*; and Farhi, E. and I. Werning (2017), “Monetary Policy, Bounded Rationality and Incomplete Markets”, *NBER Working Paper No. 23281*.
- ¹⁵ Blanchard, O., G. Lorenzoni and J. P. L’Huillier (2017), “Short-run effects of lower productivity growth. A twist on the secular stagnation hypothesis”, *Journal of Policy Modeling*, 2017, ISSN 0161–8938.
- ¹⁶ Blanchard, O., E. Cerutti and L. Summers (2016), “Inflation and activity – two explorations and their monetary policy implications”, ECB, *Inflation and Unemployment in Europe, Conference proceedings of the ECB Forum on Central Banking*, pp. 25–46.
- ¹⁷ For a summary see Constâncio, V. (2015) “Understanding inflation dynamics and monetary policy” remarks at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming. See also Constâncio, V. (2017), “Understanding and overcoming low inflation”, remarks at the Conference on “Understanding inflation: lessons from the past, lessons for the future?”, Frankfurt am Main, 21 and 22 September 2017.
- ¹⁸ Bernanke, B. (2010), “The Economic Outlook and Monetary Policy”, speech at the *Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming*.
- ¹⁹ Daly, M. C. and B. Hobijn, (2014), “Downward Nominal Wage Rigidities Bend the Phillips Curve”, *Journal of Money, Credit and Banking*, Vol. 46(S2), 51–93.
- ²⁰ Christiano, L. J., M. S. Eichenbaum and M. Trabandt (2015), “Understanding the Great Recession”, *American Economic Journal: Macroeconomics*, Vol. 7(1), 110–167.
- ²¹ See Gertler, M. and P. Karadi (2015), “Monetary Policy Surprises, Credit Costs, and Economic Activity”, *American Economic Journal: Macroeconomics*, pp. 44–76.
- ²² Clerc, L., A. Deriz, C. Mendicino, S. Møyen, K. Nikolov, L. Stracca, J. Suarez and A. P. Vardoulakis (2015), “Capital Regulation in a Macroeconomic Model with Three Layers of Default”, *International Journal of Central Banking*, pp. 9-63.
- ²³ See: Blanchard, O. (2016), “Do DSGE models have a future?”, *Peterson Institute for International Economics Policy Brief 16, 11 August*; Blanchard, O. (2016), “Further Thoughts on DSGE Models”, *Peterson Institute for International Economics Realtime Economic Issues Watch*, 3 October; Blanchard, O. (2017), “The need for different classes of macroeconomic models”, *Peterson Institute for International Economics Realtime Economic Issues Watch*, 12 January.