12  ASYMMETRIES IN
BUSINESS CYCLES:
ECONOMETRIC TECHNIQUES
AND EMPIRICAL EVIDENCE

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1. Introduction

Recent empirical studies suggest that a number of economic time series
cannot be viewed as the output of a linear, Gaussian process. These find-
ings are compatible with earlier claims by Mitchell (1927), Keynes (1936),
and Hicks (1950) that the nature of economic activities varies over the
different stages of a business cycle. Specifically, these authors observed
that expansions are more persistent but less sharp than recessions. The
presence of asymmetries in business cycles would have important theoret-
ical and practical implications. For examples, economic theories would
have to explain such asymmetries. Similarly, models used for forecasting
or policy-analysis purposes should reflect asymmetric properties.

To categorize the sources of asymmetric behavior, we view a variable
as the output of a stochastic dynamic system as illustrated in Figure 1. Let
the system be represented by

\[ y_t = g(\varepsilon_{t-1}, \varepsilon_{t-2}, \cdots) + \varepsilon_t \]  

(1)

where \( y_t \) denotes the variable of interest; \( \varepsilon_t \) is an innovation or noise-input
sequence; and function \( g \) represents the economic system or transmission
mechanism. Then, asymmetries in \( y_t \) can be due to properties of the noise input, the transmission mechanism or both.

Classifying the input noise, \( \varepsilon_t \), according to whether or not it is distributed symmetrically and the transmission mechanisms, \( g \), according to whether it has a linear or nonlinear functional form, we obtain, as summarized in Table 1, four categories of dynamic systems. In the first category, i.e., the case of symmetric noise and linear transmission, output \( y_t \) will be symmetric. In all other categories the output will generally be asymmetric.

Note that, in principle, deterministic chaos models can also be viewed as belonging to Category 2. They represent the extreme case where the probability mass of the input noise is concentrated at zero.

If asymmetries are present in a time series and the model to be derived should reflect this property, one has to decide which category of model, i.e., Category 2, 3 or 4, is most appropriate. By adopting nonlinear models suggested in the statistical time series literature most of the efforts found in the nonlinear empirical macro literature have been focusing on models in Category 2. More recently, models belonging to Category 3 have been proposed; while models of Category 4, i.e., allowing for asymmetric inputs and nonlinear transmission, have not been widely considered in business cycle research.

In this paper, with the above categorization in mind, we provide an overview of econometric methods that have been used to model business cycle asymmetries. The next section considers two approaches to testing