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# Measurement error in general equilibrium: the aggregate effects of noisy economic indicators<sup>☆</sup>

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## Abstract

I analyze the business cycle implications of noisy economic indicators in the context of a dynamic general equilibrium model. Two main results emerge. First, measurement error in preliminary data releases can have a quantitatively important effect on economic fluctuations. For instance, under efficient signal-extraction, the introduction of accurate economic indicators would make aggregate output 10–30 percent *more* volatile than suggested by the post-war experience of the U.S. economy. Second, the sign — but not the magnitude — of the measurement error effect depends crucially on the signal processing capabilities of agents. In particular, if agents take the noisy data at face value, significant improvement in the quality of key economic indicators would lead to considerably *less* cyclical volatility. © 2001 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

From the GDP to M2, to productivity growth to the index of leading economic indicators, preliminary releases of economic data are routinely subject to sizable revisions as more information becomes available in subsequent periods. The existence of noise in these and other economic indicators has been the subject of several studies, but the associated literature is primarily statistical and of a partial equilibrium nature.<sup>1</sup> In this paper I take a novel and complementary approach, examining the effects of indicator noise in a fully articulated dynamic macroeconomic model.

In choosing a theoretical framework for the analysis, I opted for the class of models in the real business cycle (RBC) tradition. Such a choice is motivated by two main factors. First, this modeling approach attempts to describe economic behavior from first principles, i.e., from individual optimization in a dynamic environment under uncertainty. Second, even if one disagrees with the main assumptions in the vast RBC literature, the RBC framework is well understood by the profession, and the results that I obtain under noisy indicators can be directly and quantitatively compared to the extant literature, which has generally abstracted from considering the economic effects of noisy information. Moreover, for the RBC skeptic, I review recent results in the monetary policy literature that suggest that the main thrust of this paper's findings should carry to a wide range of macroeconomic models and are thus not specific to the RBC structure.

This paper can be thought of as a well-defined sequence of computational experiments (Kydland and Prescott, 1996). Motivated by the findings of the empirical literature on indicator noise — which are summarized in Section 2 — I pose a very simple question: If economic data are as noisy as suggested by the statistical literature, what are the likely consequences for individual and macroeconomic behavior?<sup>2</sup> To address this question, I introduce a version of the model first proposed by Baxter and King (1991), which I augment to include a noisy productivity indicator. In Section 3, I describe the model and lay out the solution to the representative agent's dynamic optimization problem. Such a solution, which assumes that agents use fully efficient signal extraction techniques, characterizes the business cycles of the artificial economy. Using the conventional tools of the quantitative approach to macroeconomics (King, 1995), I calibrate the model to the U.S. postwar data and run, in Section 4, a series of experiments designed to quantify the aggregate

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<sup>1</sup>The work of Oh and Waldman (1990, 1995), which I discuss below, is an important exception to this rule.

<sup>2</sup>This paper attempts to extend and quantify the main results derived by Bomfim (1999), who used a very simple model to discuss the macroeconomic implications of indicator noise under alternative characterizations of agents' expectations.

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