

Inflation Persistence, Output Gaps and Monetary Policy

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Our presentation summarizes two important concepts: inflation persistence and output gaps. These seemingly disparate concepts are linked through the Phillips Curve. We argue that interpretations of inflation persistence and output gaps derived from Phillips Curve models are sensitive to assumptions made in estimating these models and assumptions made about the nature of shocks entering the models. Unfortunately, there is not always a sound basis for choosing among candidate assumptions. As a result basing policy discussions on measures of persistence or output gaps may not be productive.

Our work shows that (1) observed inflation persistence may be the result of monetary policy choices and thus cannot be used to infer structural features of the economy; (2) statistical measures of output gaps are not useful in formulating monetary policy; and (3) theoretical measures of output gaps may in principle be helpful for guiding policy, but in practice they are probably not.

So, let me turn my attention to inflation persistence. To investigate the potential sources of inflation persistence, we used a simple sticky-price model. In this model, the NKPC accounts for deviations of inflation from average—or trend inflation. In looking at inflation over the last 50 years, it appears that inflation can be characterized as a process having a time varying mean. Thus, how one models trend inflation has important implications for the structure of the model. If trend inflation is changing over time and is modeled as changing over time, then the NKPC needs to account only for the deviations of inflation from a changing trend, not for overall inflation. Thus a NKPC estimated on deviations from trend inflation will predict less backward-looking indexation or shock persistence. There will be less structural rigidities than if the trend is depicted as a constant.

To clarify the sources of inflation persistence, consider the reduced form NKPC on page 3 of the handout. This equation indicates there are several potential sources of inflation persistence.

¹ With Roc Armenter and Keith Sill (Federal Reserve Bank of Philadelphia), and Andreas Hornstein, Thomas Lubik, and Alexander Wolman (Federal Reserve Bank of Richmond).

Inflation can be persistent because marginal cost is persistent, because markup shocks are persistent, because prices are indexed to past inflation, or because the inflation trend is itself persistent. It seems natural to interpret a time-varying inflation trend as the result of a drifting inflation target.

We estimate our simple model for two specifications for the inflation trend: a specification with a fixed inflation target and a specification with an inflation target that follows a random walk. We find that allowing for a random walk inflation target reduces the overall contribution of indexation and markup shocks to inflation persistence. Further, the random walk inflation target specification is statistically preferred to the constant target specification.

That finding implies that the persistence of inflation (or the lack thereof) is to a large degree determined by policy. Supporting this point is the observation (see Benati (2008)) that historically across countries inflation persistence depends on the monetary regime. In particular, inflation persistence is lower in countries that are on a gold standard or where the central bank targets inflation. The finding that inflation persistence is largely determined by monetary policy and that other sources of persistence are not very important implies that policy is fully capable of changing the behavior of inflation without generating large economic costs, especially if inflation expectations are well anchored.

Now let me turn to my second topic: the usefulness of output gaps for conducting monetary policy. We are going to conclude that they are not very useful. Broadly speaking, output gaps refer to the deviation of output from a level deemed to be desirable. Thus, constructing an output gap requires one to take a stand on the desired level of output, often referred to as potential output. There are two primary approaches to defining and measuring potential output, those based on statistical procedures and those based on explicit theoretical models. Statistical measures of potential output are constructed either as smoothed measures of actual output, or smoothed estimates of output derived from a production-function.

A second approach to constructing potential output relies on estimated theoretical models,

where the behavior of output and potential output depend on the structure of the economy and the exogenous shocks buffeting the economy. Some features of the economy's structure and some of the shocks hitting the economy may give rise to inefficient outcomes. For example, monopolistic price setting and nominal rigidities introduce distortions. In addition, markup shocks introduce inefficient fluctuations. This suggests defining potential output as that output that could be obtained in the absence of distortions and inefficient shocks, but including the effects of shocks that are classified as efficient. In simple versions of these models, a monetary policy that minimizes the difference between actual output and the model-based definition of potential output, that is, the model-based output gap, is welfare improving.

Thus, in principle model-based output gaps may be useful for policy purposes. In contrast, the statistical measures of the output gap are less useful for policy purposes, because these measures need not be closely related to model-based gaps. For example, in figure 1 of the handout we consider a productivity increase in an economy with sticky nominal prices. With sticky prices, output responds more sluggishly than it would if prices were flexible. Because of this, potential output rises by more than actual output and the theoretical output gap is negative. However, if we were to graph a statistical measure of potential, which is a smoothed version of actual output, it would rise by less than actual output producing a positive output gap. Thus the model-based output gap and the statistical-based output gap would move in opposite directions and imply different monetary policy responses. This example illustrates why we think it unwise to base policy on statistical-based gaps.

However, at this stage of model development, we are also uncomfortable with using model-based gaps for policy purposes. First, in more complicated models, the output gap is no longer a sufficient statistic for evaluating the welfare implications of monetary policy (see. Woodford (2003, Ch.6)). Moreover, the models are still preliminary. In addition, shocks play an important quantitative role in these models, but the economic interpretation of many of these shocks is unclear.

While we have come to accept productivity shocks as structural, we have not yet reached that comfort level with many of the new ‘structural’ shocks coming out of NKPC models (see Chari, Kehoe, and McGrattan (2009)).

Also of importance is that different models may produce very different measures of the output gap. In Figure 2 we plot the output gaps from three representative models. The blue line represents the output gap from our small scale model, the green line is the output gap from a medium scale NKPC model developed by my colleague Keith Sill (2009), and the two red lines represent alternative output gaps from the Board’s larger scale EDO model. It is abundantly clear that the output gaps from these different models are very different. We, therefore, are not confident that, given the current state of knowledge, one can rely on model-based gaps as sufficient indicators for monetary policy.

On a more positive note, we believe that the process of formulating and estimating a particular model can be quite useful for policy purposes. Estimation can inform a policymaker about the shocks that the model suggests are impacting the economy. If the shocks have been correctly identified, the model can be a useful guide to policy. A general lesson from our models is that it is not enough to know that output is high or low relative to trend to conclude that output is high or low relative to potential; rather one needs to know something about the shocks hitting the economy and the assumed structure of the economy. It seems more appropriate that policy discussions proceed based on explicit discussion of these shocks, rather than the implied gaps. From this we conclude that the use of models in policy discussions is beneficial. Also, because we have no agreed upon model, it is useful to consider the implications from a number of models, and it is certainly not necessary that all the models be of the New Keynesian variety. It is only the careful consideration of a full range of imperfect models that enlightens and places discipline on policy discussion.

*Material for Briefing on
Inflation Persistence, Output Gaps and
Monetary Policy*

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Overview

- Inflation Persistence and output gaps are linked through the Phillips Curve.
- Three main points.
 - Inflation persistence is largely an outcome of monetary policy and not structural features.
 - Statistically derived output gaps are not useful.
 - Theoretical measures of output gaps may be useful in principle but not in practice.

Inflation Persistence

- Reduced-form Phillips Curve.

$$\ln \pi_t = \alpha \ln \pi_{t-1} + (1-\alpha) \ln \pi_t^* + \kappa mc_t + \lambda e_t$$

Π is the gross inflation rate,

π^* is the inflation trend,

mc is marginal cost,

and e is a mark-up shock.

- Modeling trend inflation is of key importance.
 - If trend is stochastic our model implies structural rigidities are less important in explaining inflation persistence.

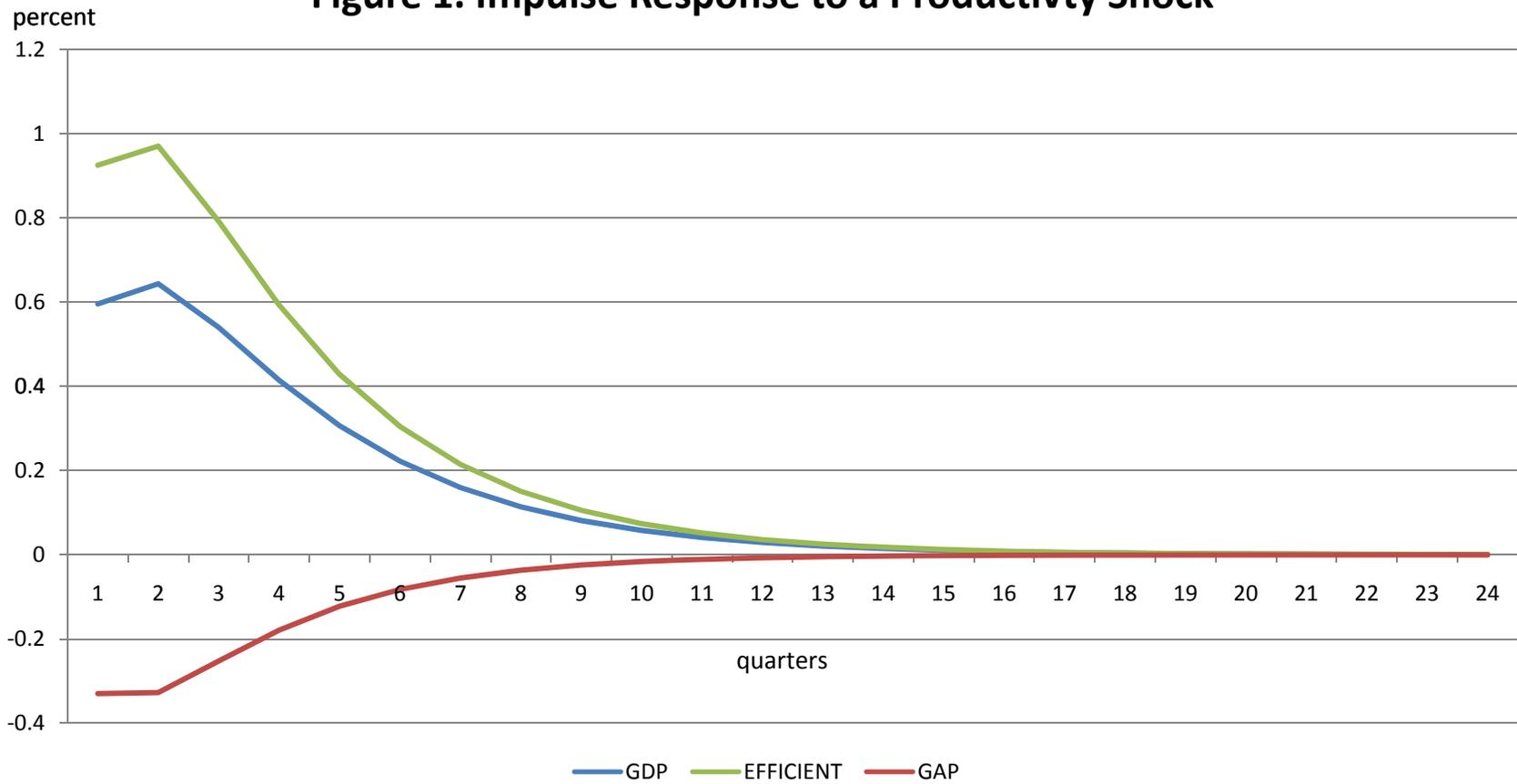
Policy Implication

- Inflation trend is a result of past policy.
 - Controlling inflation may not be too costly, especially if inflationary expectations are well anchored.

Output Gaps

- Gap = output – desired output.
- Desired output can be calculated either.
 - Statistically (deviation from a trend), or
 - From an estimated theoretical model.
- Model-based measures are potentially a useful guide for conducting monetary policy.
- Statistical and model-based measures may differ (figure 1).

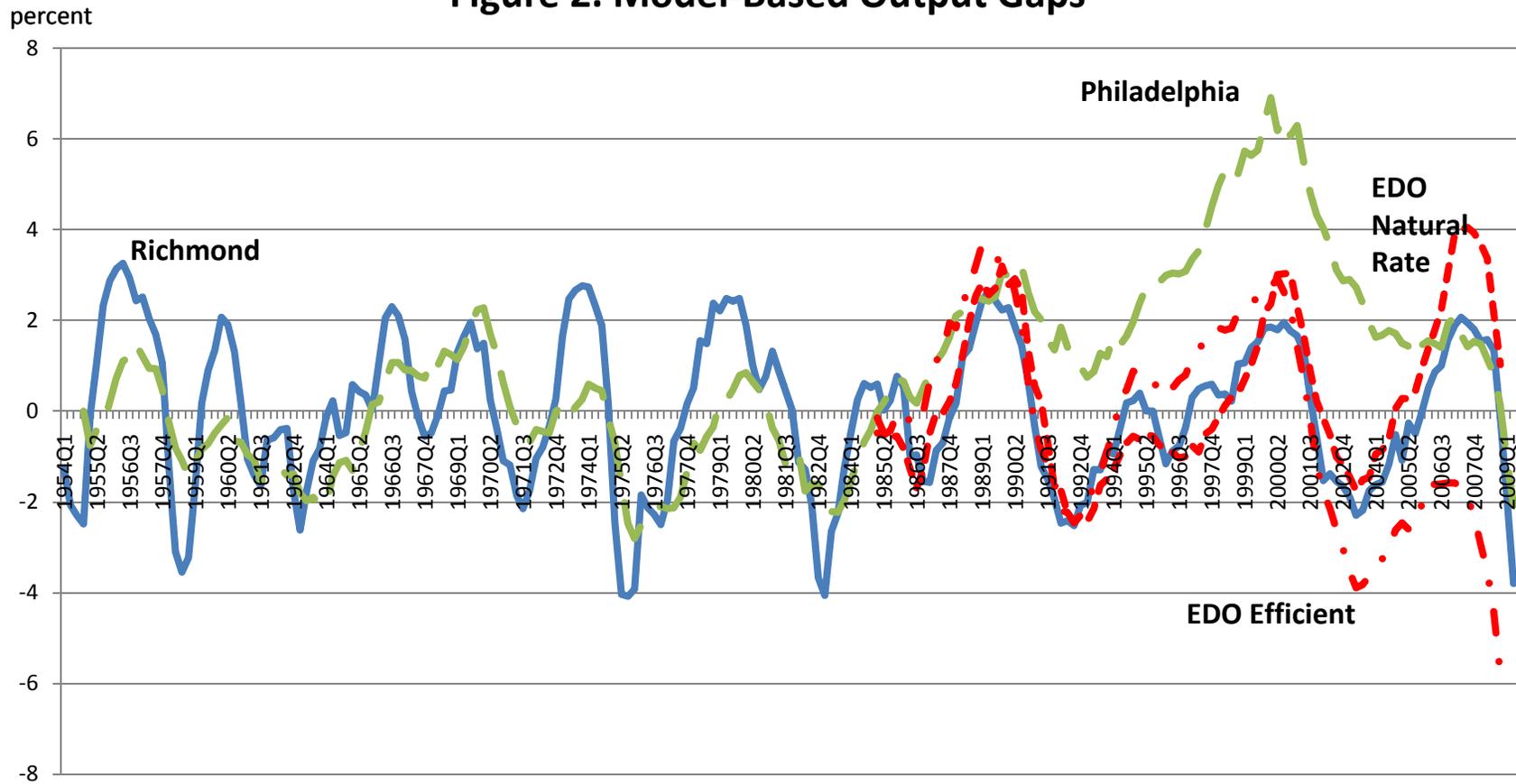
Figure 1. Impulse Response to a Productivity Shock



Theoretical Gaps

- Not quite ready for use in policy because:
 - In complex models the output gap is no longer sufficient statistic for welfare.
 - Models are still preliminary
 - Different models produce very different output gaps (figure 2).

Figure 2. Model-Based Output Gaps



Models are Useful

- Models can inform of us about shocks.
- Need to look at a number of models, because they produce different results.
- Models can place discipline on policy discussions.