Multivariate techniques to improve revisions of trend estimates

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Introduction

A time series of original estimates, y_t can be decomposed into trend, seasonal and irregular components, $y_t = T_t \times s_t \times i_t$. Seasonally adjusted estimates are derived by estimating and removing the seasonal component $\hat{s}_t$, to give $\hat{SA}_t = y_t/\hat{s}_t$. Trend estimates are derived by smoothing the seasonally adjusted estimates. Official government statistical agencies typically derive seasonally adjusted time series using a univariate approach. This most commonly used approach is X12ARIMA (Findley et. al, 1998). Some agencies do not publish trend estimates due to revisions at the current end of the time series. This paper considers a multivariate approach to improve revisions of the trend estimates.

Framework

Filter based seasonal adjustment packages use symmetric filters in the middle of the time series and asymmetric filters at the beginning and end of the time series. The design of asymmetric filters includes an implicit projection of the data. An alternative approach is to use ARIMA models to forecast future values at the current end of the series, ie. X12ARIMA. Typically, current approaches focus on individual series and do not use external information in the seasonal adjustment or trending process. Cointegration and error correction models proposed by Engle and Granger (1987) are considered to predict the underlying long run relationship between multivariate time series. We apply a vector autoregressive error correction model (VAR-ECM), Johansen (1991). The general framework is given by

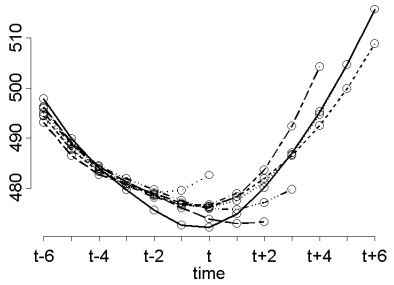
$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + AD_t + \epsilon_t$$

where X_t is a time series, β is the long run coefficient, α is the error correction coefficient, and Γ captures the short term dynamics of the series. Our proposed approach has initially considered the improvement in the revisions of trend estimates. This can be achieved by a) seasonally adjusting all series by an X11 framework, b) using a VAR-ECM model to forecast seasonally adjusted estimates, c) apply trend filters to the forecast seasonally adjusted estimates. This is done using an appropriate choice of time series.

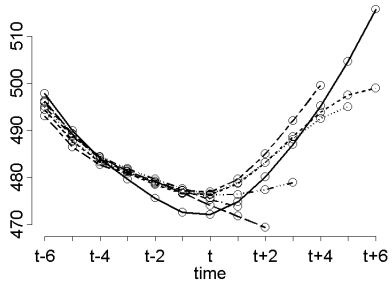
Results and conclusion

We illustrate this approach using a target time series of employed and unemployed persons in relation to other time series of not in the labour force and a job vacancy advertisments (www.anz.com). Results for unemployed persons are plotted. Figures a) and b) show that using a VAR-ECM approach detects turning points earlier. Figures c) and d) show that on average revisions to the trend are reduced where $\cdots$ represents no forecasts, —— represents univariate forecasts, and $- \cdot - \cdot -\cdot$ represents VAR-ECM forecasts.

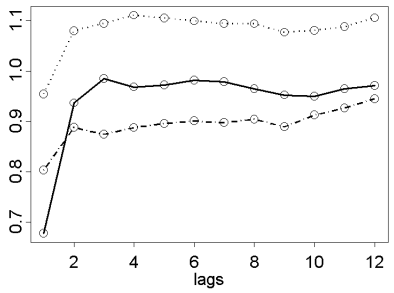
Advantages of the VAR-ECM approach are that the direction of the trend at the current end is improved when a turning point occurs. Disadvantages are that analysis is needed to ensure cointegration relationships. Future work will look at improving seasonally adjusted estimates and allowing evolving and lagged cointegration relationships.



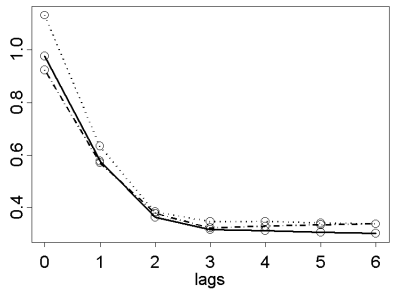
(a) Turning point in trend (VAR-ECM). Initial to final.



(b) Turning point in trend (univariate). Initial to final.



(c) Average absolute percentage revision at current end (trend).



(d) Average absolute percentage revision to benchmark (trend).

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RÉSUMÉ

L'ajustement saisonnier des statistiques officielles de gouvernement est effectué individuellement sur la série chronologique univariable pour dériver des évaluations corrigées des variations saisonnières et de tendance. À la fin courante de la série chronologique, ces évaluations seront mises à jour en tant qu'évaluations originales additionnelles deviennent disponibles. Cet article explore un cadre multivariable pour améliorer des évaluations de série chronologique, en termes de propriétés de révision. Une comparaison entre l'univarate et les résultats multivariables est donnée.