

BV 4 – An Easy-to-Use High-Quality Procedure for the Decomposition of Economic Time Series

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Methods for decomposing economic time series that are applied at statistical offices have to meet especially the following requirements:

1. The decomposition method must be transparent and be based on a clear mathematical concept to ensure the information value of the results.
2. The decomposition method must be suitable for mass production, i.e. it must be easy to use and run fully automated without requiring time-consuming setting of series-specific parameters. This is necessary because, in official statistics, thousands of time series have to be analysed every month and the current decomposition results should be published as early as possible.
3. The decomposition method must be able to serve the needs of various user groups:
 - Experts with economic background knowledge and experience in dealing with the decomposition procedure applied are usually interested especially in seasonally adjusted data that may serve as a basis for their own in-depth analyses of current economic trends.
 - "Normal" users, such as politicians, journalists and the general public, derive information on current trends direct from the decomposition results. For that purpose, the trend cycle component is better suited than the seasonally adjusted series - whose course often is quite volatile -, especially if the series includes considerable irregular influences.

The seasonal adjustment methods of the X-11 family, which are widespread used, cannot meet all of those requirements. Their main purpose is to eliminate seasonal influences from the series. In many situations, however, the trend cycle estimation is not suitable, as is shown in Stier/Edel (1997). Also, using the default option produces suboptimal decomposition results for most series.

The BV 4 decomposition method, which is currently in use at the Federal Statistical Office, meets the above requirements very well. The method is based on moving filter applications derived from approximating functions by a regression approach (for details see Nourney, M. (1983), (1984)). It was originally developed by the University of Technology of Berlin, the German Institute for Economic Research and the Federal Statistical Office of Germany.

The method assumes the components trend cycle, seasonal, calendar and irregular to be additive composed. The trend cycle component T_t ($t = 1, \dots, m$) is approximated by a polynomial of order 3, while the seasonal component S_t is approximated by 11 trigonometric functions for monthly series:

$$\hat{T}_t = \sum_{i=0}^3 a_i t^i$$

$$\hat{S}_t = \sum_{i=1}^6 b_i \cos\left(\frac{\delta_i}{6}t\right) + \sum_{i=1}^5 c_i \sin\left(\frac{\delta_i}{6}t\right)$$

The parameters of the basic functions are estimated by the method of weighted least squares. The estimation is not done over the whole time series but over partial time intervals of different lengths moving over the whole time series. As weighting function a symmetric triangular function is used in the middle of the times series and an asymmetric triangular function at the ends of the time series. In the middle of the time series for the seasonal component an interval length of 47, and for the trend cycle component an interval length of 27 is chosen. The estimation point within the interval is chosen as $t = 14$ for the trend cycle component and $t = 24$ for the seasonal component, so that a symmetric filter is used. At both ends of the time series, several asymmetric filters are used. The appropriateness of the filters is judged by comparing their transfer functions to "optimal" transfer functions.

BV 4 of course also offers procedures for the adjustment of calendar effects and extreme values in the original series, as well as a procedures for decomposing quarterly time series.

Other qualities of BV 4 that are highly useful for decomposition in practice are summarised below:

- BV 4 quickly reacts to changes occurring in series structures.
- BV 4 produces the same results with all users.
- The revisions of successive trend cycle estimates at the current end of the series can be used as a leading indicator of trend cycle turning points.
- Applying BV 4 does not require any user training.
- A PC version of BV 4 is available on the Internet for free download at www.statistik-bund.de. A much more user-friendly PC version with improved extreme value and calendar adjustment will be developed and made available on the Internet by the end of the year.

REFERENCES

Nourney, M. (1983). Umstellung der Zeitreihenanalyse. *Wirtschaft und Statistik* (ed Federal Statistical Office) 11, 841-852.

Nourney, M. (1984). Seasonal adjustment by frequency determined filter procedures. *Statistical Journal of the United Nations ECE* 2, 161-168.

Stier, W. / Edel, K. (1997). Eigenschaften von Saisonbereinigungsverfahren im Frequenzbereich. In *Analyse saisonaler Zeitreihen* (eds K. Edel, K.-A. Schäffer, W. Stier), 207-222. Physica, Heidelberg.

RESUME

La méthode BV 4 de désagrégation de séries chronologiques, mise au point par l'Office statistique fédéral, convient parfaitement à la production à grande échelle d'analyses actualisées. Elle repose sur un concept mathématique clair et permet d'obtenir en particulier des profils économiquement plausibles de la composante tendance-conjoncture. Son utilisation n'exige aucune formation particulière. Une version conviviale et mise à jour de la méthode BV 4, utilisable sur PC, est en cours d'élaboration et sera disponible gratuitement sur Internet à la fin de l'année.