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Seasonal Adjustment of the International Transport Forum Quarterly Transport Statistics

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1. Introduction

This paper introduces the methodology used for the seasonal adjustment of the International Transport Forum Quarterly Transport Statistics. It also discusses the motivation for the adjustment and its potential for supporting analysis.

Short-term data is normally compiled to allow timely identification of changes in any indicator and especially to identify possible turning points. Quarterly transport statistics are often characterized by seasonal patterns and when non-seasonally adjusted observations are analyzed in a time series, it is often difficult to identify turning points and the underlying direction of the change.

A way around the seasonal patterns is to look at rates of change from the same quarter of the previous year. Quarterly year-to-year rates of change, however, are inadequate for business-cycle analysis at least for three reasons. First, turning points or changes in the trend will be visible only after some delay. Secondly, these do not fully exclude some of the seasonal elements due for example to the fact that number of working days per month vary from quarter to quarter. Finally, they will reflect also irregular events (such as strikes, extreme weather conditions) during one or more periods under study.

Seasonal adjustment helps in understanding the development of the data, especially its direction and magnitude of change. A time series from which seasonal variations have been eliminated basically allows for the comparison of data between two quarters for which seasonal patterns are different. Seasonal adjustment means using an analytical technique to break down a series into its components (trend, irregular component and seasonal component).

Although transport data are often highly seasonal, there are a limited number of examples on seasonally adjusted short-term transport data. Some existing examples include the US Bureau of Transportation monthly Transportation Services Index (BTS undated), the UK Department for Transport quarterly data on road traffic in Great Britain (DfT undated) and the IATA monthly aviation data (IATA 2010). Some countries also publish seasonally adjusted data on car registrations and sales.

2. ITF Quarterly Transport Statistics

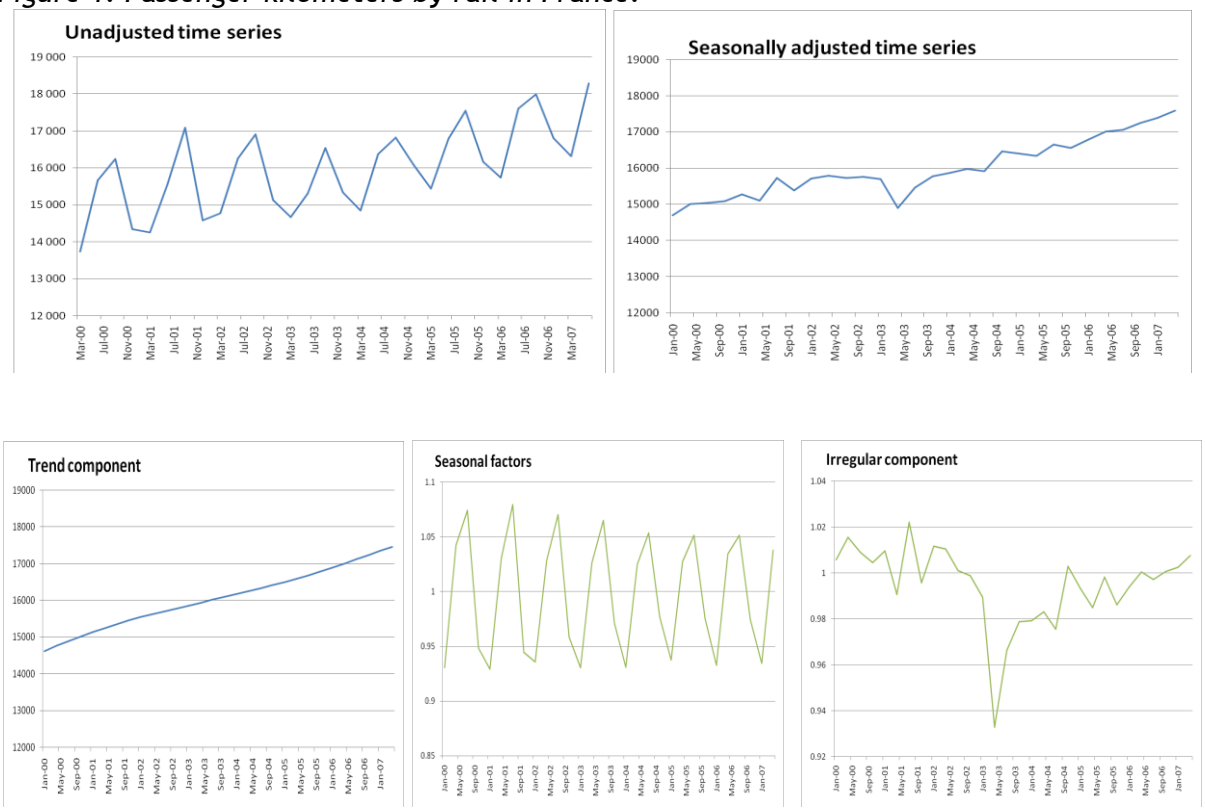
The International Transport Forum carries out a quarterly exercise collecting data on the short term evolution of the transport sector so as to foresee trend shifts in the sector as a result of economic down or upturn. It presents the latest quarterly data on transport available for the ITF member countries, collected through a questionnaire. The questionnaire contains a limited number of indicators, selected according to their quarterly availability and their usefulness as transport trend indicators.

The questionnaire covers three modes of inland transport (rail, road and inland waterways) together with some economic indicators for all ITF countries. Depending on the variable, data is available for around 30-40 countries. Series are available since 1995. The main data variables are freight on rail, road and inland waterways (ton-km), rail passenger transport (passenger km), vehicle kilometres on road, registration of new cars and road fatalities.

The ITF Quarterly Transport Statistics data are characterized by strong seasonality. As discussed above, it is quite difficult to draw any deep-going conclusions about the trend shifts based on raw data. In a seasonal adjustment, time series are normally decomposed into three components: trend, irregular component and seasonal component. Figure 1 presents time series on passenger kilometers by rail in France from the year 2000 onwards on quarterly basis. In this example, the original data is broken down into different components: the trend component, the seasonal component and the irregular component.

As this example shows, seasonal adjustment of data makes it easier to see possible changes in the trend and allows for better analysis of this data.

Figure 1. Passenger kilometers by rail in France.



Source: ITF.

3. Methodology and quality of results

The seasonal adjustment programme Demetra[1] is used to produce adjusted figures for the ITF Quarterly Transport Statistics. Demetra is a seasonal adjustment computer program developed by the Eurostat. It provides a tool for using and comparing the two seasonal adjustment methods recommended by the Eurostat, namely those of X-12-Arima and Tramo-Seats.

The X12-Arima is basically a moving average method while the Tramo-Seats method focuses on the modeling of the data series. In the model, the value of the series is given determined by several components. Tramo automatically identifies outliers and calculates other regression variables such as trading days or Eastern variable.

There have not been any final conclusions on which method should be preferred. Eurostat however concludes that Tramo-Seats method has also been regarded as more flexible in terms of automatic running and it provides a test for both multiplicative and additive decomposition as well as complete automatic model identification (Eurostat 2002a). Tramo-Seats accept slightly more series than X-12-Arima when the programme is ran in the default mode. A large number of seasonally adjusted series are published by different agencies around the word running different programmes in their default modes (Bloem *et al*. 2001).

For analytical purposes then, the ITF Quarterly Transport Statistics are seasonally adjusted using the Tramo-Seats adjustment method. Trading day & leap year and Eastern effect adjustments are done with seven regressors, allowing reducing the number of trading day regressors (it is possible that no trading day adjustments are done if the model cannot find any trading day effect). No country-specific holidays are used due to the great number of countries and variables.

For aggregates (EU area), country data are first adjusted for trading day and leap-year effect. Resulted series are then summed up and seasonal adjustment is done on the new aggregated series.

Depending on the variable, five to ten years of data is used for the seasonal adjustment. What generally is considered useful is to have at least five years of relatively stable seasonality to obtain properly adjusted estimates (Bloem *et al*. 2001).

Quality check of Tramo-Seats adjustment include Ljung-Box on residuals, Ljung-Box on squared residuals, Box-Pierce on residuals, Box-Pierce on squared residuals and normality. A time series adjustment is rejected:

- If the decomposition of the chosen ARIMA model was not admissible.
- If there is at least 1 of the selected statistics which is significant at a 0.1% level.
- If there are at least 3 of the selected statistics which are significant at a 5% level.
- If the automatic outlier detection procedure detected more outliers than 5% of the number of observations of the original time series.

As regards the rule for quality check of X-12 Arima adjustments, a time series is rejected:

- If the Ljung-Box statistics is significant at a 0.1% level.

[1] Demetra was originally developed for Eurostat's internal use but has been since made publicly available for other users. Demetra can be freely downloaded from the Eurostat website. More detailed model descriptions can be downloaded from: http://circa.europa.eu/irc/dsis/eurosam/info/data/

- If the average percentage standard error in within-sample forecasts over the last year is greater than 15%.
- If the automatic outlier detection procedure detected more outliers than 5% of the number of observations of the original time series.
- If the combined statistic Q (M1, M3-M11) is not accepted.

Quality check is carried out for each variable and data passes all statistical tests mentioned above.

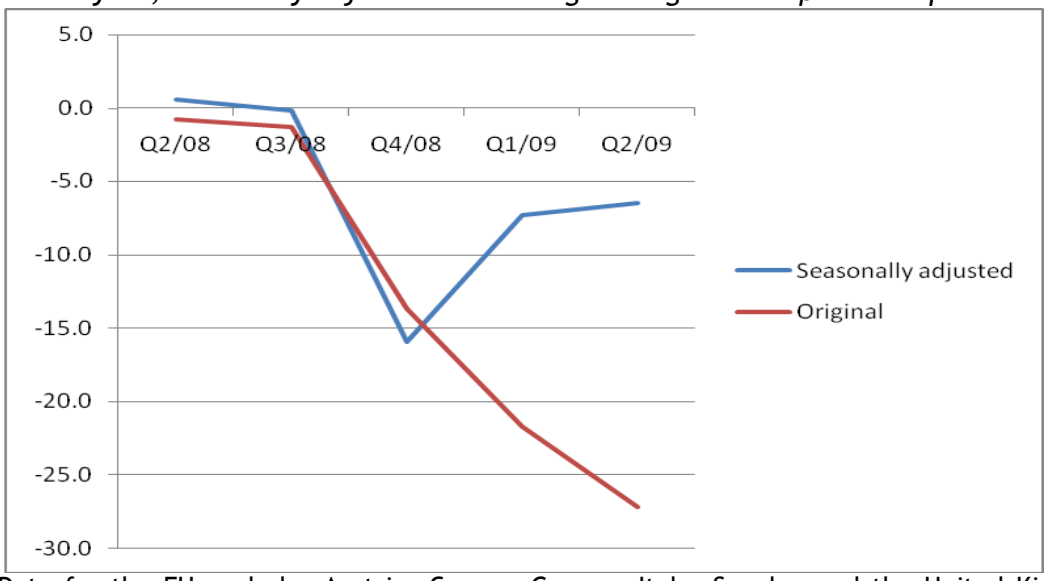
4. Results on rail freight and implications for analysis

There is still no consensus on whether one should present only seasonally adjusted data or trend data in graphical illustrations. However, it is important to note that seasonal adjustment does not attempt to smooth the series. If the irregular component is strong, even a seasonally adjusted time series may not be easy to interpret. Therefore it is equally important to look at the trend and irregular components which are designed to smooth the series. In line with the IMF recommendations (Bloem *at al*. 2001, p. 145) on quarterly national accounts, we present both.

The following figure 2 illustrates this. The volume of rail freight in the second quarter 2009 in the EU was 27 % below the second quarter 2008 level. As the following figure shows, using only original data might lead to a conclusion that the rail freight in the EU continued to decline still during the second quarter 2009.

However, seasonally adjusted data, on the other hand, shows that the decline has actually slowed down and there are signs of recovery. While rail freight volume still fell during the first half of 2009, decline was much smaller than in the last quarter of 2008. The recovery has actually already started the first quarter 2009. Hence, the decline started to slow down already the first quarter 2009. Naturally the level of activity is still far below 2008 level but using seasonally adjusted data allows us to give an additional view on trend and direction of change.

Figure 2. Rail freight in the EU (ton-km), Original: growth compared to the same period of the previous year, seasonally adjusted: Percentage change on the previous quarter



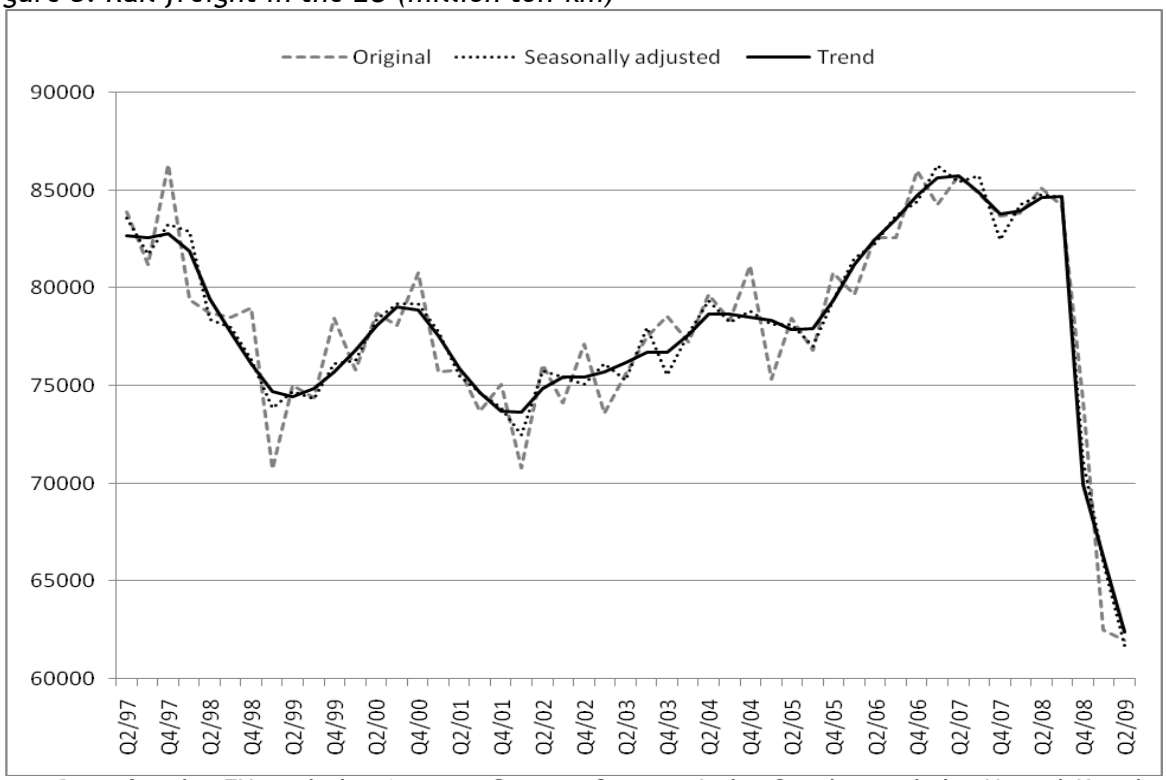
Note: Data for the EU excludes Austria, Cyprus, Greece, Italy, Sweden and the United Kingdom.
Source ITF.

Our overall analysis of the second quarter 2009 then shows that rail freight transport continued to contract but the decline shows also signs of slowing down, according to preliminary estimates.

Rail freight transport in the EU area showed a decline of 27% in the second quarter of 2009 compared with the same quarter in 2008 (Figure 2). Data also for other countries show that rail freight figures remain at a depressed level compared to the previous year. In the Russian Federation and the United States rail freight volumes fell by 17% and 18% respectively compared with Q2 2008. These two countries alone account for over 90 percent of the total rail freight in the ITF member countries.

However, seasonally adjusted data suggests that the decline is slowing down or has come to an end in some countries. While overall ton-kilometers are below the 2008 level, the adjusted volume of rail freight increased in the second quarter by 4.8% in the Russian Federation, 3.6% in France, and 0.4% in Mexico compared with the previous quarter. The decline seems to have come to a halt also in Germany. In the United, where rail freight is the main mode of freight transport, the figures still show a decline for the second quarter compared with the previous quarter, but the rate of decline is also slowing (Figures 3-5).

Figure 3. Rail freight in the EU (million ton-km)

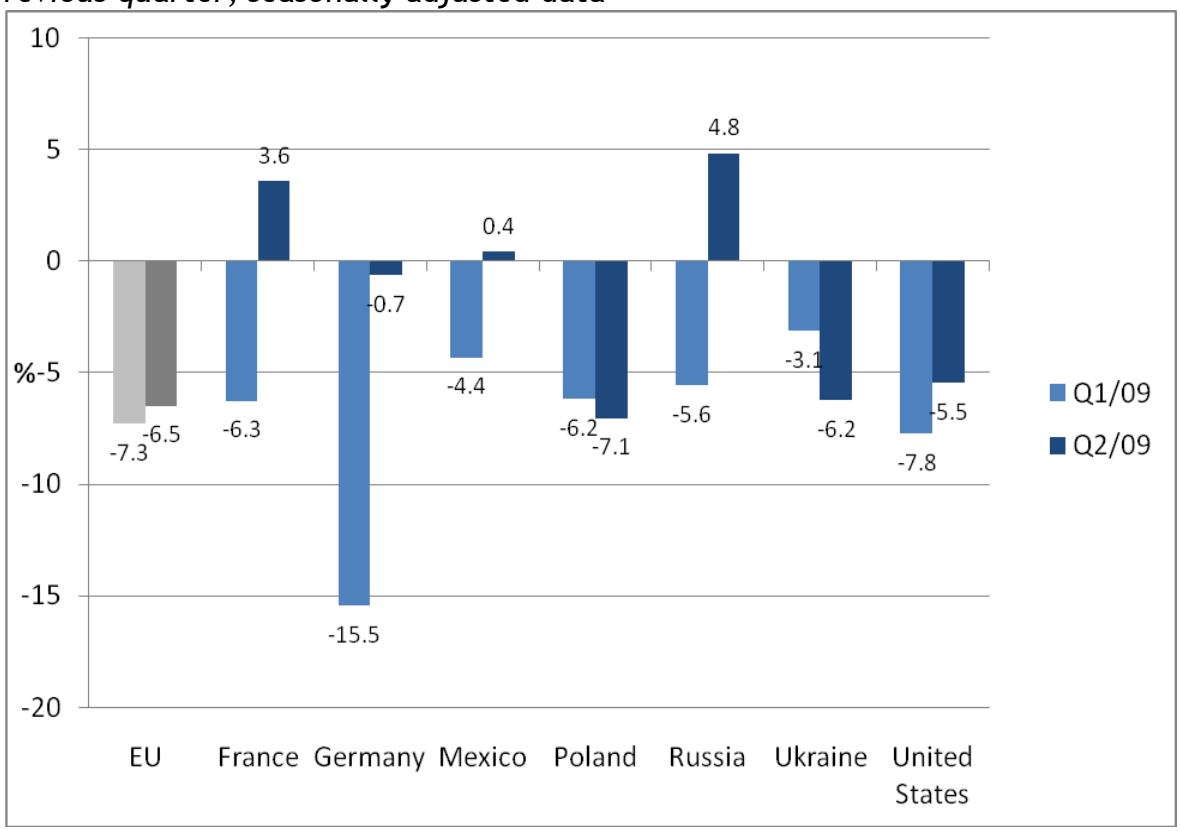


Note: Data for the EU excludes Austria, Cyprus, Greece, Italy, Sweden and the United Kingdom.
Source ITF.

Figure 4. Rail freight in the United States and Russia (million ton-km)

Source: ITF

Figure 5. Rail freight in selected ITF countries (ton-km), Percentage change on the previous quarter, seasonally adjusted data



Source: ITF.

5. Conclusions

Although seasonal adjustment methodology itself is not at all new, new tools, such as the Demetra programme, have made it easier for statisticians to apply it to different data. The gap to introduce seasonally adjusted data is not so great as it used to be.

The exercise carried out in this paper shows that it is possible to seasonally adjust the International Transport Forum Quarterly Transport Statistics data. Deseasonalization of data has great potential for improving analysis of transportation time series data. Seasonal adjustments allows for better identifying turning points that otherwise might be left unnoticed.

While the traditional way of looking at the quarterly transport data looks backwards, in a way, seasonal adjustment allows the analytical use of the same data looking forward. By decomposing the time series data it is possible to identify the impact of different components of the time series and to provide a better understanding of the series for modeling and forecasting purposes.

The International Transport Forum will make the seasonally adjusted series available together with the original data series but they are considered as additional (unofficial) estimates of the official data provided by the official national sources. The International Transport Forum will develop the methodology and analysis further in trying to provide users of the statistics a better understanding of recent trends and possible turning points.

References

Bloem A., Dippelsman, R., Maehle, N. (2001), *Quarterly National Accounts Manual - Concepts, Data Sources, and Compilation*, International Monetary Fund, Washington DC.

BTS (undated), Methodology: Seasonal Adjustment of the Transportation Services Index Time Series Data, Available at: http://www.bts.gov/programs/economics_and_finance/transportation_services_index/methodology/pdf/methodology_seasonal_adjustments.pdf

BTS (undated), Use of the Chained Fisher Ideal Index to produce the Aggregated Transportation Services Index, Available at: http://www.bts.gov/programs/economics_and_finance/transportation_services_index/methodology/pdf/methodology_chained_fisher_ideal_index.pdf

DfT (undated), Quarterly Bulletin: Traffic in Great Britain, UK Department for Transport, Available at: http://www.dft.gov.uk/pgr/statistics/datatablespublications/roadstraffic/traffic/qbtrafficgb/

Eurostat (2009), *ESS Guidelines on Seasonal Adjustment, 2009 edition*, Eurostat Methodologies and Working Papers, European Commission, European Communities.

Eurostat (2006), *Timely detection of turning points: Should I use the seasonally adjusted or trend estimates?, Conference on seasonality, seasonal adjustment and their implications for short-term analysis and forecasting*, Luxembourg, 10-12 May 2006, Eurostat Methodologies and Working Papers, European Commission, European Communities.

Eurostat (2002a), Demetra 2.0, Pedagogical Manual, May 2002.

Eurostat (2002b), Demetra 2.0, User Manual, May 2002.

Feuerberg, G. (2008), *Uncovering Trends in Seasonal Transportation Data, New tool analyzes airline revenue passenger-mile trend data,* Bureau of Transportation Statistics Technical Report, May 2008.

IATA (2010), Air transport market analysis, November 2009, Available at: http://www.iata.org/whatwedo/economics/index

Planas,C (1997), *Applied Time Series Analysis: Modelling, Forecasting, Unobserved Components Analysis and the Wiener-Kolmogorov Filter*, Eurostat Seasonal Adjustment Project, Available at: http://circa.europa.eu/irc/dsis/eurosam/info/data/