Detrending

The algorithm has a dynamic filter for de-trending that is required for data preprocessing. Detrending ensures that the data under consideration is not affected by trends or one-time events. The extraction of linear trends in time series data is a required precondition for successful cycle research. In the business cycle literature, the Hodrick and Prescott (1980) filter (HP filter) has become the standard method for removing long-run movements, like trends, from the data. Hodrick and Prescott proposed the HP filter to decompose macroeconomic time series data into cycle and trend components. The HP filter assumes that movements in time series include a smooth and slowly changing trend component. By removing this trend component from the data series, the filter delivers the pure underlying cyclic behavior.

Visually, this de-trending technique is like drawing a smooth linear freehand trend line through the plotted chart data and extracting this "freehand" trend line from the full data set. The resulting component is only based on the cyclic behavior without the underlying trend. Now, we can proceed and start to apply additional cycle analysis in the next step to detect the cycles that are dominant and genuine within this filtered data set.

However, we must carefully treat the output obtained from this pure mechanical detrending algorithm because it is well-known that this technique may generate spurious cycle variants; that is, the HP filter can generate cycle dynamics even if none are present in the original data. Hence, the presence of cycles in HP-filtered data does not imply that real cycles exist in the original data. Therefore, we need to apply additional mechanisms to validate genuine identified cycles afterward and to remove possible "invalid" cycles. Later, at step 3 of our Cycle Scanner framework, we will show how to circumvent this problem by including goodness-of-fit statistics for our genuine dominant cycle filtering. [[1], [2]]

To optimize the HP filter and to keep these shortcomings of spurious cycles as small as possible, first the proper adjustment of parameter "λ" in the decomposition of the HP filter is important.[[3]] Second, additional testing on how the estimated cyclical components behave based on cross-correlation evaluations are needed to differentiate “genuine” cycles from “spurious” ones. Both adjustments have been incorporated into our Cycle Scanner framework to compensate for the drawbacks of the HP filter.

A review of the critical discussions on the HP filter method, however, indicates that the HP filter is likely to remain the standard method for detrending for still a long time to come. Ravn and Uhlig concluded in 1997 as follows:

> None of the shortcomings and undesirable properties are particularly compelling: the HP filter has withstood the test of the time and the fire of discussion

remarkably well.

To further optimize the detrending preprocessing, additional recent findings based on the work of Jim Hamilton (2016) might be considered. [[4]]

However, the HP filter has broad support in the scientific area, and is widely used. We have been able to successfully use the approach for years in cycle forecasting: Never change a running system too fast. Therefore, we strongly recommend that anyone who wants to rebuild a similar or more optimized detrending framework should conduct further research in this area.

References

[1] Cogley, T., Nason, J. (1992): "Effects of the Hodrick-Prescott filter on trend and difference stationary time series: Implications for business cycle research," Journal of Economic Dynamics and Control.

[2] "Hodrick-Prescott Filter in Practice," Source:
http://www.depeco.econo.unlp.edu.ar/jemi/1999/trabajo01.pdf

[3] Ravn, M., Uhlig, H. (1997): “On adjusting the HP-Filter for the Frequency of Observations.”

[4] James D. Hamilton (2016): “Why You Should Never Use the Hodrick-Prescott Filter,” Department of Economics, UC San Diego. Source http://econweb.ucsd.edu/~jhamilto/hp.pdf

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