THE CASE OF THE DISAPPEARING PHILLIPS CURVE

James Bullard
President and CEO

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Any opinions expressed here are my own and do not necessarily reflect those of the FOMC.
Introduction
The slope of estimated Phillips curves in G-7 economies was negative in the 1980s but has been drifting toward zero in the inflation targeting era since 1995.

This is an empirical phenomenon often referred to as a “flattening Phillips curve.”

Monetary authorities have generally improved policy during the inflation targeting era—inflation has generally been lower, less volatile and closer to stated inflation targets.

I will argue that the improved monetary policy has led to the flatter empirical Phillips curve.

I will draw out the implications for monetary policy after making my core argument.
Empirical Evidence of a Flatter Phillips Curve
In the past 30 years, the empirical Phillips curve has flattened in advanced economies.

The following chart shows the coefficient on a measure of resource slack (unemployment) in a regression of price inflation on resource utilization.

- The analysis is contained in the latest BIS annual report.
- The data are for a panel of G-7 economies.
- The coefficient is estimated for rolling 15-year samples, from the 1980s to the present.
- The point estimate is a weighted average across economies.
**Flattening of the Phillips curve in G-7 economies**

**Figure:** Source: Bank for International Settlements (2017).
A Simple Model
A SIMPLE AND STANDARD MODEL

- I will use a simple and standard model to state the argument.
- This model is a version of more complicated models that underlie much of the analysis in modern central banking.
THE STANDARD NEW KEYNESIAN MODEL

- Dynamic IS equation:

\[ y_t = E_t (y_{t+1}) - \frac{1}{\sigma} [i_t - (\rho + \epsilon_t) - E_t (\pi_{t+1})] \] (1)

- A structural, New Keynesian Phillips curve:

\[ \pi_t = \kappa y_t + \beta E_t (\pi_{t+1}) + u_t \] (2)

- Monetary policy conducted using a Taylor-type monetary policy rule:

\[ i_t = \rho + \varphi_\pi \pi_t + \varphi_y y_t \] (3)

- Notation:
  - \( y, \pi, i, \rho + \epsilon \): the output gap, inflation gap, short-term nominal interest rate and natural real rate of interest, respectively.
  - \( \epsilon, u \): the natural rate shock and the cost push shock, respectively.
  - \( \sigma, \kappa, \beta \): structural parameters, all positive.
  - \( \varphi_\pi, \varphi_y \): policy parameters, with \( \varphi_\pi > 1 \) and \( \varphi_y > 0 \).
The equilibrium has the output gap and the inflation gap evolving as linear functions of the shocks:

\[ y_t = \frac{\epsilon_t - \varphi_\pi u_t}{\sigma + \varphi_y + \kappa \varphi_\pi}, \]  
\( \text{(4)} \)

\[ \pi_t = \frac{\kappa \epsilon_t + (\sigma + \varphi_y) u_t}{\sigma + \varphi_y + \kappa \varphi_\pi}. \]  
\( \text{(5)} \)
Monetary Policy
**Constrained optimal monetary policy**

- We look for optimal monetary policy within the set of Taylor-type rules in the model.
- Fix $\phi_y$ to any positive value, and then choose the optimal value of $\phi_\pi$ by minimizing a quadratic:

$$
\phi_\pi = \arg \min (1 - \beta) \sum_{t=0}^{\infty} \beta^t \left( \alpha \pi_t^2 + y_t^2 \right),
$$

(6)

where $\alpha > 0$ represents the relative weight on the desirability of inflation stabilization compared to output stabilization.
- Regardless of the value of $\alpha$, the solution to this problem is to set a large coefficient on the inflation gap, technically, $\phi_\pi \rightarrow \infty$. 
INTERPRETATION AS BETTER INFLATION TARGETING

- Interpretation of the solution: “The policymaker should promise to react aggressively to deviations of inflation from target in conducting monetary policy.”
- The idea that policymakers put more weight on inflation deviations during the post-1995 period could be related, in part, to quantitative easing and other unconventional policy measures during years when inflation has been below target.
Empirical Phillips Curves from Model Data
**The Phillips curve slope in theory**

- Now let’s regress the inflation gap on the output gap inside the model and call the estimated coefficient “the slope of the empirical Phillips curve.”
- The slope can be calculated exactly as

\[
\gamma = \frac{\text{Cov}(\pi_t, y_t)}{\text{Var}(y_t)} = \frac{\kappa \sigma^2_{\epsilon} - \varphi_{\pi} \left( \sigma + \varphi_y \right) \sigma^2_u}{\sigma^2_{\epsilon} + \varphi^2_{\pi} \sigma^2_u}. \tag{7}
\]

- \(\sigma^2_{\epsilon}, \sigma^2_u\): variance of the natural rate shock and cost push shock, respectively.
- **Main result:** Under the optimal monetary policy defined above, the empirical Phillips curve becomes flat, that is,

\[
\lim_{\varphi_{\pi} \to \infty} \gamma = 0. \tag{8}
\]
Empirical Relevance
Empirical relevance

- Would this Lucas critique effect be large enough to importantly affect estimated Phillips curve coefficients?
- I use mean estimates for post-1982 data from their Table 3, p. 206 to generate artificial data and regress inflation on the output gap.
- I use Okun’s law with a coefficient of −2.3 to translate the Phillips curve slope in terms of unemployment.
- The following chart suggests that, at these parameter values, the slope of the estimated Phillips curve would attenuate significantly as $\varphi_\pi$ increases.
**Empirical relevance**

**Figure:** Phillips curve slope as a function of the interest rate response to inflation.
Implications for Today’s Monetary Policymakers
Implications for today’s monetary policymakers

- Ultimately, successful monetary policy can push the empirical Phillips curve slope all the way to zero.
- The model economy in this talk still has a structural Phillips curve; it is only the empirical Phillips curve that is “disappearing.”
- Today’s G-7 monetary policymakers are unlikely to glean a reliable signal for monetary policy based on empirical Phillips curve slope estimates—they have to look elsewhere.