
Does threshold cointegration matter for short-term interactions between US commodity prices and inflation? A historical perspective

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Abstract

The role of commodity prices as a precursor of inflation has been extensively studied in the literature. The empirical findings indicate the presence of a pass-through mechanism that changes substantially over time. However, the identification of the leading behavior of commodity prices seems to be affected by the fact that they respond both to economic shocks, such as changes in demand, and idiosyncratic shocks mirroring variations in supply of certain products, such as crude oil. In a broader perspective, conclusions regarding the direction of the driving between commodity prices and inflation appear to be subject to the specific factors dominating their short- and long-run dynamics.

Indeed, Sidaoui et al. (2010) attribute the absence of conclusive evidence regarding the linkage between the commodity prices, as measured by the producer price index (PPI), and the overall prices, explained by the consumer price index (CPI), to the inappropriate modelling of their dynamic interdependence. They point out that ignoring possible cointegrating relationship between CPI and PPI can make Granger-causality tests lead to misleading results. Further, if CPI and PPI follow an asymmetric path of adjustment to some long-term equilibrium, inferences based on linear cointegration analysis may be biased.

In the aim to address adequately all the aforementioned issues and shed light to the real short-run dynamics between CPI and PPI, in a first step we use recent developments on the threshold cointegration allowing for a nonlinear adjustment to the long-run dynamics between the variables and then causality analysis is implemented to the resulting residual series. The dataset consists of long monthly time series for the US commodity and producer price indexes that span the period from January 1913 to January 2016.

More specifically, we test for the presence of threshold effects under the null hypothesis of linear cointegration for the bivariate VECM specification in CPI and PPI (in logarithms). Following Hansen and Seo (2002), both fixed regressor and residual bootstrap methods strongly reject linear cointegration at 1% confidence level. Accepting the presence of threshold cointegration induces variations in the error correction mechanism depending on the deviations

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from equilibrium below or above the estimated threshold parameter. In our application, the first regime, characterized as "extreme" or "turbulent", corresponds to $CPI - 1.119 * PPI < -0.473$ and retains 37% of total observations, while the second one, called "normal", corresponds to $CPI - 1.119 * PPI > -0.473$ and contains the remaining 63% of the sample. Estimation is performed by MLE following the grid-search algorithm proposed by Hansen and Seo (2002). Empirical results reveal that during the "turbulent" regime (below the threshold value) a fast adjustment to the long-run equilibrium occurs and it is mainly driven by CPI. On the contrary, above the threshold we observe a flat near-zero effect for PPI together with a slightly greater effect for CPI. In other words, asymmetry suggests a stronger error-correction mechanism in the "extreme" regime compared to the "normal" one, dominated by the impact of CPI.

Taking the nonlinear long-run interdependence between CPI and PPI into account, we proceed with the filtering of data, giving us the respective residual series for both variables. In the effort to capture short-term relationship we employ a battery of tools including the standard linear Granger causality test (Granger, 1969), the transfer entropy (Schreiber, 2000), the mutual information on mixed embedding (Vlachos and Kugiumtzis, 2010), and finally the Mackey-Glass nonlinear causality test (Hristu-Varsakelis and Kyrtsov, 2010). The identified causal couplings highlight a persistent link from the PPI growth rates to inflation over the "normal" regimes i.e. 12/1920-09/1946, 04/1961-05/1973 and 06/1989-01/2008. They also show the absence of significant causal relationship during the "extreme" ones, except the period from December 1973 to February 1986 where changes in the commodity price index clearly cause inflation. These results are in line with the historical characteristics of the different subsamples. "Normal" regimes are marked by the systematic occurrence of oil shocks signifying the dominance of the supply-side explanation of inflation, without excluding fluctuations in the PPI index as a response to aggregate demand shocks. The fact that this idiosyncratic part of the commodity price index prevails in the "extreme" regime of December 1973-February 1986 can be explained by the mix of the US tight monetary policy to combat inflation (captured by the driving of CPI in the long-run) and the sequence of four oil episodes, translated into the short-run causality from the PPI growth rates to inflation.