Cycle Validation

After finishing cycle analysis, we will get a list of detected active cycles. The cycle detection algorithm gave us a list of cycles with length, amplitude, and current phase status at the end of the data set. Now, we need to validate and rank these cycles as our approach is looking for the most active cycles out of this list.

Before we start to do some ranking, let us get back to what we introduced already in first detrending step: Based on the pitfalls of the HP-filter, we need to cross-check the detected cycles by using a second algorithm to validate if a cycle is genuine or perhaps spurious. So, this step is important to avoid getting "virtual" cycles that are not in the original data set and have just been returned by the detrending algorithm itself. Therefore, we apply a special form of statistical correlation analysis for each detected cycle length.

During this step of cycle validation, the statistical reliability of each cycle is evaluated. The goal of the algorithm is to exclude cycles that have been influenced by one-time random events (news, for example) and cycles that are not genuine.

One of the algorithms used for this purpose is a more sophisticated **Bartels Test**. The test builds on detailed mathematics (statistics) and measures the stability of the amplitude and phase of each cycle.

Bartels’ statistical test for periodicity, published at the Carnegie Institution of Washington in 1932, was embraced by the Foundation for the Study of Cycles decades ago as the single best test for a given cycle's projected reliability, robustness, and consequently, usefulness.

It was originally published in 1935 by Julius Bartels in Volume 40 No. 1 of the scientific magazine "Terrestrial Magnetism and Atmospheric Electricity" with the title "Random fluctuations, Persistence, and quasi-persistence in geophysical and cosmical periodicities." Later, Charles E. Armstrong gave a brief example and case study on how to apply the Bartels test in financial time series data in 1973, titled "Applying the Bartels Test of Significance to a Time Series Cycle Analysis." [1]

> The Bartels test returns a value that gives the measure of the likelihood of genuineness of a cycle: values range from 0 up to 1, and the lower the value, the less likely is that this cycle is due to chance, or random.

The test considers both the consistency and the persistence of a given cycle within the data set it is applied to.

To make it more human readable as we are looking for an easily readable indication if the cycle is genuine, we just convert the raw Bartels value into a percentage that indicates how likely the cycle is genuine by using the conversion formula:

Cycle Score Genuine % = (1 - Bartels Score) * 100

It gives us a value between 0% (random) and 100% (genuine).

This test helps us now to filter out possible cycles that might have been detected in the cycle detection step (Step 2), but had only been in the data series for a short or random period and should therefore not be considered as dominant cycles in the underlying original data series.

As we have a final percentage score, we just need to define an individual threshold below which the cycles should be skipped. We recommend using a threshold of >49% and hence cycles with a Bartels genuine percentage value below 49% should be skipped by any cycle forecasting or analysis techniques that follow.

Further Reference:

[1] C. E. Armstrong, Cycles Magazine, October 1973, p. 231ff, "Part 25: Testing Cycles for Statistical Significance" (see pdf attachment)

Revision #4
Created 11 May 2020 19:30:24
Updated 14 May 2020 16:31:05