

SEASONAL ADJUSTMENT OF SELECTED FINANCIAL PUBLISHED DATA OF BANGLADESH BANK

Samina Islam^{1*}, Md. Saiful Islam Khan² and Md. Saif Uddin Rashed^{3**}

¹ *Department of Mathematics, University of Barisal, Barisal 8200, Bangladesh*

² *Credit Information Bureau, Head Office, Bangladesh Bank, Dhaka, Bangladesh*

³ *Department of Finance and Banking, University of Barisal, Barisal 8200, Bangladesh*

Abstract

Financial decision is mainly based on economic data which are usually time based such as share prices on successive days, average incomes in successive months, company profits in successive year etc. Seasonal is the part of the variations in a time series and seasonal fluctuations in data make it difficult to analyze with accuracy. So, if we ignore the seasonal effect in time series analysis, our whole analysis may be distorted. In order to remove the seasonality, seasonal adjustment is very essential for time series data. Seasonal adjusted data provide more interpretable measures of changes occurring in a given period, reflect real economic movements without the misleading seasonal changes. In Bangladesh different organization such as BIDS, Bangladesh Bank usually publishes weekly, quarterly, monthly, yearly seasonally un-adjusted data. Here, we will consider the monthly economic trend data of the production of major industrial commodities of Bangladesh Bank and apply the different seasonal adjustment (non filter and filter based) method to remove the seasonality in the data set. Finally, we compare the different seasonal adjustment method and we will propose best method of seasonal adjustment for Bangladeshi time series data.

Keywords: Time series, Seasonal variation, Non filter and filter based seasonal adjustment method.

Introduction

Overall development of a country usually depends on mainly economic growth. Agriculture, export, import etc. are the important sectors in the country's economy. For developing purpose, we need to analyze economic behavior of these sectors. Most of the

* *Present Address Statistics Department, Head Office, Bangladesh Bank, Dhaka, Bangladesh*

** *Corresponding author's e-mail: md.saifuddinrashed@gmail.com*

financial data such as GDP, production, export, import, balance payment are time based data. Time series has four different components of which seasonal variation is an important component. Seasonal variation is typically found in quarterly, monthly or weekly data. Seasonal variation is defined as the repetitive and predictable movement around the trend line in small time intervals such as one year or less. Most of economic time series are influenced by seasonal swings, e.g., prices, production and consumption of commodities; sales and profits in a departmental store; bank clearings and bank deposits are all affected by seasonal variation. A study of the seasonal patterns is extremely useful to businessmen, producers, sales-managers in planning future operations and in formulation of policy decision regarding purchase, production, inventory control, personnel requirements, selling and advertising programmes.

Seasonal fluctuations in data in many sectors for example agriculture, construction, travel sectors make it difficult to analyze whether changes in data for a given period reflect important increases or decreases in the level of the data, or are due to regularly occurring variation. So absence of any knowledge of seasonal variations, a seasonal upswing may be mistaken as indicator of better business conditions while a seasonal slump may be miss-interpreted as deteriorating business conditions (Gupta, et al., 2000). In fact, the seasonal variation of a series may account for the preponderance of its total variance. Researchers forecast that, ignorance of important seasonal patterns will have a high variance. Too many people fall into the trap of ignoring seasonality if they are working with seasonally adjusted data (Enders, 2003). Seasonal adjustment is a statistical method for removing the seasonal component of a time series that is used when analyzing non seasonal trends. The main aim of seasonal adjustment is to estimate the seasonal variations and to eliminate its impact from the time series. Consequently, seasonally adjusted data are always used in economic modelling and cyclical analysis. Presentation of data on a seasonally adjusted basis allows the comparison of the evolution of different series, which have different seasonal patterns, and is particularly pertinent in the context of international comparisons since countries may be in different seasons at identical periods of the year (Armstrong, 1983).

In Bangladesh, Economists, Policy makers, and some organizations use or publish time series data and try to identify important features of economic series such as direction, turning points, and consistency between other economic indicators but most of the times they do not provide the seasonal adjusted data. Seasonal movements can make these features difficult to see and destroy the analysis. Thus, to understand the behavior of the phenomenon in a time series properly, the time series data must be adjusted for seasonal variations. In contrast, most of the developed countries (Australia, USA, and Singapore) use the seasonal adjusted data in time series analysis in their own

way. There are different methods of seasonal adjustment such as non-filter based seasonal adjustment method and filter based seasonal adjustment method. Measure of forecasting error is very essential to compare the different seasonal adjustment method and find the best seasonal adjustment method. So, in this paper we will concentrate on seasonal adjustment, then we will compare between the different techniques of seasonal adjustment and finally develop best method of seasonal adjustment for Bangladeshi time series data.

Methodology

To conduct the research here we consider monthly economic trend data of Bangladesh Bank for Paper and Chemical industries. Statistical Analysis Software (SAS) version 9.2, Minitab 16 and Microsoft Excel have been used to do the statistical analysis of data. To remove seasonal variation of time series data mainly we consider non filter based seasonal adjustment method (viz. Method of simple average, Ratio to trend method, Ratio to moving average method, Link relative method) and filter based seasonal adjustment method (viz. X-11 method).

Results

The value of the non filter based method such as simple average, ratio to moving average, ratio to trend, link relative and the filter based method X-11 five competing seasonal adjustment method under the Mean Absolute Percentage Error (MAPE), Percentage Mean Absolute Deviation (PMAD), Mean Absolute Deviation (MAD) and Root Mean Square Error (RMSE) different measuring accuracy are reported. We consider the time series data on the production of major industrial commodities such as Paper. Now the results of measuring forecasting accuracy of different seasonal adjustment methods for Paper listed below in a tabular form:

Table 1. Measuring forecasting accuracy of different seasonal adjustment methods for Paper.

Different Seasonal Adjustment Methods	Measuring Forecasting Accuracy			
	MAPE	PMAD	MAD	RMSE
Simple Average	0.989	0.989	2828.99	2968.93
Ratio to Moving Average	0.988	0.989	2828.70	2968.63
Link Relative Method	0.975	0.946	2826.90	2966.90
Ratio to Trend	0.988	0.989	2828.56	2968.84
X-11 Procedure	0.136	0.097	280.23	383.65

We observe from the **Table 1** that the filter based seasonal adjustment method X-11 contains lowest error as compare to other non filter based seasonally adjusted methods such as simple average, ratio to trend, ratio to moving average and link relative. We see that, errors of X-11 procedure is about 10 times smaller than other methods which is very significant. So we can say that, in terms of minimum error value of different error statistic X-11 procedure is better seasonally adjusted method than all other methods.

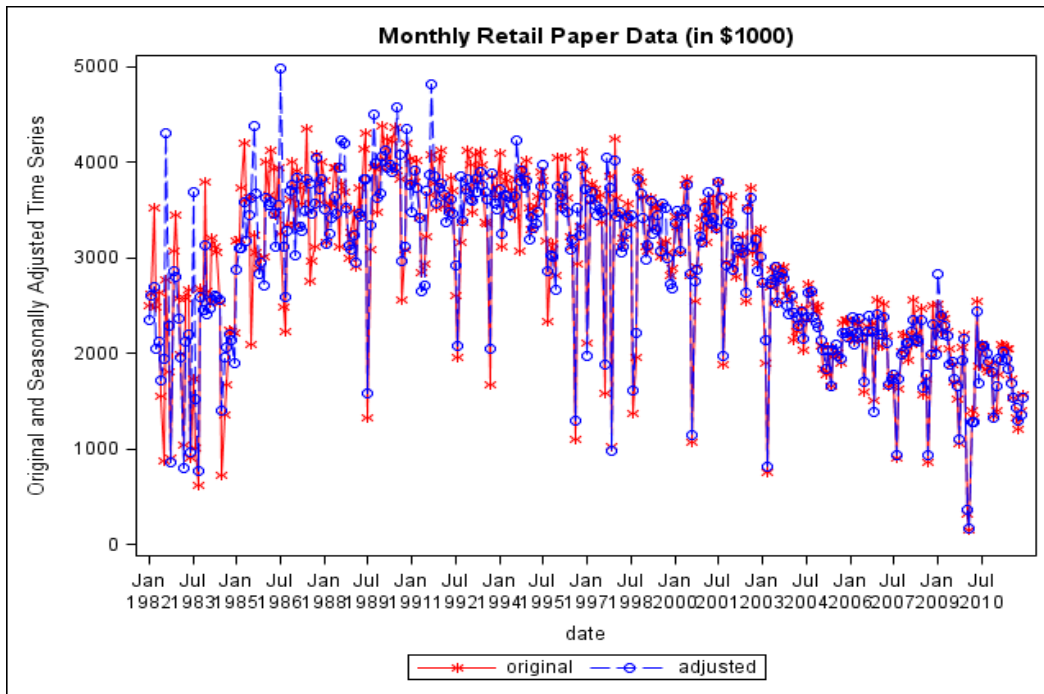


Fig.1. Original and Seasonally Adjusted Time series using X-11 Procedure of Paper.

From the **Table 1** since we can easily observe errors of other methods are about 10 times larger than X-11 method so we do not need to demonstrate the plotting they adjusted. After plotting the original series and the adjusted series X-11 method we can notice that here time series values are closely seasonally adjusted with the original series (Fig. 1).

For more illustration we also consider another monthly economic data of chemical industries (oil, natural gas, ores, etc.) and the following table shows different errors obtain by different seasonally adjusted methods for chemicals.

Table 2. Measuring forecasting accuracy of different seasonal adjustment methods for Chemicals.

Different Seasonal Adjustment Methods	Measuring Forecasting Accuracy			
	MAPE	PMAD	MAD	RMSE
Simple Average	0.989	0.990	801.63	845.97
Ratio to Moving Average	0.988	0.990	801.62	845.95
Link Relative	0.973	0.989	801.23	844.52
Ratio to Trend	0.981	0.995	801.56	845.92
X-11 Procedure	0.229	0.088	280.23	97.33

We observe from the **Table 2** that the filter based seasonal adjustment method X-11 contain lowest error as compare to other non-filter based seasonally adjusted method such as simple average, ratio to trend, ratio to moving average and link relative. We see that, errors of X-11 procedure is about 9 times smaller than other methods which is very significant. So we can say that, in terms of minimum error value of different error statistic X-11 procedure is better seasonally adjusted method than all other methods.

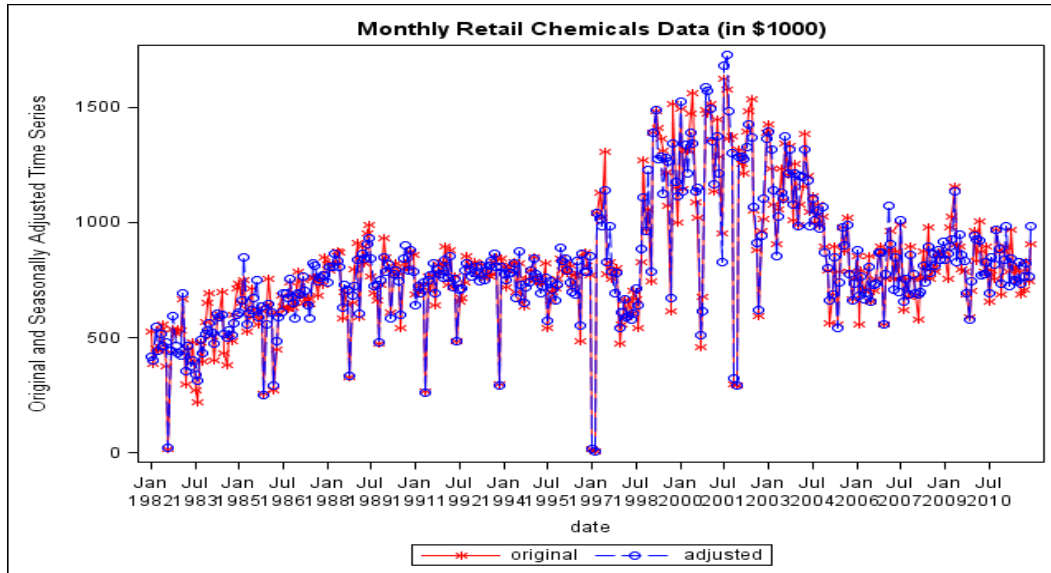


Fig. 2. Original and seasonal adjusted time series using X-11 procedure of Chemicals.

We observe from the Table 2 that errors occurred in X-11 method is about 9 times smaller than they occurred in other methods. Therefore, we do not need to demonstrate the plotting they adjusted. After plotting the original series and the adjusted series X-11 method, we can see that these two trends are close (Fig.2).

From the above results we observe that errors of X-11 method are smaller than other methods. X-11 method is an iterative method. X-11 method uses Henderson moving average method which does not take care of upward trend or downward trend. So, if the pattern of trend is known to us, then we can incorporate this method in estimation.

Conclusion

From the above study, we can summarize that in terms of minimum error value of different error statistic and graphical representation X-11 procedure is appropriate seasonal adjustment method for Bangladeshi time series data. We expect that by using this procedure we will be able to get better seasonally adjusted data series for time series analysis. In Bangladesh different organizations such as government and semi government organization publish without seasonally adjusted data and all of them are needed to be adjusted which is very common in developed countries. If we use seasonally adjusted data by suitable method result in better predicted values, then it will be very helpful for further analysis and for ignoring this leads to different solution. Therefore, we recommend that different organization should use seasonal adjustment while publishing different time series data.

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