# Monetary Theory:
# Do We Get More Out of It Than We Put Into It?

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The best measure of the value of a theory—in any field of endeavor—is how much we get out of it. In a recent speech, "Monetary Policy: Practice Ahead of Theory," Bank of England Governor Mervyn King suggests that we could get more out of monetary theory, and I am sure that this is a frequent wish of all central bankers. But wishing aside, how much do we actually get out of monetary theory? And in particular do we get more out of it than we put into it? To address this question—which should be on the minds of central bankers, their research departments, and monetary scholars everywhere—I first consider the story of the Great Moderation and then examine one of its central theoretical subplots, the theory price adjustment with forward-looking expectations.

## *The Role of Theory in the Great Moderation and the Great Monetary Policy Shift*

There is a heated debate about the role of monetary policy in bringing about the Great Moderation—the remarkable improvement in both price and output stability observed in the United States and other countries in the decades following the early 1980s. Most notably the frequency and severity of recessions has declined sharply as has the inflation rate.

In my view, monetary policy played a large role in achieving these results.[2] A key piece of evidence supporting this view is that a shift in the responsiveness of monetary policy occurred at the same time—again in the early 1980s—as the improvement in macroeconomic stability. In particular, central banks, reflecting a greater focus on inflation, started adjusting their policy interest rates in response to inflation by much larger amounts and more quickly. Their responses to real GDP also rose. Hence there was Great Monetary Policy Shift that accompanied the Great Moderation. This close timing is very strong evidence for a large role of monetary policy.

There has been relatively little discussion about the connection between monetary theory and this important shift in monetary policy. If there is such a connection, then there is no doubt that we got a great deal more from theory than we put into it Though as debatable as the causes of the Great Moderation, the timing suggests the strong possibility of such a role for theory. Staring some thirty years ago, monetary theorists set out to help find a better monetary policy with the objective of making the fluctuations in

[1] Written version of a dinner speech given at the first annual monetary research conference of the Swiss National Bank, Zurich, Switzerland, 21 September 2007.

[2] See my Homer Jones Lecture (Taylor (1998)) at the St. Louis Federal Reserve Bank and remarks by Ben Bernanke (2004) at the Eastern Economic Association.

real GDP and inflation smaller. They even wrote down that stability objective mathematically. And using a novel expectations-based theory they came up with new ideas for monetary policy, stressing the need for greater predictability and credibility, and larger responses of the instruments of policy to inflation and real GDP.

As we look back over the years, the shifts in the procedures for setting interest rates have been very close to what theory recommended, mainly in the prompt and aggressive reactions of interest rates to changes in inflation and real GDP. And in parallel with those two changes, as I already mentioned`, the economy changed too. The fluctuations in inflation and real GDP came down as was the objective of the theoretical research. This interaction between monetary theory, policy, and results is one of the most fascinating stories in economics. The connection, let alone the causal direction, between the theory, the policy and the results can never be proven beyond a shadow of doubt, but the timing is remarkably close.

### *The Engine of Monetary Theory*

The main engine of monetary theory during this period is well known to researchers in central banks. It has three interlocking parts. One part is a model of inflation which describes how firms and workers set prices and wages and how these aggregate into the price level and the inflation rate. The second part describes how the real economy is affected by the policy interest rate of the central bank. The third part focuses on how the policy rate of the central bank is set, usually through a policy rule.

To better understand the role of monetary theory I am going to look under the hood and examine the first and crucial part of this engine—the price adjustment, or inflation, model. To do so I will examine the origins of this model and how it developed over time.

### *Toward the New Keynesian Phillips Curve*

The starting place for discussing this modern, price adjustment model—which frequently goes by the name New Keynesian Phillips curve—is the expectations augmented Phillips curve, which Milton Friedman and Edmund Phelps first suggested in the late 1960s. The expectations augmented curve told us that if inflation rises above what people had expected, then output and employment will rise above normal levels, and vice versa. It also told us that if inflation is to be reduced below its currently expected level, then real output and employment have to fall below normal levels for a while. As long as expectations were assumed to be adaptive—to change slowly—this expectations augmented Phillips curve gave a reasonably accurate description of the time series pattern of inflation and real GDP. But with the advent of rational expectations, all this changed. If you assumed the expectations were rational, then monetary policy—as long as it was anticipated or followed a known rule—could not create a difference between actual and expected inflation rate; thus there was no way for monetary policy to affect the real GDP.

It could achieve any inflation rate it wanted with any degree of accuracy without any adverse impact on the real economy.

Though this striking result attracted a lot of attention at the time, it was not a very accurate theory and was not useful for finding how monetary policy could reduce fluctuations in inflation and output. So a new theory was developed, a theory that endeavored to incorporate some real world features of price and wage adjustment. The basic idea of the new theory is that firms would not change their prices instantaneously. (The same idea applied to wages but I will focus on prices here.) Instead, there would be a period of time during which the firm's price would be fixed, and the pricing decisions of different firms would not all be made at the same time. They would be staggered and unsynchronized.

This new pricing assumption required a fundamental rethinking of the theory of markets. The typical textbook diagram of a demand curve, a supply curve, and an equilibrium price would not work. When you think about how a market might work in these circumstances, you realize a number of important things not in the classic supply and demand framework. First, you realize that some firms' prices will be outstanding when another firm is deciding on a price to set. So firms need to look back at the price decisions of other firms. Second, you realize that the firm's price will be around for a while, so the firm will have to think ahead and forecast the price decisions of other firms.

### *A Simplifying Assumption and Seven Key Results*

One way to get your hands around how such a market might work is to make a simplifying assumption that the price is set at a fixed level for a fixed period of time. In any case this is what I assumed when I started working on this problem in the 1970s.[3] (This simplifying assumption is akin to the assumption used by Paul Samuelson in the original overlapping generation model that all people live for exactly two periods.) Despite the simplicity of the assumption the theory yields some fascinating results.

First, the theory generates *a simple equation* that can be used and tested. I list this result first because if the theory had not yielded an equation, none of the progress I report below would have been achieved. The equation describes the price decision of firms setting prices today. A key variable in this equation is the prevailing price set by other firms. The prevailing price itself is an average of prices set in the past and prices to be set in the future. There is a nice symmetry: the coefficients on past and the future are equal.

The second key result is that *expectations of future inflation matter* for pricing decisions today. The reason is that with the current price decision expected to last into the future, some prices set in the future will be relevant for today's decision. This is a very important result; for the first time, expectations of *future* inflation come into play in the theory of inflation. It gives a rationale for central bank credibility and inflation targeting.

[3] For example, see Taylor (1980).

Third, there is *inertia* in the inflation process; past prices matter because they are relevant for present price decisions. The coefficients on past prices can be calculated from the theory.

Fourth, the *inertia is longer than the length of the period during which prices are fixed*. Price shocks take a long time to run through the market because last period's price decisions depend on price decisions in the period before that and so on into the distant past. This phenomenon is the "contract multiplier" analogous to the Keynesian multiplier.

Fifth, the *degree of inertia or persistence depends on monetary policy*. The more aggressively the central bank responds to inflation, the less persistent inflation shocks are. This prediction was later shown to be true. Over time inflation persistence has come down as the monetary responses have gone up.

Sixth, the theory implies *a tradeoff curve between price stability and output stability*. Inefficient monetary policies would be off the curve. Performance could be improved by moving on the curve. Bernanke (2004) used this curve to explain the role of monetary policy during the Great Moderation.

Seventh, *the costs of disinflation are less than in the expectations augmented Phillips curve*. This prediction also proved accurate when people later examined the disinflation of the early 1980s.

***Theoretical Improvements and Additional Results***

The first improvement in this theory was to allow for a greater variety of time intervals during which prices are fixed. A generalized distribution of price setting intervals was used by Taylor (1979) in empirical work. A geometric distribution was introduced by Calvo (1982). A modification by Fuhrer and Moore (1995) generated additional inflation inertia which was needed empirically. Fortunately the seven results I mentioned were robust to these changes.

Later on, there were more improvements. The price adjustment equations were shown to be optimal if firms had some market power (see Chari, Kehoe, and McGrattan (2000), for example). Though the functional form of the optimization-based price setting equation is the same as in the original model, we got more out of this theory—an eighth result: more aggressive monetary policy responses imply a *smaller pass-through of price shocks* (commodities or exchange rates) to core inflation. Such a reduced pass-through has now been documented in many countries.

A more recent improvement in the theory has been to relax the simplifying assumption that prices are set for an exogenous interval and allow the firm's price decision to depend on the state of the market, which gave rise to name "state dependent" pricing models and created the need to give the original model a new name, "time dependent." (See Dotsey, King, and Wolman (1999), Golosov and Lucas (2006), and Gertler and Leahy ( 2006 )). There are benefits from these improvements as Klenow and

Kryvtsov (2007) have shown by evaluating the different generations of models—Taylor (1980), Calvo (1982), Dotsey, King, and Wolman (1999), and Golosov and Lucas (2006)—using new microeconomic data. Nevertheless, it appears that the key policy results I have highlighted in this lecture will continue to hold.

### *Conclusion*

In this lecture I reviewed the monetary theory that underlies the monetary policy that led to the dramatic Great Moderation. I also examined eight important predictions implied by a key part of that theory—the model of price adjustment with rational expectations—from its origins to the present. I think this review makes it clear that we got more out of monetary theory than we put into it in recent years. Central bankers will undoubtedly face new practical problems in the future. Monetary research at central banks and elsewhere will need to focus on these practical problems if it is to continue to deliver.

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