BDS Test of nonlinearity

TAR

SELF-EXCITING THRESHOLD AUTOREGRESSIVEMODELS (SETAR)

The threshold autoregressive model (TAR) was proposed by Tong (1978) in time series modelling.

Threshold/switching co-integration

**Markov Switching Model (MSM)**

The purpose to apply Markov switching model is to determine the regimes of financial and business/poverty time series data with respect to Pakistan. It will also help to compare the results with previous results such as breakpoints and turning points. Previously applied methods yield largely similar results except some deviations. Markov switching model assumes that regimes are unobserved and exogenous. MSM has been widely used in financial and economic research in forecasting and identification of regimes. However in this study we adapted MSM to identify regimes in financial and business time series and to compare them with already determined turning points and breakpoints. We utilize previously disaggregated time series data. Figure \ref{} provides the visuals of filtered and smoothed probabilities of $y\_t = f(x\_t)$, where $y\_t$ is household final consumption to GDP for poverty and $x\_t$ is domestic credit to GDP that represents financial sector. MSM is applied using least square with two regimes specifications and AR-1 process. This figure depicts two regimes in the specified model; regime 1 is dominant in seven to eight time periods over the entire duration. Figure \ref{} demonstrates the relationship between financial development and poverty in two regimes. Where the plot of $y\_t$ variable is in regime 1 and plot of $x\_t$ indicator is show in regime 2. Regimes can be located in shaded and unshaded regions of the plot. Loosely speaking this figure shows the behavior of these two variables in two regimes, whether they move together (similarity) or not (dissimilarity) over time. This figure indicates that both variable move differently initially across two regimes until third block. In first shaded bar $y\_t$ goes down while $x\_t$ shows increasing trend. Similarly, in second regime (white) $y\_t$ and $x\_t$ move in different directions. This behavior continues up to the approximately 30th time. After this period these series show similar movements across regimes until the final block of regime 1. This implies that the relationship between financial development and poverty in Pakistan suffers from regime changes upto some extent. As we also noticed similar movements for a larger part of this plot irrespective of the regime. Furthermore, if we compare this regime switching with structural breaks, we previously found break in financial development in 2007, trace test predicted breakpoint in 2004. Most importantly, the dates of financial turning points in table \ref{} and figure \ref{} also suggest a recession in 2004 and expansion in 2006-2008. The shaded regions of figure \ref{} Hamilton filter and \ref{} exhibit largely similar patterns as both figures come from the Hamilton approach for modeling time series.