

## Macroeconomic Models for Monetary Policy: Conference Summary

BY ERIC SWANSON

Papers presented at the conference on “Macroeconomic Models for Monetary Policy,” held March 6, 2009, at the Federal Reserve Bank of San Francisco, addressed such issues as how to model wage and price behavior and how to measure economic output. The answers to these and other questions examined at the conference are highly relevant for monetary policy and for the macroeconomic models in use at central banks around the world.

The current financial crisis underscores the need for better macroeconomic models to help central banks forecast the economy and analyze the effects of monetary and fiscal policy. The “Macroeconomic Models for Monetary Policy” conference held March 6, 2009, at the Federal Reserve Bank of San Francisco brought together leading researchers from academia and central banks to discuss ways of improving macroeconomic models for monetary policy. Papers presented at the conference focused on five important questions: Why do many prices respond slowly to economic events? What makes wages sluggish and at what point do firms lay off workers? How do households and firms form expectations about the future? How do financial market frictions affect the decisions of households, firms, and the central bank? What is the best way to measure potential output?

### What makes prices slow to adjust?

Some prices—such as those for gasoline, airfare, and fresh produce—change very frequently. But prices for about 70% of goods and services in the United States change much less often, only about once every six to twelve months. The speed of price adjustment matters for monetary policy because, if all prices in the economy always changed instantaneously, monetary policy would have little effect on the economy other than to cause prices to change. This is the classic argument that “money is a veil”—if the central bank were to double the quantity of money in circulation and the monetary doubling were perfectly anticipated by everyone in the economy and all prices were perfectly flexible, then the only effect of the central bank’s action would be that all prices in the economy would double. On the other hand, if prices respond slowly—for example, because it is costly for firms to change them or because prices are set in contracts that last for several months—then changes in the quantity of money or the federal funds rate can have significant effects not only on prices, but also on production and sales.

Bils, Klenow, and Malin use data on thousands of individual price quotes from the consumer price index to create a new measure of price changes, which they call “reset price inflation.” For any product, the “reset price” is defined as the price the seller would like to be in effect today. Reset price inflation—the average percent change in reset prices—is less persistent than observed inflation because in the latter price changes don’t occur instantly, but rather are spread out over several months. Reset price inflation

thus provides us with an additional perspective on how prices in a macroeconomic model behave and how that behavior compares to the data.

Bils, Klenow, and Malin estimate the reset price for every product in every month using price changes of comparable products to infer what every other product's reset price would have been if that product had also experienced a price change. The method is like using comparable sales to estimate the price of a home. The authors compare their constructed measure of reset price inflation to the prediction of a number of different models of price rigidity. They find that reset price inflation is most consistent with models in which firms can change prices whenever they want, subject to a cost—which may be due to printing new menus or catalogs, losing some percentage of repeat customers, or other factors—rather than models in which prices are set for fixed periods, such as a year. The lack of persistence in reset price inflation in the late 1980s and 1990s also suggests that monetary policy reacted strongly to movements in inflation throughout that period. The authors note that these conclusions are still tentative and many puzzles remain regarding the behavior of reset price inflation.

### **What makes labor markets sluggish?**

It takes time to find a job or fill a vacancy. When compatible workers and firms do meet, terms of employment such as wages, hours, and benefits are often subject to negotiation. When economic conditions deteriorate, firms typically lay off a fraction of their employees rather than spread wage cuts across their entire workforce. What are the economic causes and consequences of these labor market frictions?

Traditional macroeconomic models invoke union-type wage contracts as the primary source of labor market frictions. But as the extent of unionization in the United States has declined to less than 15% of the labor force, explanations based solely on union contracts have become less persuasive. Christiano, Trabandt, and Walentin consider alternative labor market frictions in an otherwise standard macroeconomic model and find that the traditional union-type model of wage contracting is hard to beat. One reason might be that there are implicit rather than explicit wage contracts between workers and firms that mimic formal union agreements. However, the authors also find that they can match U.S. GDP and inflation data just as well using a more decentralized model in which workers and firms search for each other, bargain over wages once matches are found, and continue employment until either the worker leaves for personal reasons or the firm fires the worker due to deteriorating business conditions. The advantage of the authors' more decentralized model is that it more accurately describes worker flows into and out of employment than a union-type wage contracting model, in which workers are never truly considered unemployed but, in effect, relax at home until the union calls them back to work. Thus, the authors' decentralized labor market model can potentially make better predictions about the effectiveness of such government policies as unemployment benefits and job training programs in helping unemployed workers find suitable jobs.

### **How are expectations formed?**

Decisions by households and firms today are closely tied to their views about the future. As a result, understanding how households and firms form expectations is crucial for understanding how they make decisions regarding consumption, investment, and employment today.

A common assumption in macroeconomics is that households and firms have “rational expectations”—that is, they form expectations about the future in a mathematically optimal way, taking into account all

of the equations that describe the economy and all of the information in the economy. While this assumption provides a useful and mathematically tractable benchmark, it probably overstates the knowledge and mathematical acumen possessed by actual households and firms. Slobodyan and Wouters modify an otherwise typical macroeconomic model to allow households and firms to form expectations using small, simple forecasting models. Agents in the authors' model are not naive, but rather update their forecasting models continuously and favor alternative models based on how their forecasts have performed over time.

Slobodyan and Wouters show that models that allow expectations to be formed this way fit many aspects of the data much better than do models in which expectations are formed with perfect rationality. For example, prices and wages in the authors' model respond sluggishly to surprise changes in policy because they assume it takes households and firms some time to learn what the effects of those policies will be. Also, inflation expectations and inflation persistence in the United States have both gradually declined since the 1970s, which is much easier to explain using the authors' dynamic model of expectations than with a model assuming perfectly rational expectations.

### **Financial market frictions**

A striking feature of the current economic crisis is the dramatic effect financial market disruptions have had on the real economy. Yet standard macroeconomic models assume that financial markets are frictionless, always matching buyers and sellers at prices that perfectly equate risk-adjusted returns across all types of securities. Bankruptcy and default are typically nonexistent in these models.

De Fiore and Tristani begin to address these shortcomings by incorporating credit market frictions into an otherwise standard macroeconomic model. In the authors' model, banks lend to firms, but there is some probability that any given firm will be unable to repay a loan and default. When firms default, the bankruptcy process imposes costs on the bank and to society. Banks cover the expected losses from default by diversifying, lending to large numbers of firms at an interest rate above the federal funds rate.

De Fiore and Tristani use their model to analyze the mathematically optimal monetary policy in the presence of financial frictions and default. They show that it is optimal for monetary policy to ease very aggressively in response to an adverse financial market shock, a finding that stands in sharp contrast to the popular Taylor rule, which would set short-term interest rates based on how far output diverges from potential output and inflation diverges from the central bank's target for inflation and would prescribe only a mild response to financial disruption.

### **Potential output**

One of the central concepts in macroeconomics is potential output, the level of a country's GDP that would occur if that country were not in an unusually expansionary or recessionary period. When output is above potential, then the "output gap" is positive, the economy is in a boom, and it is generally optimal for monetary policy to be tighter than normal. When output is below potential, the output gap is negative, the economy is in a slump, and it is usually optimal for monetary policy to be easier than normal.

The standard method of measuring potential output is to draw a smooth trend line (or a smooth curve) through the history of U.S. data. However, that approach is problematic in a macroeconomic model, because such models are independent of any single country's data and should be applicable to many different national economies. Moreover, the trend-line approach is unsatisfying because one can imagine

that a persistent boom or slump might inappropriately affect the estimated trend. A model-based definition of potential output avoids these problems and has other applications, such as simulating how the output gap and monetary policy would evolve under alternative forecast scenarios.

Justiniano and Primiceri assess different measures of potential output in a state-of-the-art macroeconomic model. They show under what conditions the model can produce an output gap estimate that closely matches the traditional, trend-based measure for the United States. The authors' model generalizes the traditional measure of the output gap to the case of a macroeconomic model, which makes the definition easy to apply to any country or any forecast scenario. Moreover, their approach is well adapted to the case of a long boom or slump, and allows potential output to change rapidly if fundamental economic conditions change suddenly, something that a slowly evolving trend does not allow. The authors conclude with an exercise that investigates the extent to which U.S. business cycles have been amplified by imperfect competition in product and labor markets and find that this amplification has been substantial.

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### Conference papers

Agenda available at <http://www.frbsf.org/economics/conferences/0903/index.html>

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