

**MODIFIED X-11 SEASONAL ADJUSTMENT PROCEDURES
USING ITERATED MEDIAN SMOOTHING**

By

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Abstract

A novel modification of the X-11 procedure in seasonal adjustment using Tukey-based median smoothing techniques is introduced. Trend estimation is carried out via iterated centered moving median filter. Seasonal component estimates are achieved by iterated centered seasonal moving median filter, with additive or multiplicative decomposition procedures for quarterly and monthly series.

The modified median X-11 procedures for both additive and multiplicative decomposition are assessed and compared with default X-11-ARIMA in simulation studies based on five criteria: (i) acceptability of the estimates, quality statistics used in the X-11 family of procedures; (ii) minimum revisions, using the revision history mean absolute percentage error; (iii) idempotency, using the mean square idempotency statistic; (iv) smoothness, using the mean absolute difference smoothness statistic, and (v) accuracy in estimation of non-seasonal component, using the mean absolute percentage error. To demonstrate the applications, Philippine economic time series data are seasonally adjusted using median X-11 and Census X-11-ARIMA and comparisons of results are done.

From simulation studies, the median-based procedures show better minimum revisions, accuracy for estimates and are smoother than default X-11-ARIMA, at a price of acceptability of seasonal adjustment estimates. Multiplicative median X-11 tends to be more acceptable, whilst additive median X-11 tends to be smoother and has lower revision history. In cases of seasonal volatility, smoothness and revision history properties are preserved on the average. From the analysis of applications, it shows that it produced better adjustment results in smoothness compared to Census X-11 procedures. The research reopens a field of research in seasonal adjustment using robust time series filters, especially in the nature of unstable seasonal behavior of Philippine time series.

Keywords: median smoothing, seasonal adjustment, Census X-11