



Errors in the Measurement of the Output Gap and the Design of Monetary Policy

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We exploit data on historical revisions to real-time estimates of the output gap to examine the implications of measurement error for the design of monetary policy, using the Federal Reserve's model of the U.S. economy, FRB/US. Measurement error brings about a substantial deterioration in economic performance, although the problem can be mitigated somewhat by reducing the coefficient on the output gap in policy rules. We also show that it is usually optimal to place some weight on the level of the output gap in the conduct of policy, but under extreme conditions it may be preferable to focus on output growth. © 2000 Elsevier Science Inc.

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I. Introduction

Decision making by the Federal Reserve takes place in the context of considerable uncertainty about the current as well as prospective state of the economy. Data on economic activity and prices are incomplete and subject to substantial revision; moreover, the correct interpretation of these data is often unclear. Key elements in this interpretation are current readings on aggregate resource utilization: To the extent that they are accurate, readings combining actual data and inferences about the economy's productive potential are useful indicators of future inflationary tendencies. Unfortunately, at times their reliability is questionable. This would seem to have been the case during the late 1990s when inflation was coming in persistently lower than would have been expected given most estimates of resource utilization.

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This paper examines the role of the output gap and other measures of aggregate resource utilization in the conduct of monetary policy, given that readings on the state of excess demand are inherently imprecise. In particular, we examine how the usefulness of the estimated output gap declines when its measurement error increases in magnitude, and how macroeconomic performance can suffer as a result, even if policymakers respond to increased uncertainty by reducing the weight placed on resource utilization in the formulation of policy.

The problem we investigate is by no means new; in discussions of monetary policy and macroeconomic stabilization, researchers have recognized the difficulties associated with the measurement of potential output and resource utilization for years, beginning at least with Friedman (1947, 1953). Many authors have highlighted the issue since then. For example, Kuttner (1994) and McCallum (1998) emphasize that monetary policy is complicated by mismeasurement of the output gap. Estrella and Mishkin (1999) and Staiger et al. (1997) draw attention to the corresponding problems associated with errors in estimates of the unemployment gap. However, quantitative assessments of the policy implications of mismeasurement have appeared only recently. Smets (1998) integrates estimation of the output trend in a policy evaluation model, and illustrates the effect of errors in this estimation on the choice of efficient simple policy rules. Using estimates of measurement error derived from real-time estimates of the output gap, Orphanides (1998) shows that such errors lead to a significant deterioration of feasible policy outcomes and cause efficient policies to be less activist. Finally, Rudebusch (1999) shows that these considerations are essential for reconciling estimated policy reaction functions and optimal policy.

The contribution of this paper is twofold. First, in order to assess the measurement error problem, we follow Orphanides (1998) in taking advantage of the real-time estimates of the output gap that were historically available to the Federal Reserve. Unlike preceding papers, however, we use the Board of Governors' staff econometric model, FRB/US to analyze the implications of output gap mismeasurement in the policy process. The size and scope of the model ensure that a large range of disturbances and propagation mechanisms in the economy are incorporated into the analysis. Second, we specify that agent expectations are model-consistent. This assumption assures that private agents take into account the response of the Federal Open Market Committee (FOMC) to uncertainty and that any results we obtain are not a manifestation of arbitrary or unstated assumptions of policymakers' ability to systematically mislead private agents. This formulation makes our analysis less vulnerable to the Lucas critique.

In this analysis, we use simple interest-rate reaction functions to characterize the setting of the federal funds rate. In particular, our focus is on rules that respond to the measured *level* of resource utilization (among other factors), although we also consider alternative policies that respond to *growth* of actual and potential output. Such simple policy rules, the Taylor rule for example, have been shown to perform well at stabilizing the economy in experiments with a variety of economic models, at least if the output gap is measured well.

Based on the experience of the last 30 years, real-time assessments of the output gap have often fallen wide of the mark, as judged in hindsight with the benefit of more complete information and analysis. By contrast, revisions to measures of inflation, the other input to these rules, are much smaller. Hence, we assume that the monetary authority has only an approximate knowledge of the true current level of resource utilization in the economy, but retains a correct understanding of the true inflation outcomes. The degree

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