Comparing Seasonally Adjusted Results Obtained with Demetra and J-Demetra+

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Abstract

Seasonal adjustment aims at identifying and estimating the seasonal pattern of a time series. Statistics Finland uses a software tool called Demetra (version 2.2) and a model-based method called Tramo/Seats to produce seasonally adjusted figures. Recently a new seasonal adjustment tool, J-Demetra+, has been released. This tool also allows the user to do seasonal adjustment with Tramo/Seats. This paper makes a comparison of J-Demetra+ and Demetra. We put emphasis on the comparison of results obtained by these two tools and using them in day-to-day production. The findings are illustrated by using empirical time series by Statistics Finland. We also discuss practical implications of replacing Demetra by J-Demetra+ in the daily production system.

Key Words: software, Tramo/Seats

1. Introduction

Statistics Finland has been using Tramo/Seats to seasonally adjust its time series since 2005 (Kokkinen and Alsuhail, 2005). Tramo/Seats is a model-based seasonal adjustment method. The method includes two steps. First, a regression model is fitted to the data. The aim of this phase is to catch the deterministic calendar variation, detect outliers and correct for missing values. A linear, autoregressive integrated moving average (ARIMA), time series model can be used to describe the residual of this regression model. In the second step, this ARIMA model is used to detect, estimate and remove the seasonal component from the time series.

A more comprehensive discussion on Tramo/Seats can be found from Kaiser and Maravall (2000). For the theory of ARIMA models Box and Jenkins (1970) can be consulted.

Statistics Finland uses Tramo/Seats through a software program called Demetra (version 2.2). In the mid-2000's Demetra was widely used across Europe. More than 70% of the national statistical institutes (NSI) within the European Statistical System (ESS) used Demetra to seasonally adjust their time series (Hungarian Central Statistical Office, 2007). The popularity of Demetra comes from the fact that it includes two methods, namely Tramo/Seats and X12. Both of them are recommended by the ESS (Eurostat, 2009).

Recently the National Bank of Belgium delivered a new software program for seasonal adjustment called J-Demetra+ (version 1.2.0). Now the ESS is slowly moving towards a wide use of this new software program. Demetra is no longer maintained nor is it available through the web-portals of the ESS. All the training courses of the European statistical training program (ESTP) on seasonal adjustment include computer classes where J-Demetra+ is being demonstrated.

Statistics Finland is still using Demetra to run seasonal adjustment. However, J-Demetra+ has been tested and knowledge on the new tool has been gained. This paper summarizes some of the findings. Our main interest is to know whether the results obtained by J-Demetra+ will differ from those obtained by Demetra. This is a relevant question since different results would mean revisions in the published figures. In this case an NSI considering switching from Demetra to J-Demetra+ would need to consider how to communicate these changes to its users.

2. Time series and seasonal adjustment filters

We study the seasonal adjustment of a handful of important time series, namely the Gross Domestic Product (GDP), the Industrial Production Index (IPI) for total industries, the Labor Cost Index (LCI) for all industries in private sector, the Finnish unemployment rate and the Retail trade.

These time series are chosen because they draw considerable attention from the users. They provide a good selection of both social and economic statistics. In addition, the time series range from short to long ones: the LCI and the unemployment rates have 23 and 302 observations respectively.

There are also differences in the way the series are treated in the seasonal adjustment process: some series are log-transformed and some are not. The number of trading day (TD) regressors and detected outliers vary across time series. The (0 1 1)(0 1 1) -airline model is the most used one, but for example the seasonal adjustment of the unemployment series is based on a different ARIMA model.

The following table provides a summary of the time series and some of their current seasonal adjustment settings. It shows that the time series studied in this paper include both quarterly and monthly time series.

Series	Frequency	Series span	n° of obs.	n° of TD regressors	n° of outliers	Transf.	ARIMA-model
GDP	Quarterly	1990Q1 - 2012Q4	92	1	2	Log	(0 1 1)(0 1 1)
VIIO	Monthly	1995M1 - 2013M1	217	7	3	Log	(0 1 1)(0 1 1)
LCI	Quarterly	2007Q1 - 2012Q4	24	6	None	None	(0 1 1)(0 1 1)
Unempl.	Monthly	1988M1 - 2013M2	302	None	5	None	(2 2 1)(0 1 1)
Retail trade	Monthly	1995M1 - 2013M1	217	6	1	Log	(0 1 1)(0 1 1)

Table 1. A summary of some the characteristics of the time series studied.

For the sake of comparability it is important to use the same TD variables and ARIMA-models in the seasonal adjustment carried out by J-Demetra+. We also want to use the same outliers in both approaches. Otherwise, we might obtain results that are different from the ones published just because of using different seasonal adjustment filters.

Trading day adjustment is an important part of seasonal adjustment. Demetra includes the national calendars of several European countries. J-Demetra+, however, does not include national calendars. Instead, the user is able to create a national calendar according to his preferences. Some of options provided by J-Demetra+ are quite sophisticated: for example, one is able to create a calendar where a certain holiday applies only for a certain period (Grudkowska, 2011).

Because we are trying to obtain identical results by using two software programs, we create an holiday calendar which is similar to the one used in Demetra. The following public holidays are included in the national calendar of J-Demetra+: New Year, January 6th (Epiphany), May Day, Easter Monday, Good Friday, Ascension, December 6th (the Finnish Independence Day) and Christmas. The long-term mean correction is taken into account in the trading day correction.

Midsummer and All Saints Day could not be included in J-Demetra+. Depending on the year, Midsummer is celebrated on either the third or fourth Friday or Saturday of June, and All Saints Day is celebrated on either the last Saturday of October or the first Saturday of November. J-Demetra+ cannot handle these kind of outliers. However, these public holidays are included in the national calendar of Demetra.

3. Results

Despite using identical model settings, J-Demetra+ and Demetra provide slightly different results. This applies to the seasonally adjusted time series, trends, trading day adjusted times series as well as estimates for the model parameters and regressors. The size of the difference varies from series to series. One reason for the difference in results might be the difference in the holiday correction. As mentioned above, Midsummer and All Saints Day are taken into account in the seasonal adjustment carried out by Demetra, but not in the one carried out by J-Demetra+.

The following table summarizes the model settings used for the seasonal adjustment of the GDP. The biggest difference seems to be in the trading day regressor, which is statistically significant in J-Demetra+, but insignificant in Demetra. There are also some differences in the parameter estimates of the ARIMA models. On the other hand, the outliers used seem to have almost an identical impact in both software. Similar findings can be made by looking at the other time series.

Gross National Product	J-Demetra+	Demetra
Series Span (n° of obs.)	Q1.1990 - Q4.2012 (92)	Q1.1990 - Q4.2012 (92)
Method	Tramo/Seats	Tramo/Seats
Transformation	Logarithm	Logarithm
Trading day correction	1 Regressor (holiday-corr.)	1 Regressor (holiday-corr.)
Trad1 value	0,0007	0.0001
Trad1 t-value	2,75	0.25
Correction for Easter Effects	None	None
Outliers	Yes, 2 outliers	Yes, 2 outliers
LS2008Q4 value	-0,0284	-0.0296
LS2008Q4 t-value	-2.46	-2.47
LS2009Q1 value	-0.0712	-0,0756
LS2009Q1 t-value	-6,12	-6.29
ARIMA model	(0 1 1)(0 1 1)	(0 1 1)(0 1 1)
Non-seas. MA (lag 1) value	-0,0746	-0.1615
Non-seas. MA (lag 1) t-value	-0,66	-1.44
Seasonal MA (lag 4) value	-0,4658	-0.4509
Seasonal MA (lag 4) t-value	-4,82	-4.29
Mean correction	None	None

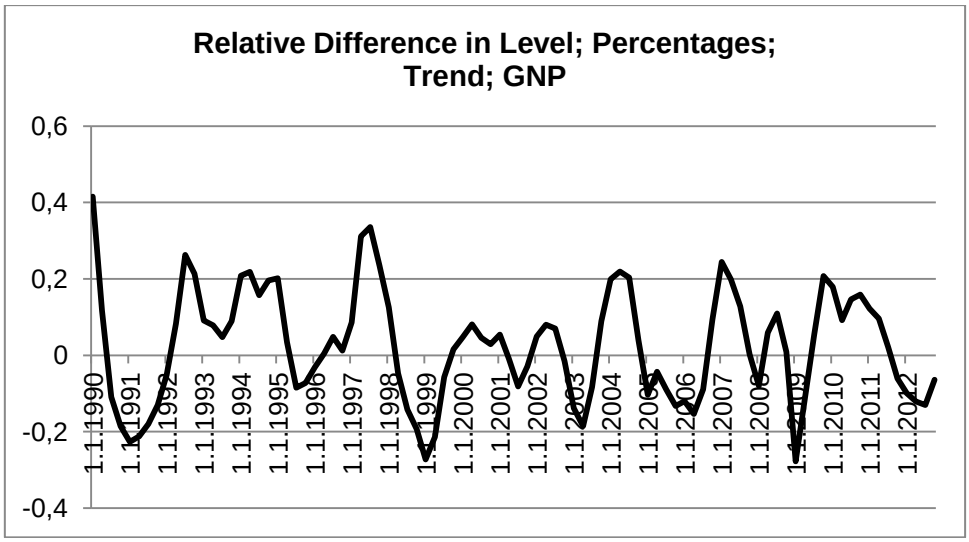
Table 2: Model information provided by J-Demetra+ and Demetra to the time series describing GDP.

The results computed by these two methods, however, differ only a little. The first graph compares the difference in levels of the trend series computed by Demetra and J-Demetra+. The graph shows how many percentages the trend of the GDP (computed by J-Demetra+) differs from the results computed using Demetra and published by Statistics Finland.

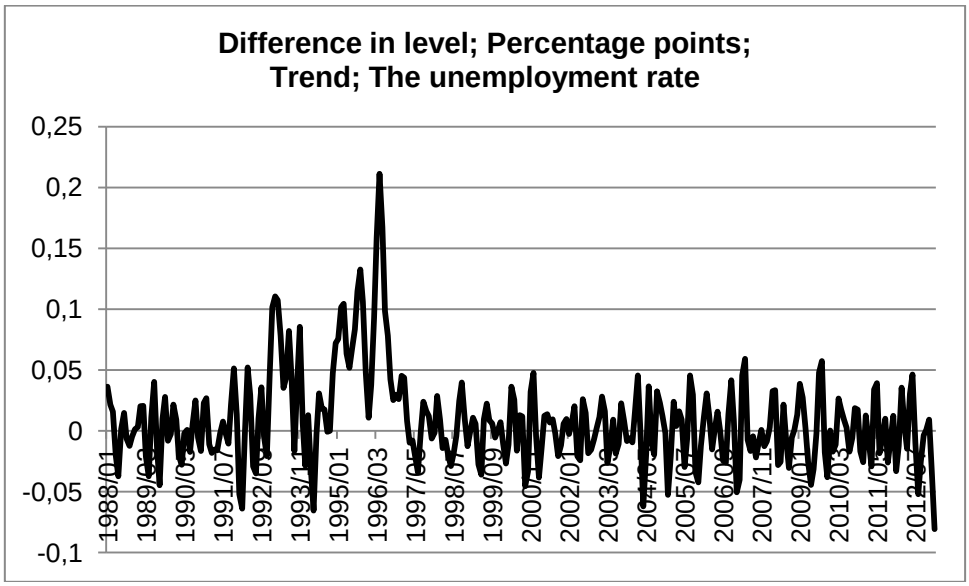
The differences are very seldom larger than 0,2% in absolute value, the median deviation being 0,10%. On average the trend level obtained by J-Demetra+ differs 0,12% from the trend computed by using Demetra. Such small differences are impossible to detect from graphs. The two trends are hence practically identical and the interpretation of the economic situation is unaffected. Another remark is that neither of the methods produces a trend, which would be systematically on a higher or lower level than the other.

When it comes to the unemployment rate, the levels are what the users are interested in. Statistics Finland publishes the trend of the time series, whereas the seasonally adjusted time series is available only upon request. Graph 2 shows how many percentage points do the results computed by J-Demetra+ differ from those published by Statistics Finland. Also here, the differences are very small: on average the unemployment rate computed by J-Demetra+ differs by 0,03 percentage points from the ones obtained by Demetra. The median difference is 0,02 percentage points.

The biggest differences in the unemployment rates computed by using J-Demetra+ and Demetra fall for the period between January 1995 and March 1996. Another period of larger differences in the results is in 1993, between January and October. Four out of the five outliers in the seasonal adjustment model fall under these periods. However, the type and timing of the outliers are same and the estimates of the outliers as well as their t-statistics are almost identical.



Graph 1. How many percentages do the levels of the GDP trend series obtained by J-Demetra+ differ from those obtained by Demetra?



Graph 2. How much do the trend series of the unemployment rate differ from each other in percentage points?

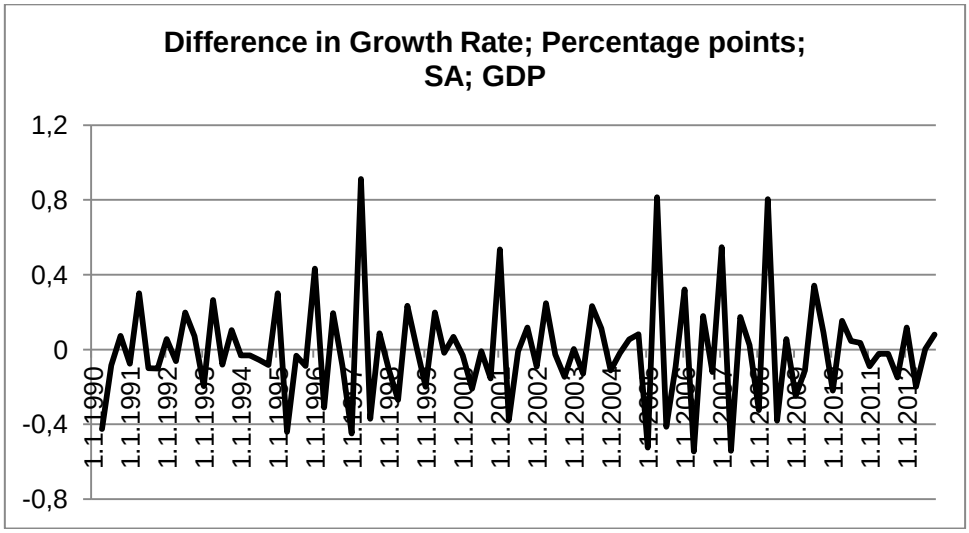
Unemployment; Outliers	J-Demetra+	Demetra
TC1995m7 value	1,4558	1.4550
TC1995m7 t-value	4,17	4.16
TC1996m3 value	-1,6482	-1.6471
TC1996m3 t-value	-4,72	-4.72
TC2000m2 value	1,4398	1.4397
TC2000m2 t-value	4,13	4.13
TC1993m2 value	1,2896	1.2893
TC1993m2 t-value	3,69	3.68
TC1995m1 value	0,9689	0.9679
TC1995m1 t-value	2,77	2.77

Table 3. Outliers used in the seasonal adjustment of the unemployment series.

The levels of the trend series seem to be almost identical for the other series as well. For the Retail trade and the LCI the trend series computed by J-Demetra+ differ by average by 0,12% and 0,56% respectively from the results obtained by Demetra. For the IPI the average difference is 0,22%.

When it comes to seasonally adjusted figures, the levels are not so interesting. Instead, the users pay attention to quarter-to-quarter or month-to-month growth rates. Graph 3 illustrates differences in the quarter-to-quarter growth rates of the of the seasonally adjusted GDP. The differences are in percentage points. Most of the time the differences are no larger than 0,4 percentage points in absolute value. On average the growth rates differ by 0,19 percentage points, the median difference being 0,11 percentage points. From the users' point of view these differences are small.

The differences probably reflect the differences in estimated parameters as seen in Table 1. On the other hand, the seasonally adjusted time series includes an irregular component and therefore it is not surprising to witness some difference in growth rates.



Graph 3. How many percentage points do the quarter-to-quarter growth rates of the seasonally adjusted GDP obtained by J-Demetra+ and Demetra differ from each other?

The differences in growth rates are larger for the other series studied. As the IPI is concerned, differences in the month-to-month growth rates of the seasonally adjusted series are on average 0,64 percentage points. For the LCI and the Retail trade the average differences are 0,67 and 0,82 percentage points respectively the median differences being 0,30 and 0,65 percentage points. All these time series have a high number of trading day regressors which have different estimates in the two software.

	Average of Differences in the Growth Rates (SA), percentage points	Median of Differences in Growth Rates (SA), percentage points
GDP	0,19	0,11
LCI	0,34	0,30
VIIO	0,64	0,50
Retail Trade	0,82	0,65

Table 4. Average and median differences in month-to-month or quarter-to-quarter growth rates.

4. Conclusions

Our findings suggest that switching from Demetra to J-Demetra+ induces minor revisions in the published time series even if the model settings, trading day regressors and the way outliers are handled are kept unchanged. Comparing these revisions to the everyday revisions, which are due to new observations and re-estimation of parameters, is left for future studies.

Whether one should keep the model settings fixed when swithing from Demetra to J-Demetra+ depends on the NSI's and users' preferences. Keeping the model settings fixed requires plenty of manual work as the model settings cannot be automatically read from existing seasonal adjustment files. On the other hand, one is able to get results close to the ones published in the past.

However, using the same filters as in the past is not a necessity if one is able to improve the results of seasonal adjustment. According to the ESS Guidelines on Seasonal Adjustment (Eurostat, 2009) one should re-identify the model, outliers and calendar regressors once a year and re-estimate the respective parameters and factors every time a new or revised data becomes available. This annual review could be a good time to switch from Demetra to J-Demetra+.

J-Demetra+ offers plenty of information that can be used to improve seasonal adjustment. If e.g. includes six different seasonality tests and a direct-indirect seasonal adjustment test. There is also a possibility to create a calendar where certain holidays are used as regressors for certain periods (Grudkowska, 2011). This could be a way to tackle the issue of time-varying trading day effects studied by Monsell (1983) and Bell & Martin (2004).

Using all the new information provided by J-Demetra+ should be used before deciding whether to keep the same seasonal adjustment models or not.

References

Bell W. & Martin D. (2004) "Modelling time-varying trading-day effects in monthly time series" *Proceedings of the American Statistical Association: Alexandria,* VA [CD-ROM], Also http://www.census.gov/ts/papers/jsm2004dem.pdf

Box, G. & Jenkins, G. (1970) *Time series analysis: Forecasting and control*, San Francisco, Holden-Day.

Eurostat (2009) *ESS Guidelines on Seasonal Adjustment*.

Grudkowska, S. (2011) *Demetra+ User Manual*, National Bank of Poland.

Hungarian Central Statistical Office (2007) *Seasonal Adjustment Methods and Practices*.

Kaiser R. & Maravall A. (2000) "Notes on Time Series Analysis, ARIMA Models and Signal Extraction," *Banco de España Working Papers 0012*, Banco de España.

Kokkinen, A. & Alsuhail, F. (2005) "Aikasarjan ARIMA-mallipohjaisesta kausitasoituksesta" *Kansantaloudellinen aikakauskirja 4:2005*, 469–483.

Monsell, B. (1983) "Using the Kalman Smoother to Adjust for Moving Trading Day" *Research Report 83/04, Statistical Division*, U.S. Census Bureu.