The Importance of Non-Linearities and Expectations in the Recent Crisis

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This commentary is motivated by the papers "Unconventional Monetary Policy and the Great Recession: Estimating the Macroeconomic Effects of a Spread Compression at the Zero Lower Bound" by Christiane Baumeister and Luca Benati (this issue) and "House Prices, Credit Growth, and Excess Volatility: Implications for Monetary and Macroprudential Policy" by Paolo Gelain, Kevin J. Lansing, and Caterina Mendicino (this issue). Both papers are innovative technically, but because they are trying to capture difficult phenomena, they illustrate nicely the limits of current DSGE modeling. I focus my comments on two issues in which macro modeling needs improvement: the modeling of expectations and non-linearities.

JEL Codes: E1, E5.

The session I have been asked to comment on is titled "policy." This topic seemed a big topic, so I thought that I would focus my comments on the area that lies in the intersection of the overall theme of the conference and the particular papers in this session. Unfortunately, this intersection is not very large. The conference is entitled "New Frameworks for Monetary Policy." It is a testament to the predicament in which central bankers find themselves that neither of the papers is about monetary policy as it is conventionally defined. One is about the optimal policy in a world in which housing acts as collateral and agents have near rational expectations. It is true that the authors consider a broad range of policies, including a monetary policy rule that responds to the growth rate of household debt and the growth rate in house prices. The question that the paper asks, however, lies more naturally in the realm of prudential mortgage regulation than monetary policy, and the authors' results seem to indicate as much: directly regulating borrowing outperforms

tinkering with the monetary policy rule. The other paper studies the macroeconomic implications of conscious shifts in the yield curve arising from large-scale asset purchases. This question lies more naturally in the realm of debt management than monetary policy. In an ideal world, the Treasury would take the lead in such policy. Now it is true that central banks tend to both regulate banks and engage in debt management, and that the Treasury has been curiously absent from the policy arena. Still, it is a stretch to consider either monetary policy, unless monetary policy is defined as anything that a central bank does. So instead of discussing the papers themselves, I will try to use the two papers as springboards from which to draw some conclusions for monetary policy in general and for modeling monetary policy in particular.

I want to focus on two topics: non-linearities and expectations.

Macroeconomists have been looking for non-linearities in macroeconomic time series for a long time, without much success. Prior to the crisis, it was easier to defend the proposition that non-linearities were unimportant than it was to defend the proposition that non-linearities were essential for understanding macroeconomic dynamics. Lots of models with non-linearities have been produced—models with irreversible investment, time-varying policy, regime shifts, borrowing constraints—but most empirical studies ignored these changes and fit a single vector autoregression (VAR) to the entire post-war period.

If non-linearities are ever going to matter for macroeconomics, now is the time that we should expect to see their effects. There are at least three big non-linear mechanisms at work on the U.S. economy right now. The first, of course, is the effective zero bound on nominal interest rates. Nominal interest rates can rise all they want, but they cannot fall in any practical sense. The second is debt. A large number of American households are attempting to work their way out from under the debt burden that they accumulated in the past decade. A large fraction of American homeowners own homes that are worth less than their mortgages. A large fraction of mortgages are in default. If one believes the results of Reinhart and Rogoff, the process of working off debt is slow and painful, and the aggregate dynamics are different than what one sees in a recession without a significant debt component. As a matter of casual empiricism, it certainly seems like the gains from reducing the debt

burden by 20 percent right now would be much larger than the gains would have been fifteen years ago when debt levels were much lower. The third non-linearity is the crisis itself, which would seem to be a different beast from what we had recently experienced. The fact that most macroeconomic models found it unnecessary to even include a financial sector prior to the crisis attests to this difference, although even here most attempts to include financial frictions into general equilibrium models follow the standard practice of log-linearization in order to solve the model. This is why many recent studies find that financial shocks play a large role in explaining recent fluctuations in economic activity.

Both of the papers make heroic efforts to stretch linear methodologies to capture these non-linearities. Gelain, Lansing, and Mendicino work in the linear tradition. The economy fluctuates about steady state in response to shocks, and the goal of the policymaker is to stabilize output, inflation, and debt about these steady-state levels. The problem that I see in this paper is that they model prudential regulation without any crisis period. Bank lending and mortgage debt were in the background before the crisis. There were subprime lenders such as Long Beach Savings and Loan in the 1990s and their actions were on the margins of proper, but their actions did not have macroeconomic consequences because they were relatively small and posed no systemic risk. Something changed in the 2000s and Americans began accumulating much more debt. Subprime became more pervasive and the problems became systemic. The crisis that resulted was not a fluctuation about a steady state but a collapse of the entire financial system. I would like to understand this process better: the process by which risks build up in the system and make a collapse more likely. To me the proper focus of prudential regulation is not so much smoothing out small fluctuations about trend; it is avoiding breakdowns in the system that lead to large drops below trend. The welfare calculation is to accept some restrictions that reduce welfare today in order to prevent a catastrophe which would lead to a greater decline in welfare tomorrow. In order to make these welfare calculations, we need a model. It seems to me that we need a non-linear model in order to capture the possibility of crises and in order to model the forces that trigger crises.

Baumeister and Benati employ a time-varying parameter VAR model as a flexible tool to capture changes in the economic

environment. In principle, their model can capture shifts in the economy between crisis and non-crisis periods. Their reduced-form framework, however, cannot capture the endogeneity of these shifts. The parameters evolve exogenously, and their evolution is held fixed in the counterfactual policy experiments. I am not sure what else they can do short of writing down a structural model which makes precise the connection between policy and the parameters, but it seems to me that their framework misses an important point—that the main goal of policy at the onset of the crisis was precisely to influence the economic environment. The goal of policy was to avoid an even larger crisis. In order to fully capture the effects of policies, such as the provision of liquidity by the Federal Reserve, one needs to know how the parameters of the VAR would have evolved in the absence of these policies. This, of course, is just the Lucas critique. There is therefore a sense in which both papers miss the endogeneity of the economic environment and its relationship with policy.

My second general topic is expectations. The crisis has forced macroeconomists to think hard about expectations and expectation formation. With nominal interest rates at the zero bound, conventional monetary policy can no longer work through current actions; instead, expectations of future policy play a central role and forward guidance becomes the norm. On the theoretical side, models of monetary policy at the zero bound hinge on the response of real interest rates and consumption to future policy, with real interest rates responding to inflationary expectations and consumption responding both to real interest rates and to perceived wealth effects.

On the topic of expectations, the Gelain, Lansing, and Mendicino paper takes the more aggressive stand by assuming boundedly rational agents that forecast (in part) using an error-correction model. I have a lot of sympathy for using bounded rationality in modeling house-price expectations. Changes in house prices tend to be positively autocorrelated over relatively long horizons. This is a very difficult fact to match in a rational expectations model. House-price returns are like stock returns ignoring dividends. They can exhibit significant autocorrelation if the dividend process, which in this case is the rent process, is sufficiently autocorrelated. Rents, or proxies for rents such as wages, however, do not exhibit enough autocorrelation to generate autocorrelation in house prices. Bounded

rationality is therefore a sensible way to generate realistic movement in house prices.

It is also difficult to model the large run-up in house prices over the past decade without appealing to some form of bounded rationality. There were certainly forces pushing up house prices, namely low interest rates and new financial instruments that made it easier to own a home and to access the wealth tied to one's home. One can easily model these. What are difficult to model are the continued expectations of house-price growth and the apparent complacency over the prospect of a decline in house prices. Low interest rates are a temporary event. They should lead to expectations of declining house prices. Also, financial innovation may raise house prices but does not necessarily imply expectations of rising house prices. Yet it was the expectation of house-price growth that led to some of the greatest mistakes of the crisis, mistakes such as giving triple A ratings to mortgage-backed securities and making loans with little downpayment or little documentation. Even if the borrower could not pay, it was thought that the asset backing the mortgage would be sufficient to support the loan.

Here I think that the Gelain, Lansing, and Mendicino paper misses an opportunity. Their boundedly rational agents forecast the level of house prices rather than the growth rate. I do not believe that such a model can generate the wild swings in house prices that we have recently seen. It cannot capture the extrapolation in recent trends that leads to excessive optimism, or the belief, to use the phrase of Reinhart and Rogoff, that "this time is different."

The Baumeister and Benati paper does not pay as much attention to expectations as it should. The main innovation in the paper is to introduce a pure spread shock, a shock that affects long rates without affecting the short rate, and to see how this shock affects other macroeconomic quantities such as output and inflation. This shock is meant to capture the shifts in the yield curve that are the goal of quantitative easing. The problem, as the authors themselves note, is that the shock may combine many things, such as expected inflation, expected future policy, a term premium, or default risk. I have a feeling that each of these should affect the economy in different ways, and some of these may affect the economy in ways that might contradict the assumption that the VAR coefficients follow a random walk. Take the Federal Reserve's policy actions as

an example. The liquidity infusions that accompanied QE1 had a very specific goal: to avoid a collapse of the financial system and to reduce the probability of a collapse like the one we experienced during the Great Depression. In the language of their time-varying coefficient VAR, the Federal Reserve was trying to avoid certain parts of the parameter space. The Federal Reserve was trying to nudge the economy in a specific direction. It is tough to see how this is consistent with random-walk coefficients. Another example is forward guidance. The Federal Reserve's commitment to future policy actions pushes future rates in one direction and would appear to have a non-random effect on the future evolution of the economy. To the extent that these effects are the same as those that we normally see, the effects of these policies will probably appear as impulse responses. To the extent that these commitments to future policies are something new, they will show up either as future shocks or future changes in the coefficients. The Baumeister-Benati model is a nice advance over past efforts to model quantitative easing, but it also shows how far we have to go before we can model the time dimension of policies like forward guidance or Operation Twist.

Modeling the effects of expected future policy is a very difficult task. We do not have a set of stylized facts that we would like to have our models match as we do with the effects of current policy. Compounding these difficulties is a difficult identification problem of separating the current effects of future policy shocks from the current effects of other shocks. We are just beginning to make headway on these issues.

To sum up, I will list the models that I would like to see on the topics of crises and exceptions.

I would like to see a convincing model of the recent crisis. This model would explain not only the run-up in house prices but also the evolution of the mortgage market and how so many smart people were caught off guard. The stories that are currently being told either make the crisis seem inevitable or make the participants appear naïve.

I would like to see models that capture the slow recovery from the current crisis. Why has output remained so far below trend? Is it that monetary and fiscal policy are both constrained, the former by the zero bound and the latter by the fear of accumulating ever

more debt? Or is it something particular to financial crises and the process of working off an accumulated debt burden?

I would like to know the actual current effects of expected future policy actions. Are statements about the future effective? What makes them so? What are the channels through which they operate?

I would like to know what determines inflationary expectations at the zero bound. With no policy to pin expectations down, what do they respond to and how can they be manipulated?