

# Forecasting business cycles and identifying significant economic events by using novel network methodologies

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## Abstract

We analyze monthly time series of 57 US macroeconomic indicators (18 leading, 30 coincidental, and 9 lagging) and 5 other trade/money indexes. Using the novel methods, we confirm statistically significant co-movements among these time series and identify noteworthy economic events. The methods we use are Complex Hilbert Principal Component Analysis (CHPCA) and Rotational Random Shuffling (RRS). We obtain significant complex correlations among the US economic indicators with leads/lags. We then use the Hodge decomposition to obtain the hierarchical order of each time series. The Hodge potential allows us to better understand the lead/lag relationships. Using both CHPCA and Hodge decomposition approaches, we obtain a new lead/lag order of the macroeconomic indicators and perform clustering analysis for positively serially correlated positive and negative changes of the analyzed indicators. We identify collective negative co-movements around the Dot.com bubble in 2001 as well as the Global Financial Crisis (GFC) in October 2008. We also identify important events such as the Hurricane Katrina in August 2005 and the Oil crisis in July 2008. Additionally, we demonstrate that some coincidental and lagging indicators actually show leading indicator characteristics. This suggests that there is a room for existing indicators to be improved.