

Periods and structural breaks in US economic history 1959–2007

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Abstract

Principal component analysis (PCA) is applied to six macroeconomic time series observed over 1959–2007. Six periods in US economic history are identified by a cluster analysis of observations in the PCA score plot. The method is data driven with no a priori information on the number or dates of breaks. Our findings give independent support to the effect of the oil price shock in 1973, and the introduction of the Great Moderation period. Of the five transition periods, two have been identified by previous studies as breaks (1973, 1984), one is a well-known date of monetary policy change (1979), and two had not previously been identified (1970, 1977–1978). In the long-run inflation and the federal funds rate are unrelated to industrial production and unemployment. Inflation and interest are positively associated as predicted by the Fisher hypothesis. These long-run relations argue against the use of monetary policy to peg the rate of unemployment or real interest rates. In the short-run inflation acts a leading indicator for unemployment for the period 1959–1997, but not for the period after 1997. The well-established reduction in macroeconomic volatility in the mid-1980s is specific to the period from 1985 to 1997; volatility subsequently rises above pre-1979 levels.

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1. Introduction

The US economy has experienced several dramatic events and changes during the post-WWII period. Perhaps the most prominent of these changes is named “The Great Moderation” and started in the early 1980s (1984Q1–3) and probably ended in 2007 (Canarella, Fang, Miller, & Pollard, 2009; McConnell & Perez-Quiros, 2000). Other periods are related to the breakdown of the Bretton Woods exchange rate system around 1971 (Bayoumi & Eichengreen, 1994), to the effect of the oil price shock in 1973Q1 (Perron, 1989) and to changes in monetary policies around 1979, initiating the Volcker period of reserve targeting (Chowdhury & Schabert, 2008; Sims & Zha, 2006). To identify structural changes researchers have examined increases and declines in mean values and volatility for a range of macroeconomic variables, including GDP (Kim & Nelson, 1999; McConnell & Perez-Quiros, 2000) and prices (Stock, Watson, Gali, & Hall, 2003), but also in generalized factors expressed by principal components (Banerjee, Marcellino, & Masten, 2008; Stock & Watson, 2007). Results are, however, often not conclusive as suggested by expressions such as “... is the most plausible” (Stock & Watson, 2003, p. 39) and “thinking of them as easily detectable regime shifts is a mistake” (Sims & Zha, 2006, p. 31). Thus, there is a need for objective supporting information, using algorithm-based methods for event and period identification.

The present approach is an alternative to methods that address breaks in single time series and is related to studies using principal component analysis, e.g., Stock and Watson (2007) and Banerjee et al. (2008). Cluster analysis is applied to the observations on the principal components to identify similarities between economic states. These clusters are the basis for identification of four out of five-time windows that constitute transition events in the economy. We will return to the fifth transition below. With the exception of the selection of variables going into the analysis, and the choice of some threshold coefficients to be discussed later, the methods are data driven. There is no a priori assumption about the number or dates of breaks except that they are less than 10.

The periods identified depend upon the characteristics of six macroeconomic variables. We examine key variables such as industrial production, IP, the unemployment rate, and inflation. Movements in these target variables are often anticipated by changes in policy or indicator variables, including money supply, e.g., Sims and Zha (2006), the interest rate on federal funds, and the term structure of interest rates. These six variables provide the data for the analysis reported in this paper. For the present study we use static principal component analysis, a simple clustering algorithm, and run length theory as discussed below.

1.1. Hypotheses

Our first hypothesis is that it is possible to identify events or transitions in US macroeconomic history from 1959 to 2007 based on six major macroeconomic variables, without any a priori assumption on the number or timing of the transitions. Second, we hypothesize that these objectively identified transitions coincide with some events or breaks found in other studies, in some cases corresponding to known changes in macroeconomic policies. Third, we hypothesize that our PCA results can be related to known propositions in macroeconomic theory, such as the Fisher hypothesis and the Phillips curve, with direct implications for economic policy. Finally, we hypothesize that lead and lag features among the time series are consistent over subsets of the periods identified, but not for the whole period 1959–2007, strengthening the need for objective periodization of US economy.

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