Seasonal Adjustment of the Retail Sales Index

Modelling a Seasonal Break

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1.0 Introduction

Seasonal adjustment is a fundamental process in the interpretation of time series to inform policy-making. Seasonal fluctuations and calendar effects can mask short and long-term movements in a time series and impede a clear understanding of underlying phenomena. Seasonal adjustment filters out usual seasonal fluctuations and typical calendar effects from a time series. [ESS guidelines on seasonal adjustment 2015]

Seasonally adjusted data adds value to data users by providing clear insights into the evolution of the trend over time and by providing more meaningful period-on-period comparisons. Good seasonal adjustment practices help to meet principles 7 (sound methodology), 14 (coherence and comparability) and 15 (access and clarity) of the European Statistics Code of Practice.

There are many issues that need to be addressed before any seasonal adjustment process begins to ensure that good quality, reliable and stable seasonal components are estimated. The issues that need to be addressed include the presence of outliers, level shifts, trading effects, Easter effects and seasonal breaks. All these issues can be dealt with using the X-13 RegARIMA methods developed by the US Census Bureau (US Census Bureau, 2017) and implemented by the CSO using the Win X-13 and JDEMETRA+ packages.

This technical note is concerned with the modelling of a seasonal break that is present in six of the series published as part of the CSO's monthly Retail Sales Index (RSI) statistical release. Seasonal breaks are abrupt changes in the seasonality of a series, which do not affect the level of the series. They may be caused by changes in coverage of the survey, social behaviour, administrative practices or technological innovations.

The seasonal break in these series resulted from an administrative change in the vehicle registration system, with the introduction of the new 3-digit (year) number plates in 2013[1]. Movements in the RSI's sub-index 'Motor Trades' are, not surprisingly, heavily influenced by the sales of new cars. Moreover, the 'Motor Trade' sub-index is a significant weight in the composite RSI series of 'All Businesses' and 'Motors & Fuel'.

The six series impacted by the identified seasonal break are:

- All Businesses – Volume
- All Businesses – Value
- Motors & Fuel – Volume
- Motors & Fuel – Value
- Motor Trades – Volume

[1] Cars registered between January and the end of June 2013 had a '131' registration on their number plate. Those from July 1 to the end of 2013 had a '132' registration. This registration system was repeated for subsequent years.

- Motor Trades - Value

1.1 The issue with seasonal breaks

Seasonal breaks are abrupt changes in the seasonality of a series, which do not affect the level of the series. Failure to adequately model a seasonal break in a series will result in the following:

- A distortion in the seasonal component estimates for several years before and after the actual seasonal break,
- Increased volatility in the seasonally adjusted series,
- Unstable estimates for seasonal components, resulting in increased revisions,
- Problems identifying and quantifying trading day effects[2] and Easter effects,
- Problems fitting the optimum ARIMA model for the series,
- Providing false signals on the economy.

For further discussion on modelling seasonal breaks within the CSO see, 'Seasonal Adjustment of the New Private Cars Licencing Figures: Modelling a Seasonal Break', Foley & Linehan (2017).

1.2 Seasonally adjusting the Retail Sales Index

Modelling seasonality for the Irish retail series is particularly challenging. The seasonal adjustment of the Irish retail sales figures is complicated by the standardised reporting period (SRP) used to collect the raw data. As retail tends to be governed by weekly cyclical patterns, the CSO collects micro-data using a 4-4-5 reporting system, rather than collecting data on a calendar month basis, i.e. each quarter comprises of a 4-week SRP followed by a 4-week SRP followed by a 5-week SRP. This reporting period is favoured by most of the large retailers as it coincides with their own accounting practices; however, this reporting system results in complex atypical calendar effects in the data, making seasonal adjustment of the unadjusted retail sales figures particularly challenging.

The X-13-ARIMA program, developed by the U.S. Census Bureau, is used to seasonally adjust the retail sales figures. The X-13-ARIMA program pre-treats each time series for calendar effects and outliers before then estimating seasonal factors for each series. The calendar effects adjusted for in the Retail Sales Series are; (i) the phase shift effects caused by the 4-4-5 reporting system, (ii) Easter effects, made more complicated by the 4-4-5 reporting system and (iii) the October Bank Holiday effect resulting from the bank holiday switching between the 'October' and 'November' standardised reporting periods. Seasonal adjustment of the CSO's retail sales figures is conducted in compliance with the CSO Seasonal Adjustment Policy

[2] Trading Day effects are generally not an issue with the RSI since the data is already adjusted for trading effects through the adoption of the 4-4-5 standardised reporting period.

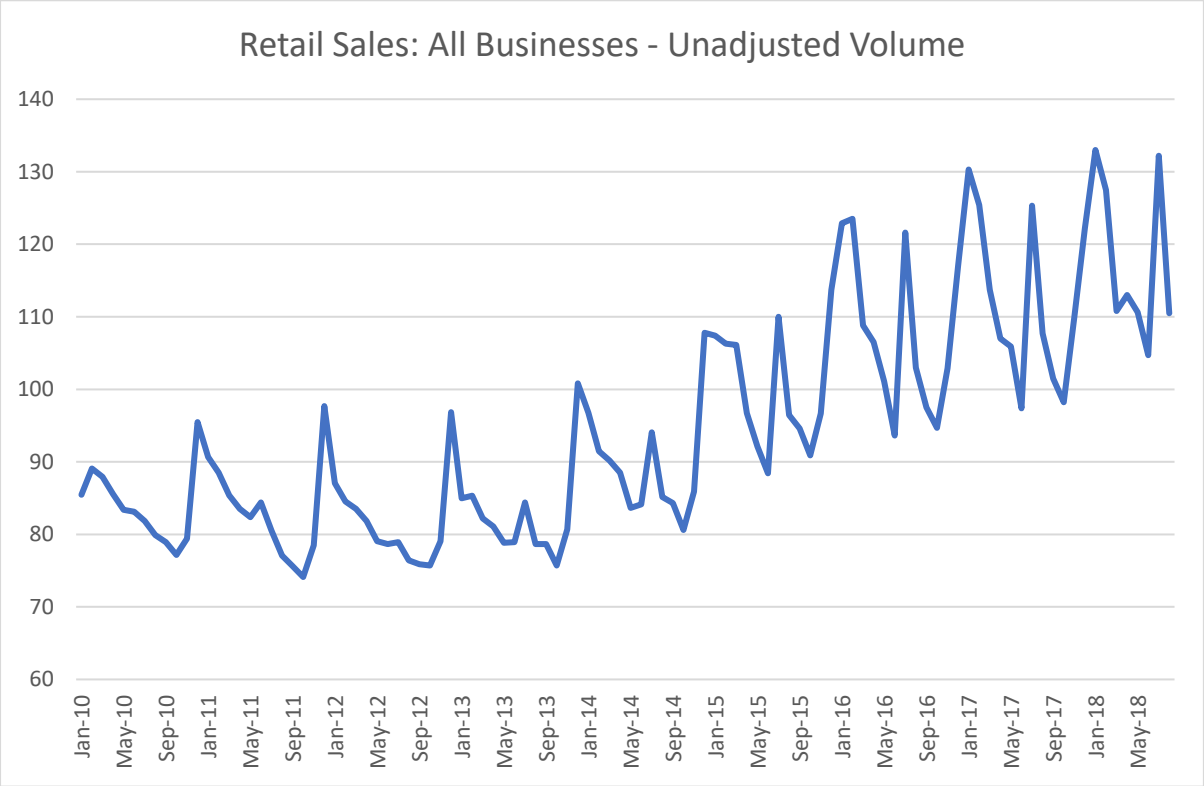
(2018) and international best practice as outlined in the European Statistical System (ESS) Guidelines on Seasonal Adjustment (2015).

For more details on the seasonal adjustment of the retail sales see, 'Improving the Seasonal Adjustment of the Retail Sales Index using X-12-ARIMA', Patrick Foley, CSO (2012).

2.0 Testing for a seasonal break

The introduction of the new licence plates for vehicles in 2013 resulted in a change in the seasonal pattern in new car sales in Ireland. Before 2013 new car sales tended to peak in January and then decline monotonically through to December. However, in 2013 a new seasonal pattern emerged, and a second significant spike evolved in July. Motor Trades is a significant component of the "All Businesses" Retail Sales figure and we can see this seasonal change in the Motor Trade figures reflected in the seasonal pattern of the "All Businesses" series, see figure 2.1. Figure 2.1 provides clear visual evidence of the presence of the seasonal break in this series. Graphical analysis of the other five series studied provides similar visual evidence of the same seasonal break in these series.

Figure 2.1



The presence of the seasonal break can be tested more formally. The seasonal break is identified in accordance with the guidelines outlined in Chapter 17 of the UK's Office of

National Statistics (ONS) 'draft' guidelines on seasonal adjustment (ONS, 2007). The presence of the seasonal break was investigated in Win X-13 using the following code in the X13-RegARIMA regression specification file:

Regression { variables = (seasonal/2013.Jan//) save = (rmx) }

In this specification we are testing to see if the seasonal break occurred in January 2013. The specification divides the series into two spans and X-13 RegARIMA tests whether the seasonal pattern before January 2013 is different to the estimated seasonality for the whole span. The difference is captured in 11 monthly regressors (the rmx file[3]) and these are saved to be used later in modelling the seasonal break. The rmx matrix is shown in full in Appendix B. The rmx matrix includes a variable for each month from January to November. December is not included in the matrix as it acts as the default benchmark month. The data available for the test spans from January 2005 to August 2018. Table 2.1 shows the X-13 RegARIMA output, for the "All Businesses" series. The output displays the estimated parameters for the 11 monthly regressors in the initial run of the RegARIMA model, together with information on their individual statistical significance.

Table 2.1 Preliminary Regression Model - RSI All Businesses (Volume)

	Parameter Estimate	Standard Error	t-value
Seasonal (before 2013.Jan)			
& Jan I	0.0307	0.02156	1.42
& Feb I	-0.0235	0.02283	-1.03
& Mar I	-0.0308	0.02439	-1.26
& Apr I	0.0315	0.02496	1.26
& May I	-0.0092	0.02250	-0.41
& Jun I	-0.0190	0.02101	-0.90
& Jul I	-0.0480	0.02094	-2.29
& Aug I	-0.0227	0.02250	-1.01
& Sep I	-0.0311	0.02328	-1.34
& Oct I	0.0646	0.02304	2.80
& Nov I	0.0365	0.02282	1.60
*** Dec I (derived)**	0.0208	0.02168	0.96

[3] These set of variables are referred to as 'permanent priors'.

Table 2.2 provides the results of the F-test to confirm if the 11 monthly regressors provide joint evidence to support the hypothesis that a seasonal break occurs in January 2013. If the reported p-value is less than 0.05 then we assume there is evidence in the data to support the hypothesis that a seasonal break occurred at the start of 2013. The p—value of 0.01, see Table 2.2, confirms the presence of a seasonal break at this time. This is hardly surprising given the graphical evidence discussed earlier.

Table 2.2 F-test for the seasonal regressors

	df	F-statistic	P-Value
Seasonal (before 2013.Jan)	11, 133	2.35	0.01

To confirm a seasonal break, at least 1–year of data is needed after the seasonal break, but ideally, you should have 3-years of data. In this case, we had 68 months of data after the break[4]. A number of dates were examined to see if the seasonal break occurred earlier or later than January 2013 before it was decided that this date was the most likely start date.

2.1 Modelling a seasonal break

There are a number of options available when faced with a seasonal break:

I. Model the seasonal break
II. Divide the series into two spans (before and after the break) and model the two spans separately
III. Do not seasonally adjust the series
IV. Ignore the seasonal break

The option chosen for the Retail Sales series was the first option and this is the preferred option as outlined in the ONS 'draft guidelines' (2007). The second option is only viable if enough data is available after the break. This option was investigated but it was not adopted, as the seasonally adjusted series was more volatile than the one achieved by modelling the seasonal break. The third option could be considered if not enough data is available after the seasonal break to model the break effectively. The final option is the least desired for all the reasons mentioned in Section 1.1.

The seasonal break is adjusted in accordance with the ONS 'draft' guidelines (ONS, 2007). The rmx matrix of regressors saved in the 'identification of the seasonal break' phase is used to model the seasonal break in the RegARIMA regression. This regression is part of the pre-treatment of the unadjusted series before the actual seasonal adjustment of the series takes

[4] The models were based on data that spanned from January 2005 to August 2018.

place. See ONS, (2007) for more information on the RegARIMA aspect of the seasonal adjustment process.

The 11 rmx variables are included in seasonal adjustment process by modifying the X13-RegARIMA regression specification file. The regression section of the specification code for the "All Businesses" series is provided below.

regression{

variables= (LS2009.Jan AO2010.Dec AO2010.Jan AO2015.Mar)

file= "G1G4B1.dat"
format = Datevalue
user = (M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 E1 E2 E3)
usertype = (seasonal seasonal seasonal seasonal seasonal seasonal seasonal seasonal seasonal seasonal seasonal holiday holiday holiday)
savelog = aictest }

where, G1G4B1.dat is the saved rmx matrix of regressors: M1 to M11 are the individual seasonal regressors representing January to November[5]. Note that three separate holiday regressors, i.e. E1, E2 and E3, modelling an Easter effect are also included in this file. Four other identified outliers are also in the final seasonal model for the "All Businesses" series.

Once the regressors for the seasonal break were established using the above procedure the six unadjusted series were seasonally adjusted using the direct seasonal adjustment method. In this method each series is adjusted independent of any of its component series. ARIMA models were finalised for each series and any outliers (including the user-defined RSI Easter/Holiday regressors) were established for each series. The ARIMA models, the outliers and the seasonal break regressors formed the basis of the Reg-ARIMA models for each series.

Individual monthly moving average filters were also established for each series. The choice of the filters was based on the moving seasonality SI ratios reported in Table D.9.A in X-12 output. The SI ratios were examined for each series and the subsequent filter choices were then individually coded in the X-11 section of the specification files.

Seasonal adjustment models were developed fully in line with the 2015 ESS guidelines on seasonal adjustment and with the CSO's own recommendations and best practice. All the series were seasonally adjusted using the X-13ARIMA-SEATS software (Release Version 1.1 Build 39) developed by U. S. Department of Commerce, U. S. Census Bureau.

3.0 The test results – confirming the seasonal break

[5] No regressor is introduced for December as it acts as the reference period.

The regression results for the RSI "All Businesses" series specified above is provided in Table 3.1. The results clearly show that the identified outliers are individually statistically significant. However, the significance or otherwise of the seasonal regressors are not tested individually but jointly. This is true also for the holiday regressors.

Table 3.1 Final Regression Model - RSI All Businesses (Volume)

	Parameter Estimate	Standard Error	t-value
LS2009.Jan	-0.1602	0.01794	-8.93
AO2010.Jan	-0.0869	0.01430	-6.07
AO2010.Dec	-0.0666	0.01358	-4.91
AO2015.Mar	0.0862	0.01504	5.73
Seasonal (before 2013.Jan)			
& Jan I	0.0307	0.02156	1.42
& Feb I	-0.0235	0.02283	-1.03
& Mar I	-0.0308	0.02439	-1.26
& Apr I	0.0315	0.02496	1.26
& May I	-0.0092	0.02250	-0.41
& Jun I	-0.0190	0.02101	-0.90
& Jul I	-0.0480	0.02094	-2.29
& Aug I	-0.0227	0.02250	-1.01
& Sep I	-0.0311	0.02328	-1.34
& Oct I	0.0646	0.02304	2.80
& Nov I	0.0365	0.02282	1.60
*** Dec I (derived)**	0.0208	0.02168	0.96
User-defined Holiday			
E1	-0.0080	0.00637	-1.25
E2	-0.0134	0.00611	-2.20
E3	0.0078	0.00784	1.00

Table 3.2 shows the results of the Chi-squared test on whether or not the user-defined regressors are significant in the model for 'All Businesses – Volume'. It is clear from Table 3.2 that the user-defined regressors, taken together, are statistically significant in modelling the seasonal break in the time series. This is also true for each of the other five series considered.

Table 3.2 Chi-squared tests for groups of regressors Model - RSI All Businesses (Volume)

	df	Chi-square	p-value
Seasonal (before 2013.Jan)	11	29.36	0.00
User-defined Holiday	3	7.83	0.05
User-defined Regressors	3	7.83	0.05

3.1 The impact of modelling for a seasonal break on the seasonally adjusted data

Models for each of the six series analysed were re-developed taking into account the seasonal break but without reference to the operational models in place at the time. This approach is completely in compliance with ESS and CSO guidelines on seasonal adjustment which requires seasonal adjustment models to be fully reviewed annually.

Seasonally adjusted data is published in the current RSI release (Rebase 2015=100) from January 2015 onwards. The seasonal adjustment is, however, based on data that spans from January 2005 to the current period. The following results only provide the sections of the series that coincide with the current dissemination span.

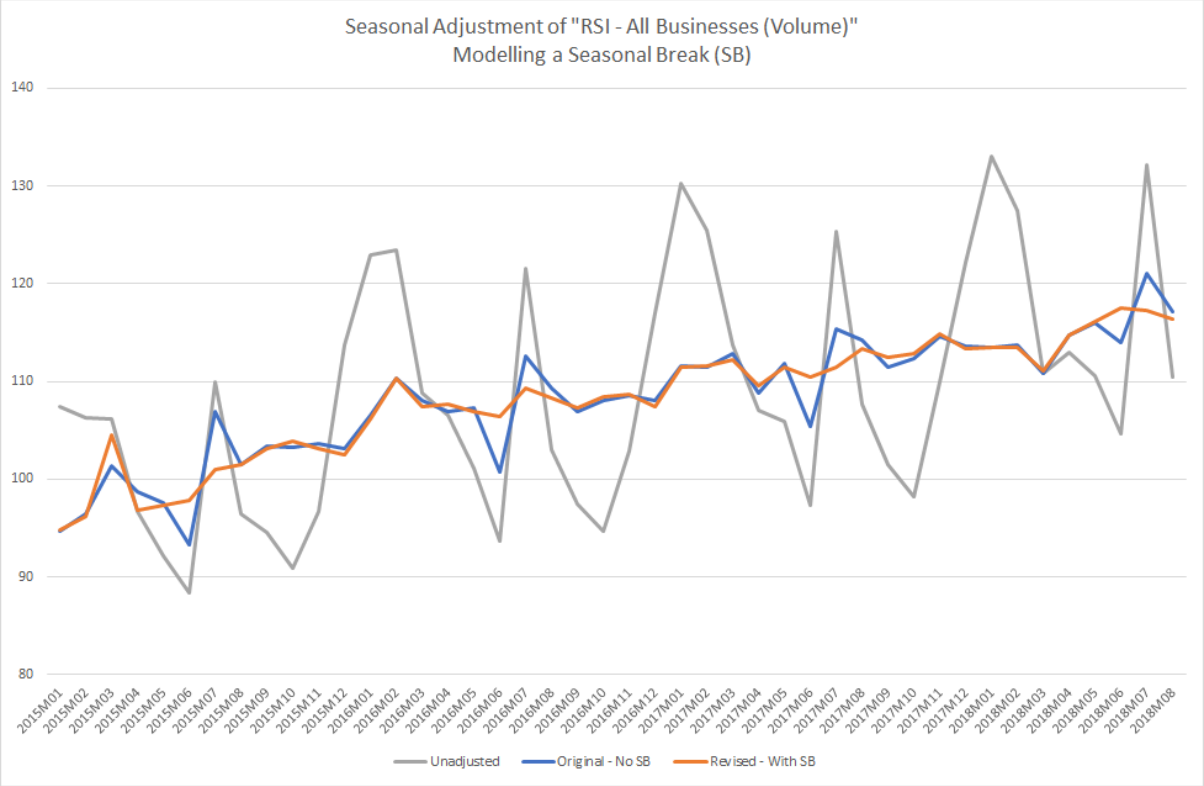
For each of the series, smoother seasonally adjusted series were estimated. However, the most significant improvements can be seen in the 'All Businesses – Volume' series. Figures 3.2 – 3.6 graph the *original* seasonally adjusted series without the seasonal break in the model versus the *revised* seasonally adjusted series with a seasonal break included in the model. It is evident from the graphs that the prominent recurring seasonal peaks and troughs (June, July, August) in the original seasonally adjusted series, for each of the series, have been largely removed. Tables 3.3 – 3.8 provides the information in tabular form.

In the 'Original' (blue) RSI "All Businesses" series, Figure 3.1, a clear seasonal pattern is still evident in the seasonally adjusted series: there is a recurring drop in retail sales in June, a large increase in July followed by a fall in sales August. This is evident in each of the years 2015 to 2018. The purpose of seasonal adjustment is to remove such seasonal patterns – leaving only a trend and the irregular component.

In contrast, the 'Revised' seasonally adjusted series, Figure 3.1, has no discernible seasonal pattern in the adjusted data. The evolution of the series is far smoother, and the underlying movement of the retail sales is more consistent and coherent.

In Table 3.3 the differences in the seasonally adjusted series between the 'Original' and the 'Revised' seasonally series is also clear. Not alone is there a difference in the level of the two series, there are also clear differences in the month-on-month changes as well as the annual changes. The monthly changes and the annual changes are also much more consistent in the seasonally adjusted series with the seasonal break included.

Figure 3.1



Similar, but less prominent outcomes, can be seen for the other five series analysed.

Figure 3.2

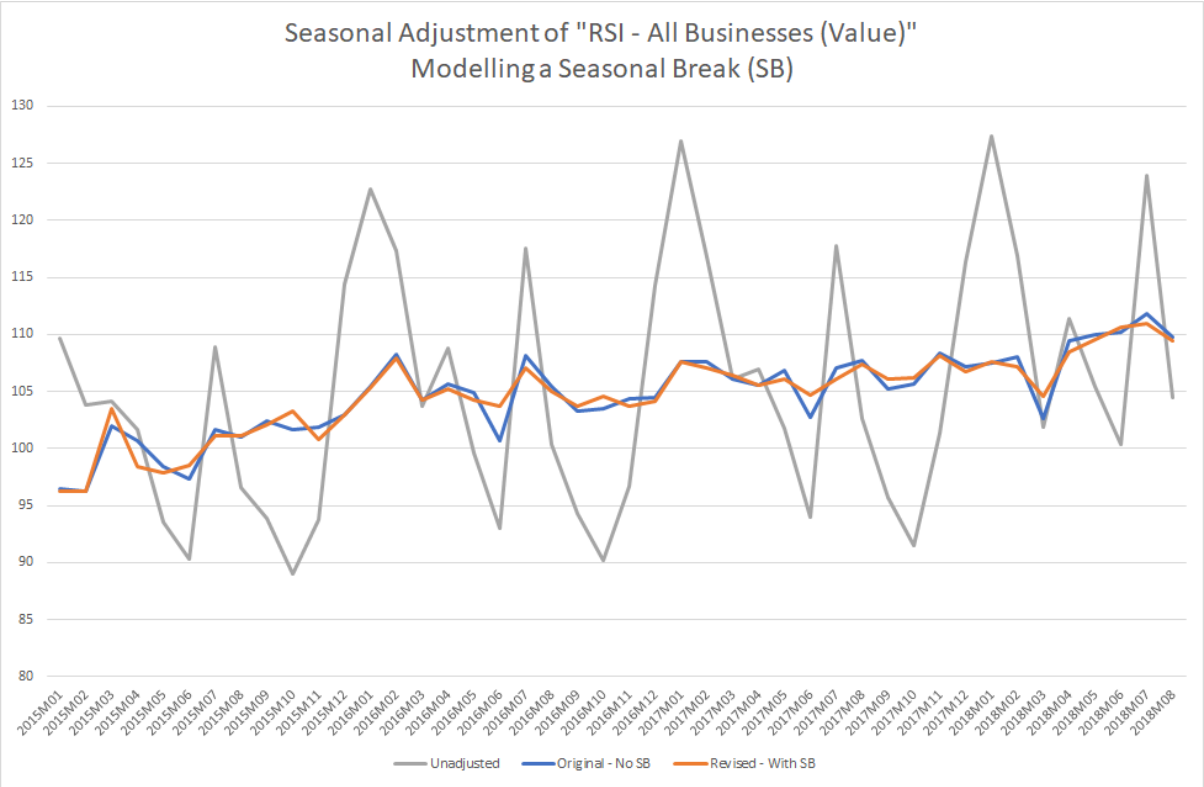


Table 3.3 RSI "All Businesses" Volume

	Original - No SB				Revised - With SB		
	SA	MOM %	YOY%		SA	MOM %	YOY%
2015M01	94.7				94.77		
2015M02	96.4	1.8%			96.15	1.4%	
2015M03	101.4	5.2%			104.55	8.7%	
2015M04	98.7	-2.7%			96.85	-7.4%	
2015M05	97.6	-1.1%			97.32	0.5%	
2015M06	93.3	-4.4%			97.89	0.6%	
2015M07	106.9	14.6%			100.97	3.2%	
2015M08	101.5	-5.1%			101.54	0.6%	
2015M09	103.4	1.9%			103.13	1.6%	
2015M10	103.3	-0.1%			103.94	0.8%	
2015M11	103.6	0.3%			103.15	-0.8%	
2015M12	103.1	-0.5%			102.54	-0.6%	
2016M01	106.5	3.3%	12.5%		106.15	3.5%	12.0%
2016M02	110.3	3.6%	14.4%		110.37	4.0%	14.8%
2016M03	108.1	-2.0%	6.6%		107.41	-2.7%	2.7%
2016M04	106.9	-1.1%	8.3%		107.67	0.2%	11.2%
2016M05	107.3	0.4%	9.9%		106.86	-0.8%	9.8%
2016M06	100.7	-6.2%	7.9%		106.37	-0.5%	8.7%
2016M07	112.6	11.8%	5.3%		109.25	2.7%	8.2%
2016M08	109.3	-2.9%	7.7%		108.29	-0.9%	6.6%
2016M09	106.9	-2.2%	3.4%		107.26	-1.0%	4.0%
2016M10	108	1.0%	4.5%		108.38	1.0%	4.3%
2016M11	108.6	0.6%	4.8%		108.63	0.2%	5.3%
2016M12	108.1	-0.5%	4.8%		107.47	-1.1%	4.8%
2017M01	111.6	3.2%	4.8%		111.40	3.7%	4.9%
2017M02	111.5	-0.1%	1.1%		111.53	0.1%	1.0%
2017M03	112.8	1.2%	4.3%		112.26	0.7%	4.5%
2017M04	108.8	-3.5%	1.8%		109.60	-2.4%	1.8%
2017M05	111.8	2.8%	4.2%		111.49	1.7%	4.3%
2017M06	105.4	-5.7%	4.7%		110.49	-0.9%	3.9%
2017M07	115.4	9.5%	2.5%		111.50	0.9%	2.1%
2017M08	114.2	-1.0%	4.5%		113.31	1.6%	4.6%
2017M09	111.5	-2.4%	4.3%		112.47	-0.7%	4.9%
2017M10	112.4	0.8%	4.1%		112.82	0.3%	4.1%
2017M11	114.6	2.0%	5.5%		114.91	1.9%	5.8%
2017M12	113.6	-0.9%	5.1%		113.32	-1.4%	5.4%
2018M01	113.5	-0.1%	1.7%		113.43	0.1%	1.8%
2018M02	113.7	0.2%	2.0%		113.45	0.0%	1.7%
2018M03	110.8	-2.6%	-1.8%		111.11	-2.1%	-1.0%
2018M04	114.7	3.5%	5.4%		114.72	3.2%	4.7%
2018M05	116	1.1%	3.8%		116.08	1.2%	4.1%
2018M06	114	-1.7%	8.2%		117.48	1.2%	6.3%
2018M07	121.1	6.2%	4.9%		117.26	-0.2%	5.2%
2018M08	117.1	-3.3%	2.5%		116.40	-0.7%	2.7%

Table 3.4 RSI "All Businesses" Value

	Original - No SB				Revised - With SB		
	SA	MOM %	YOY%		SA	MOM %	YOY%
2015M01	96.5				96.20		
2015M02	96.2	-0.3%			96.21	0.0%	
2015M03	102	6.0%			103.52	7.6%	
2015M04	100.7	-1.3%			98.40	-4.9%	
2015M05	98.4	-2.3%			97.86	-0.6%	
2015M06	97.3	-1.1%			98.48	0.6%	
2015M07	101.7	4.5%			101.10	2.7%	
2015M08	101	-0.7%			101.11	0.0%	
2015M09	102.4	1.4%			102.13	1.0%	
2015M10	101.6	-0.8%			103.28	1.1%	
2015M11	101.9	0.3%			100.81	-2.4%	
2015M12	102.9	1.0%			102.95	2.1%	
2016M01	105.4	2.4%	9.2%		105.30	2.3%	9.5%
2016M02	108.2	2.7%	12.5%		107.91	2.5%	12.2%
2016M03	104.3	-3.6%	2.3%		104.20	-3.4%	0.7%
2016M04	105.7	1.3%	5.0%		105.17	0.9%	6.9%
2016M05	104.9	-0.8%	6.6%		104.20	-0.9%	6.5%
2016M06	100.7	-4.0%	3.5%		103.68	-0.5%	5.3%
2016M07	108.1	7.3%	6.3%		107.08	3.3%	5.9%
2016M08	105.4	-2.5%	4.4%		105.03	-1.9%	3.9%
2016M09	103.3	-2.0%	0.9%		103.70	-1.3%	1.5%
2016M10	103.5	0.2%	1.9%		104.55	0.8%	1.2%
2016M11	104.4	0.9%	2.5%		103.74	-0.8%	2.9%
2016M12	104.5	0.1%	1.6%		104.11	0.4%	1.1%
2017M01	107.6	3.0%	2.1%		107.64	3.4%	2.2%
2017M02	107.6	0.0%	-0.6%		107.02	-0.6%	-0.8%
2017M03	106.1	-1.4%	1.7%		106.41	-0.6%	2.1%
2017M04	105.5	-0.6%	-0.2%		105.49	-0.9%	0.3%
2017M05	106.8	1.2%	1.8%		106.12	0.6%	1.8%
2017M06	102.7	-3.8%	2.0%		104.71	-1.3%	1.0%
2017M07	107.1	4.3%	-0.9%		106.11	1.3%	-0.9%
2017M08	107.7	0.6%	2.2%		107.37	1.2%	2.2%
2017M09	105.2	-2.3%	1.8%		106.11	-1.2%	2.3%
2017M10	105.6	0.4%	2.0%		106.16	0.1%	1.5%
2017M11	108.4	2.7%	3.8%		108.11	1.8%	4.2%
2017M12	107.2	-1.1%	2.6%		106.72	-1.3%	2.5%
2018M01	107.5	0.3%	-0.1%		107.56	0.8%	-0.1%
2018M02	108	0.5%	0.4%		107.13	-0.4%	0.1%
2018M03	102.6	-5.0%	-3.3%		104.62	-2.3%	-1.7%
2018M04	109.4	6.6%	3.7%		108.49	3.7%	2.8%
2018M05	110	0.5%	3.0%		109.58	1.0%	3.3%
2018M06	110.2	0.2%	7.3%		110.68	1.0%	5.7%
2018M07	111.8	1.5%	4.4%		110.94	0.2%	4.5%
2018M08	109.8	-1.8%	1.9%		109.49	-1.3%	2.0%

Figure 3.3

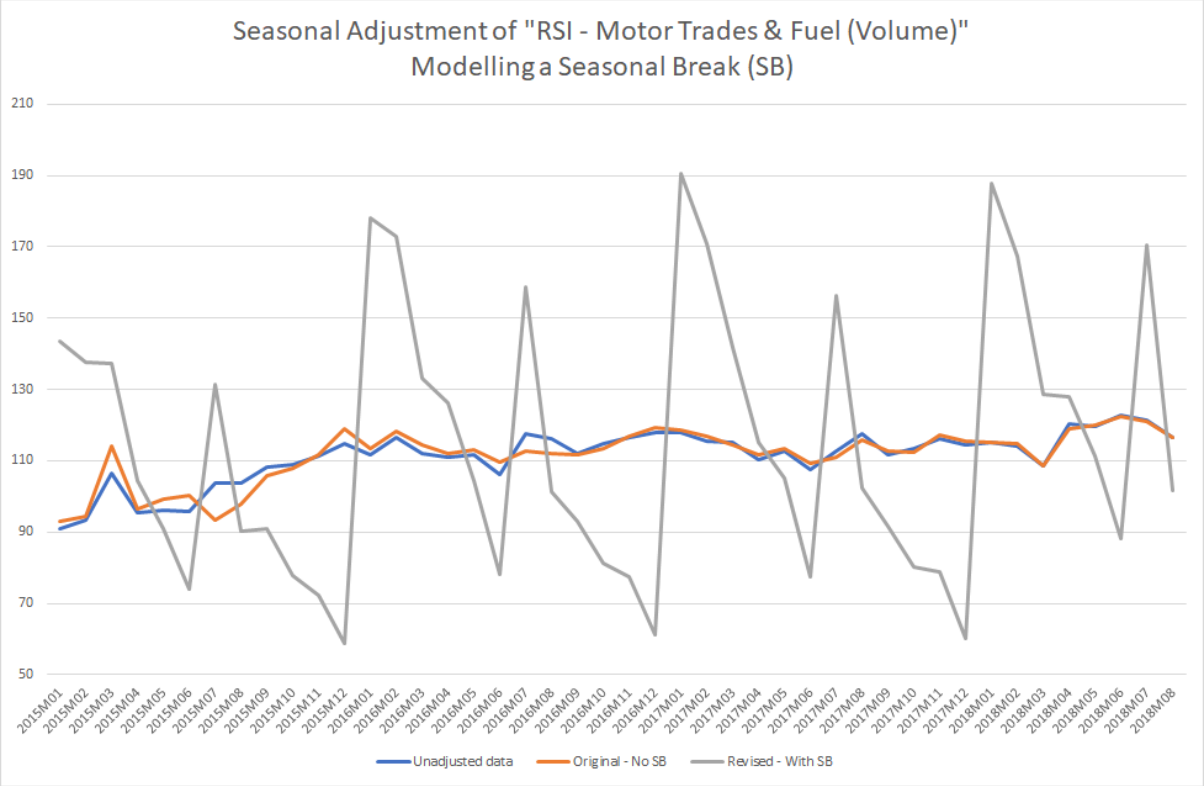


Figure 3.4

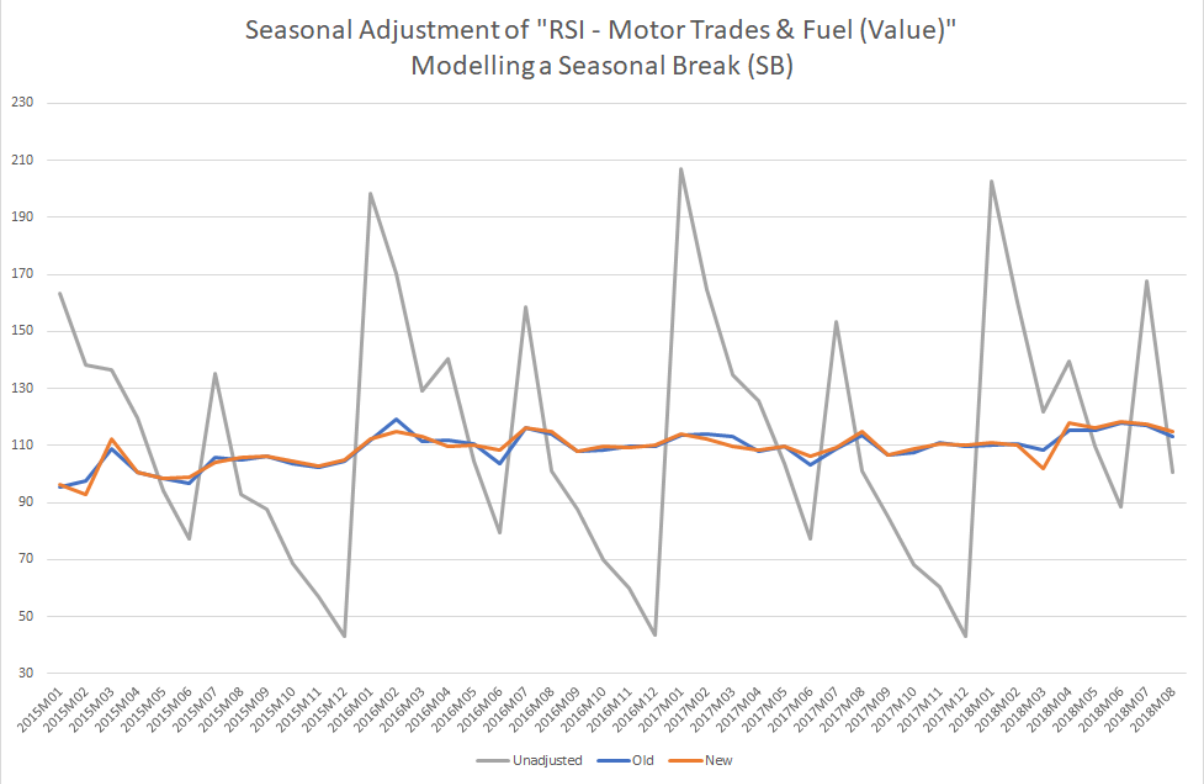


Table 3.5 RSI "Motors & Fuel" Volume

	Original - No SB				Revised - With SB		
	SA	MOM %	YOY%		SA	MOM %	YOY%
2015M01	91.1				93.08		
2015M02	93.2	2.3%			94.54	1.6%	
2015M03	106.6	14.4%			114.09	20.7%	
2015M04	95.3	-10.6%			96.34	-15.6%	
2015M05	96	0.7%			99.24	3.0%	
2015M06	95.8	-0.2%			100.25	1.0%	
2015M07	103.8	8.4%			93.30	-6.9%	
2015M08	103.7	-0.1%			97.99	5.0%	
2015M09	108.2	4.3%			105.63	7.8%	
2015M10	108.8	0.6%			107.95	2.2%	
2015M11	111.3	2.3%			111.65	3.4%	
2015M12	114.9	3.2%			118.81	6.4%	
2016M01	111.7	-2.8%	22.6%		113.30	-4.6%	21.7%
2016M02	116.6	4.4%	25.1%		118.36	4.5%	25.2%
2016M03	112	-3.9%	5.1%		114.44	-3.3%	0.3%
2016M04	111.1	-0.8%	16.6%		112.13	-2.0%	16.4%
2016M05	111.6	0.5%	16.3%		112.93	0.7%	13.8%
2016M06	106	-5.0%	10.6%		109.74	-2.8%	9.5%
2016M07	117.6	10.9%	13.3%		112.69	2.7%	20.8%
2016M08	116.2	-1.2%	12.1%		112.18	-0.5%	14.5%
2016M09	112.1	-3.5%	3.6%		111.67	-0.4%	5.7%
2016M10	114.8	2.4%	5.5%		113.45	1.6%	5.1%
2016M11	116.5	1.5%	4.7%		116.79	2.9%	4.6%
2016M12	117.8	1.1%	2.5%		119.31	2.2%	0.4%
2017M01	118	0.2%	5.6%		118.68	-0.5%	4.7%
2017M02	115.5	-2.1%	-0.9%		117.00	-1.4%	-1.2%
2017M03	115.3	-0.2%	2.9%		114.34	-2.3%	-0.1%
2017M04	110.3	-4.3%	-0.7%		111.64	-2.4%	-0.4%
2017M05	112.8	2.3%	1.1%		113.57	1.7%	0.6%
2017M06	107.7	-4.5%	1.6%		109.29	-3.8%	-0.4%
2017M07	112.8	4.7%	-4.1%		111.02	1.6%	-1.5%
2017M08	117.5	4.2%	1.1%		115.79	4.3%	3.2%
2017M09	111.8	-4.9%	-0.3%		112.59	-2.8%	0.8%
2017M10	113.5	1.5%	-1.1%		112.48	-0.1%	-0.9%
2017M11	116.1	2.3%	-0.3%		117.26	4.3%	0.4%
2017M12	114.4	-1.5%	-2.9%		115.36	-1.6%	-3.3%
2018M01	115.2	0.7%	-2.4%		115.23	-0.1%	-2.9%
2018M02	114.1	-1.0%	-1.2%		114.74	-0.4%	-1.9%
2018M03	108.6	-4.8%	-5.8%		108.44	-5.5%	-5.2%
2018M04	120.2	10.7%	9.0%		118.81	9.6%	6.4%
2018M05	119.6	-0.5%	6.0%		120.15	1.1%	5.8%
2018M06	122.6	2.5%	13.8%		122.35	1.8%	12.0%
2018M07	121.5	-0.9%	7.7%		120.97	-1.1%	9.0%
2018M08	116.6	-4.0%	-0.8%		116.60	-3.6%	0.7%

Table 3.6 RSI "Motors & Fuel" Value

	Original - No SB				Revised - With SB		
	SA	MOM %	YOY%		SA	MOM %	YOY%
2015M01	95.6				96.28		
2015M02	97.4	1.9%			92.71	-3.7%	
2015M03	108.9	11.8%			112.15	21.0%	
2015M04	100.7	-7.5%			100.50	-10.4%	
2015M05	98.5	-2.2%			98.40	-2.1%	
2015M06	96.9	-1.6%			98.98	0.6%	
2015M07	105.6	9.0%			104.25	5.3%	
2015M08	104.9	-0.7%			105.87	1.6%	
2015M09	106.2	1.2%			106.23	0.3%	
2015M10	103.5	-2.5%			104.68	-1.5%	
2015M11	102.2	-1.3%			102.84	-1.8%	
2015M12	104.3	2.1%			105.04	2.1%	
2016M01	111.8	7.2%	16.9%		112.11	6.7%	16.4%
2016M02	119	6.4%	22.2%		115.02	2.6%	24.1%
2016M03	111.6	-6.2%	2.5%		113.29	-1.5%	1.0%
2016M04	111.9	0.3%	11.1%		109.56	-3.3%	9.0%
2016M05	110.5	-1.3%	12.2%		110.28	0.7%	12.1%
2016M06	103.8	-6.1%	7.1%		108.33	-1.8%	9.4%
2016M07	116	11.8%	9.8%		116.17	7.2%	11.4%
2016M08	113.9	-1.8%	8.6%		114.75	-1.2%	8.4%
2016M09	108	-5.2%	1.7%		108.01	-5.9%	1.7%
2016M10	108.6	0.6%	4.9%		109.81	1.7%	4.9%
2016M11	109.5	0.8%	7.1%		109.42	-0.4%	6.4%
2016M12	109.8	0.3%	5.3%		110.14	0.7%	4.9%
2017M01	113.8	3.6%	1.8%		114.23	3.7%	1.9%
2017M02	114	0.2%	-4.2%		112.22	-1.8%	-2.4%
2017M03	113.2	-0.7%	1.4%		109.85	-2.1%	-3.0%
2017M04	108	-4.6%	-3.5%		108.61	-1.1%	-0.9%
2017M05	109.6	1.5%	-0.8%		109.67	1.0%	-0.6%
2017M06	103.3	-5.7%	-0.5%		106.07	-3.3%	-2.1%
2017M07	108.8	5.3%	-6.2%		109.07	2.8%	-6.1%
2017M08	113.5	4.3%	-0.4%		114.73	5.2%	0.0%
2017M09	106.7	-6.0%	-1.2%		106.81	-6.9%	-1.1%
2017M10	107.4	0.7%	-1.1%		108.86	1.9%	-0.9%
2017M11	110.8	3.2%	1.2%		110.77	1.8%	1.2%
2017M12	109.6	-1.1%	-0.2%		110.19	-0.5%	0.0%
2018M01	110.3	0.6%	-3.1%		111.13	0.9%	-2.7%
2018M02	110.7	0.4%	-2.9%		109.93	-1.1%	-2.0%
2018M03	108.3	-2.2%	-4.3%		102.05	-7.2%	-7.1%
2018M04	115.4	6.6%	6.9%		117.79	15.4%	8.4%
2018M05	115.3	-0.1%	5.2%		116.09	-1.4%	5.8%
2018M06	117.8	2.2%	14.0%		118.15	1.8%	11.4%
2018M07	117.2	-0.5%	7.7%		117.65	-0.4%	7.9%
2018M08	113	-3.6%	-0.4%		114.97	-2.3%	0.2%

Figure 3.5

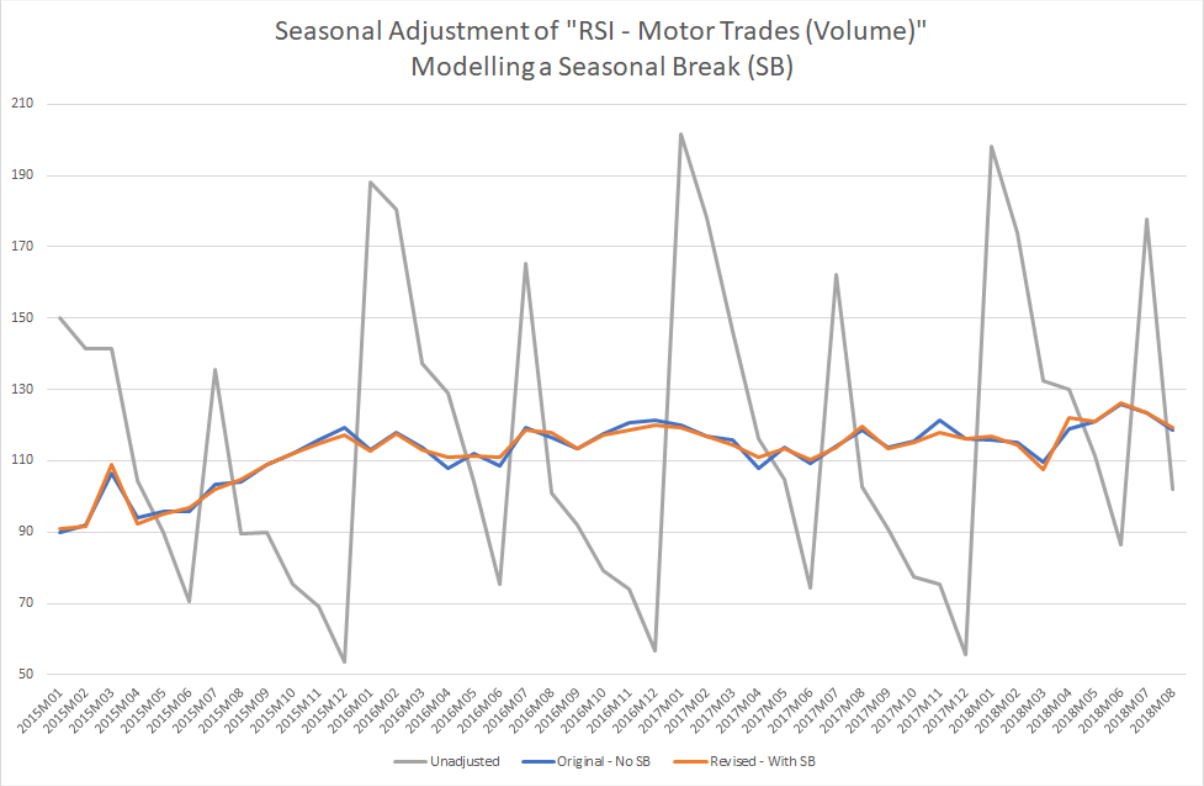


Figure 3.6

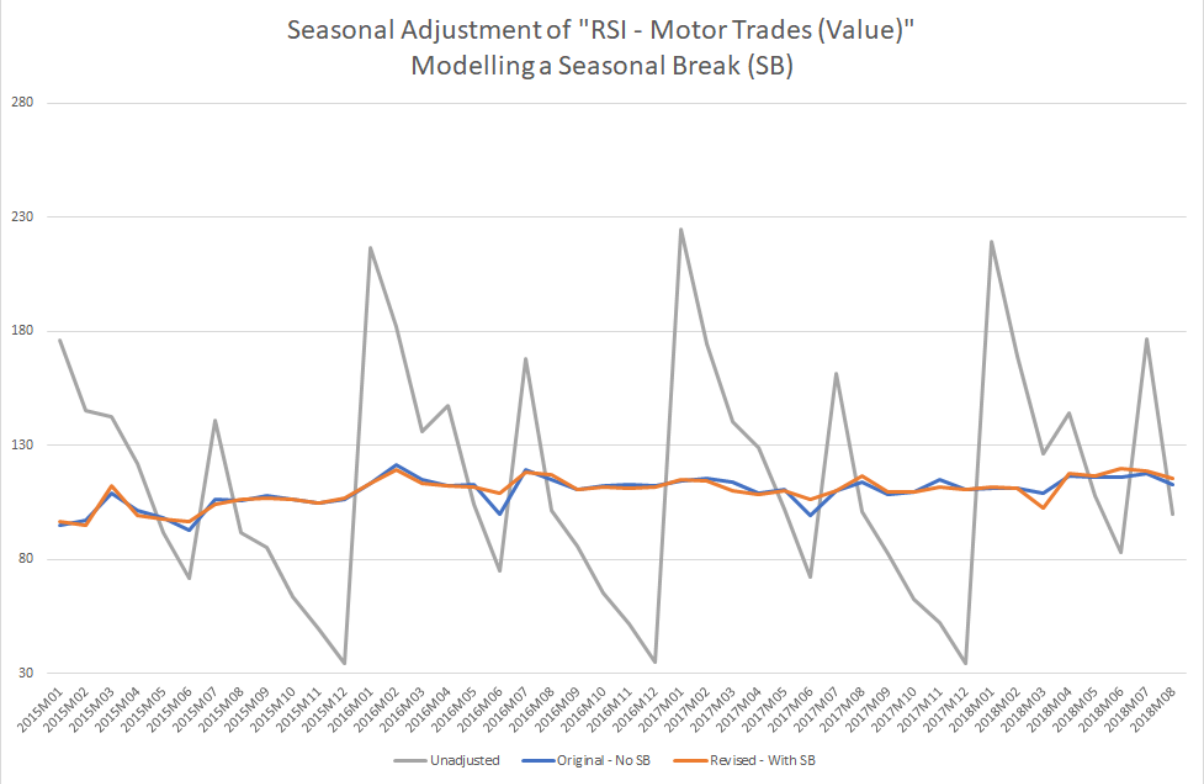


Table 3.7 RSI "Motor Trades" Volume

	Original - No SB				Revised - With SB		
	SA	MOM %	YOY%		SA	MOM %	YOY%
2015M01	89.9				91.06		
2015M02	92.1	2.4%			91.76	0.8%	
2015M03	106.5	15.6%			108.81	18.6%	
2015M04	94.1	-11.6%			92.44	-15.1%	
2015M05	95.6	1.6%			95.23	3.0%	
2015M06	95.8	0.2%			96.78	1.6%	
2015M07	103.5	8.0%			101.86	5.2%	
2015M08	104.2	0.7%			104.87	3.0%	
2015M09	109	4.6%			109.04	4.0%	
2015M10	112	2.8%			111.89	2.6%	
2015M11	115.7	3.3%			114.96	2.7%	
2015M12	119.4	3.2%			117.28	2.0%	
2016M01	113	-5.4%	25.7%		112.72	-3.9%	23.8%
2016M02	117.9	4.3%	28.0%		117.58	4.3%	28.1%
2016M03	113.8	-3.5%	6.9%		113.06	-3.8%	3.9%
2016M04	107.8	-5.3%	14.6%		110.98	-1.8%	20.1%
2016M05	112.2	4.1%	17.4%		111.45	0.4%	17.0%
2016M06	108.6	-3.2%	13.4%		110.83	-0.6%	14.5%
2016M07	119.2	9.8%	15.2%		118.62	7.0%	16.5%
2016M08	116.6	-2.2%	11.9%		117.74	-0.7%	12.3%
2016M09	113.5	-2.7%	4.1%		113.47	-3.6%	4.1%
2016M10	117.6	3.6%	5.0%		117.11	3.2%	4.7%
2016M11	120.8	2.7%	4.4%		118.49	1.2%	3.1%
2016M12	121.2	0.3%	1.5%		119.95	1.2%	2.3%
2017M01	120	-1.0%	6.2%		119.26	-0.6%	5.8%
2017M02	116.8	-2.7%	-0.9%		116.83	-2.0%	-0.6%
2017M03	115.8	-0.9%	1.8%		114.58	-1.9%	1.4%
2017M04	107.9	-6.8%	0.1%		111.16	-3.0%	0.2%
2017M05	113.6	5.3%	1.2%		113.54	2.1%	1.9%
2017M06	109.2	-3.9%	0.6%		110.16	-3.0%	-0.6%
2017M07	114	4.4%	-4.4%		113.69	3.2%	-4.2%
2017M08	118.6	4.0%	1.7%		119.69	5.3%	1.6%
2017M09	113.7	-4.1%	0.2%		113.51	-5.2%	0.0%
2017M10	115.5	1.6%	-1.8%		115.21	1.5%	-1.6%
2017M11	121.2	4.9%	0.3%		117.84	2.3%	-0.6%
2017M12	116.2	-4.1%	-4.1%		116.04	-1.5%	-3.3%
2018M01	116	-0.2%	-3.3%		116.71	0.6%	-2.1%
2018M02	115.1	-0.8%	-1.5%		114.61	-1.8%	-1.9%
2018M03	109.5	-4.9%	-5.4%		107.59	-6.1%	-6.1%
2018M04	119	8.7%	10.3%		121.90	13.3%	9.7%
2018M05	120.9	1.6%	6.4%		121.13	-0.6%	6.7%
2018M06	125.9	4.1%	15.3%		126.06	4.1%	14.4%
2018M07	123.3	-2.1%	8.2%		123.48	-2.0%	8.6%
2018M08	118.5	-3.9%	-0.1%		119.14	-3.5%	-0.5%

Table 3.8 RSI "Motor Trades" Value

	Original - No SB				Revised - With SB		
	SA	MOM %	YOY%		SA	MOM %	YOY%
2015M01	95				96.48		
2015M02	97.1	2.2%			94.97	-1.6%	
2015M03	109.3	12.6%			112.27	18.2%	
2015M04	101.5	-7.1%			99.23	-11.6%	
2015M05	98.2	-3.3%			97.49	-1.8%	
2015M06	92.7	-5.6%			96.70	-0.8%	
2015M07	106.4	14.8%			104.01	7.6%	
2015M08	105.8	-0.6%			106.64	2.5%	
2015M09	107.8	1.9%			106.98	0.3%	
2015M10	106.4	-1.3%			106.61	-0.3%	
2015M11	104.5	-1.8%			104.60	-1.9%	
2015M12	106.4	1.8%			107.09	2.4%	
2016M01	113.2	6.4%	19.2%		113.55	6.0%	17.7%
2016M02	121.6	7.4%	25.2%		119.21	5.0%	25.5%
2016M03	114.9	-5.5%	5.1%		113.52	-4.8%	1.1%
2016M04	112.4	-2.2%	10.7%		112.54	-0.9%	13.4%
2016M05	112.9	0.4%	15.0%		111.68	-0.8%	14.6%
2016M06	100	-11.4%	7.9%		108.98	-2.4%	12.7%
2016M07	119.2	19.2%	12.0%		118.31	8.6%	13.8%
2016M08	115	-3.5%	8.7%		117.02	-1.1%	9.7%
2016M09	110.5	-3.9%	2.5%		110.54	-5.5%	3.3%
2016M10	112.4	1.7%	5.6%		111.92	1.2%	5.0%
2016M11	113.1	0.6%	8.2%		111.19	-0.7%	6.3%
2016M12	112.3	-0.7%	5.5%		111.94	0.7%	4.5%
2017M01	114.5	2.0%	1.1%		115.03	2.8%	1.3%
2017M02	115.5	0.9%	-5.0%		114.42	-0.5%	-4.0%
2017M03	113.7	-1.6%	-1.0%		109.93	-3.9%	-3.2%
2017M04	109	-4.1%	-3.0%		108.69	-1.1%	-3.4%
2017M05	110.9	1.7%	-1.8%		110.24	1.4%	-1.3%
2017M06	99.3	-10.5%	-0.7%		106.30	-3.6%	-2.5%
2017M07	110.4	11.2%	-7.4%		110.20	3.7%	-6.9%
2017M08	113.8	3.1%	-1.0%		116.70	5.9%	-0.3%
2017M09	108.4	-4.7%	-1.9%		109.42	-6.2%	-1.0%
2017M10	109.7	1.2%	-2.4%		109.69	0.3%	-2.0%
2017M11	114.9	4.7%	1.6%		111.96	2.1%	0.7%
2017M12	110.5	-3.8%	-1.6%		110.74	-1.1%	-1.1%
2018M01	111.3	0.7%	-2.8%		111.70	0.9%	-2.9%
2018M02	111.5	0.2%	-3.5%		111.13	-0.5%	-2.9%
2018M03	108.9	-2.3%	-4.2%		102.66	-7.6%	-6.6%
2018M04	116.8	7.3%	7.2%		117.92	14.9%	8.5%
2018M05	116	-0.7%	4.6%		116.55	-1.2%	5.7%
2018M06	115.9	-0.1%	16.7%		119.84	2.8%	12.7%
2018M07	117.7	1.6%	6.6%		118.57	-1.1%	7.6%
2018M08	112.7	-4.2%	-1.0%		115.69	-2.4%	-0.9%

4.0 Conclusion

The CSO introduced the revised models at the earliest possible opportunity. The updated models were introduced as part of the Retail Sales statistical release for October 2018. The release was accompanied by the following statement.

The seasonal adjustment models for the RSI have been updated in line with CSO's policy to regularly review seasonal adjustment. The review focused in particular on the 'July' effect in Motor Trade. This has resulted in revisions to the indices for the sectors Motor Trade, All Businesses, Motors & Fuel *for the months of June, July and August.*

There are no revisions to the unadjusted series. The CSO will continue to review the models used in the RSI on a yearly basis.

As outlined in the Statement of Strategy 2016 – 2019 (CSO 2016), the CSO is committed to providing high quality information. Independence, objectivity and integrity are core values. We constantly strive to provide excellent service to our customers. We are professional, reliable and trusted. Providing high quality seasonally adjusted data is part of that commitment.

References

Eurostat (2015), 'ESS Guidelines on Seasonal Adjustment', Eurostat Manuals and Guidelines.

Office of National Statistics, UK (2007), *"Guide to Seasonal Adjustment with X-12-ARIMA (Draft)",* ONS Methodology and Statistical Development.

Improving the Seasonal Adjustment of the Retail Sales Index using X-12-ARIMA, Patrick Foley (2012).

Seasonal Adjustment of the New Private Cars Licencing Figures: Modelling a Seasonal Break, Patrick Foley & Tim Linehan, CSO (2017).

Central Statistics Office Seasonal Adjustment Policy, CSO 2018.

Retail Sales Index October 2018 (Provisional) September 2018 (Final), CSO statistical release, 28th November 2018.
https://www.cso.ie/en/releasesandpublications/er/rsi/retailsalesindexoctober2018/

Appendix A – Code

RSI All Businesses - Volume

```
#Z:\RSI\Processing\RAP\Rebase_2015\Seasonal_Adjustment\g1vol.spc was
created on 25/10/2016 09:04:58

series{
    file = "g1vol.dat"
    period = 12
    format = Datevalue
}
spectrum{
    savelog = peaks
}
transform{
    function = log  }
regression{
        variables= ( LS2009.Jan AO2010.Dec AO2010.Jan AO2015.Mar)

    file= "G1G4B1.dat"
      format = Datevalue
    user = (M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 E1 E2 E3 )
    usertype = (seasonal seasonal seasonal seasonal seasonal seasonal
seasonal
seasonal seasonal seasonal seasonal holiday holiday holiday)
    savelog = aictest

}
outlier{
    types= ( AO LS TC)
}
arima{ model= (2 1 2)(0 1 1)}
forecast{
    maxlead= 12
    print= none
}
estimate{
    print= (roots regcmatrix acm)
    savelog= (aicc aic bic hq afc)
}
check{print= all savelog= (lbq nrm)}
x11{
    seasonalma= (s3x3 s3x3 s3x5 s3x5 s3x3 s3x1 s3x3 s3x5 s3x3 s3x5 s3x3
s3x3)

    savelog=(M1 M7 M8 M9 M10 M11 Q Q2)
    sigmalim = (,3.5)
    save=(d11 d16 d12)
    appendfcst=yes

}
slidingspans{
    savelog= percent
    additivesa= percent }
history{
    estimates= (fcst aic sadj sadjchng trend trendchng)
    savelog= (asa ach atr atc) }
```

Appendix B

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11
Jan-05	1	0	0	0	0	0	0	0	0	0	0
Feb-05	0	1	0	0	0	0	0	0	0	0	0
Mar-05	0	0	1	0	0	0	0	0	0	0	0
Apr-05	0	0	0	1	0	0	0	0	0	0	0
May-05	0	0	0	0	1	0	0	0	0	0	0
Jun-05	0	0	0	0	0	1	0	0	0	0	0
Jul-05	0	0	0	0	0	0	1	0	0	0	0
Aug-05	0	0	0	0	0	0	0	1	0	0	0
Sep-05	0	0	0	0	0	0	0	0	1	0	0
Oct-05	0	0	0	0	0	0	0	0	0	1	0
Nov-05	0	0	0	0	0	0	0	0	0	0	1
Dec-05	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-06	1	0	0	0	0	0	0	0	0	0	0
Feb-06	0	1	0	0	0	0	0	0	0	0	0
Mar-06	0	0	1	0	0	0	0	0	0	0	0
Apr-06	0	0	0	1	0	0	0	0	0	0	0
May-06	0	0	0	0	1	0	0	0	0	0	0
Jun-06	0	0	0	0	0	1	0	0	0	0	0
Jul-06	0	0	0	0	0	0	1	0	0	0	0
Aug-06	0	0	0	0	0	0	0	1	0	0	0
Sep-06	0	0	0	0	0	0	0	0	1	0	0
Oct-06	0	0	0	0	0	0	0	0	0	1	0
Nov-06	0	0	0	0	0	0	0	0	0	0	1
Dec-06	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-07	1	0	0	0	0	0	0	0	0	0	0
Feb-07	0	1	0	0	0	0	0	0	0	0	0
Mar-07	0	0	1	0	0	0	0	0	0	0	0
Apr-07	0	0	0	1	0	0	0	0	0	0	0
May-07	0	0	0	0	1	0	0	0	0	0	0
Jun-07	0	0	0	0	0	1	0	0	0	0	0
Jul-07	0	0	0	0	0	0	1	0	0	0	0
Aug-07	0	0	0	0	0	0	0	1	0	0	0
Sep-07	0	0	0	0	0	0	0	0	1	0	0
Oct-07	0	0	0	0	0	0	0	0	0	1	0
Nov-07	0	0	0	0	0	0	0	0	0	0	1
Dec-07	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-08	1	0	0	0	0	0	0	0	0	0	0
Feb-08	0	1	0	0	0	0	0	0	0	0	0
Mar-08	0	0	1	0	0	0	0	0	0	0	0
Apr-08	0	0	0	1	0	0	0	0	0	0	0
May-08	0	0	0	0	1	0	0	0	0	0	0
Jun-08	0	0	0	0	0	1	0	0	0	0	0
Jul-08	0	0	0	0	0	0	1	0	0	0	0

Aug-08	0	0	0	0	0	0	0	1	0	0	0
Sep-08	0	0	0	0	0	0	0	0	1	0	0
Oct-08	0	0	0	0	0	0	0	0	0	1	0
Nov-08	0	0	0	0	0	0	0	0	0	0	1
Dec-08	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-09	1	0	0	0	0	0	0	0	0	0	0
Feb-09	0	1	0	0	0	0	0	0	0	0	0
Mar-09	0	0	1	0	0	0	0	0	0	0	0
Apr-09	0	0	0	1	0	0	0	0	0	0	0
May-09	0	0	0	0	1	0	0	0	0	0	0
Jun-09	0	0	0	0	0	1	0	0	0	0	0
Jul-09	0	0	0	0	0	0	1	0	0	0	0
Aug-09	0	0	0	0	0	0	0	1	0	0	0
Sep-09	0	0	0	0	0	0	0	0	1	0	0
Oct-09	0	0	0	0	0	0	0	0	0	1	0
Nov-09	0	0	0	0	0	0	0	0	0	0	1
Dec-09	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-10	1	0	0	0	0	0	0	0	0	0	0
Feb-10	0	1	0	0	0	0	0	0	0	0	0
Mar-10	0	0	1	0	0	0	0	0	0	0	0
Apr-10	0	0	0	1	0	0	0	0	0	0	0
May-10	0	0	0	0	1	0	0	0	0	0	0
Jun-10	0	0	0	0	0	1	0	0	0	0	0
Jul-10	0	0	0	0	0	0	1	0	0	0	0
Aug-10	0	0	0	0	0	0	0	1	0	0	0
Sep-10	0	0	0	0	0	0	0	0	1	0	0
Oct-10	0	0	0	0	0	0	0	0	0	1	0
Nov-10	0	0	0	0	0	0	0	0	0	0	1
Dec-10	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-11	1	0	0	0	0	0	0	0	0	0	0
Feb-11	0	1	0	0	0	0	0	0	0	0	0
Mar-11	0	0	1	0	0	0	0	0	0	0	0
Apr-11	0	0	0	1	0	0	0	0	0	0	0
May-11	0	0	0	0	1	0	0	0	0	0	0
Jun-11	0	0	0	0	0	1	0	0	0	0	0
Jul-11	0	0	0	0	0	0	1	0	0	0	0
Aug-11	0	0	0	0	0	0	0	1	0	0	0
Sep-11	0	0	0	0	0	0	0	0	1	0	0
Oct-11	0	0	0	0	0	0	0	0	0	1	0
Nov-11	0	0	0	0	0	0	0	0	0	0	1
Dec-11	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-12	1	0	0	0	0	0	0	0	0	0	0
Feb-12	0	1	0	0	0	0	0	0	0	0	0
Mar-12	0	0	1	0	0	0	0	0	0	0	0
Apr-12	0	0	0	1	0	0	0	0	0	0	0
May-12	0	0	0	0	1	0	0	0	0	0	0

Jun-12	0	0	0	0	0	1	0	0	0	0	0
Jul-12	0	0	0	0	0	0	1	0	0	0	0
Aug-12	0	0	0	0	0	0	0	1	0	0	0
Sep-12	0	0	0	0	0	0	0	0	1	0	0
Oct-12	0	0	0	0	0	0	0	0	0	1	0
Nov-12	0	0	0	0	0	0	0	0	0	0	1
Dec-12	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Jan-13	0	0	0	0	0	0	0	0	0	0	0
Feb-13	0	0	0	0	0	0	0	0	0	0	0
Mar-13	0	0	0	0	0	0	0	0	0	0	0
Apr-13	0	0	0	0	0	0	0	0	0	0	0
May-13	0	0	0	0	0	0	0	0	0	0	0
Jun-13	0	0	0	0	0	0	0	0	0	0	0
Jul-13	0	0	0	0	0	0	0	0	0	0	0
Aug-13	0	0	0	0	0	0	0	0	0	0	0
Sep-13	0	0	0	0	0	0	0	0	0	0	0
Oct-13	0	0	0	0	0	0	0	0	0	0	0
Nov-13	0	0	0	0	0	0	0	0	0	0	0
Dec-13	0	0	0	0	0	0	0	0	0	0	0
Jan-14	0	0	0	0	0	0	0	0	0	0	0
Feb-14	0	0	0	0	0	0	0	0	0	0	0
Mar-14	0	0	0	0	0	0	0	0	0	0	0
Apr-14	0	0	0	0	0	0	0	0	0	0	0
May-14	0	0	0	0	0	0	0	0	0	0	0
Jun-14	0	0	0	0	0	0	0	0	0	0	0
Jul-14	0	0	0	0	0	0	0	0	0	0	0
Aug-14	0	0	0	0	0	0	0	0	0	0	0
Sep-14	0	0	0	0	0	0	0	0	0	0	0
Oct-14	0	0	0	0	0	0	0	0	0	0	0
Nov-14	0	0	0	0	0	0	0	0	0	0	0
Dec-14	0	0	0	0	0	0	0	0	0	0	0
Jan-15	0	0	0	0	0	0	0	0	0	0	0
Feb-15	0	0	0	0	0	0	0	0	0	0	0
Mar-15	0	0	0	0	0	0	0	0	0	0	0
Apr-15	0	0	0	0	0	0	0	0	0	0	0
May-15	0	0	0	0	0	0	0	0	0	0	0
Jun-15	0	0	0	0	0	0	0	0	0	0	0
Jul-15	0	0	0	0	0	0	0	0	0	0	0
Aug-15	0	0	0	0	0	0	0	0	0	0	0
Sep-15	0	0	0	0	0	0	0	0	0	0	0
Oct-15	0	0	0	0	0	0	0	0	0	0	0
Nov-15	0	0	0	0	0	0	0	0	0	0	0
Dec-15	0	0	0	0	0	0	0	0	0	0	0
Jan-16	0	0	0	0	0	0	0	0	0	0	0
Feb-16	0	0	0	0	0	0	0	0	0	0	0
Mar-16	0	0	0	0	0	0	0	0	0	0	0

Apr-16	0	0	0	0	0	0	0	0	0	0	0
May-16	0	0	0	0	0	0	0	0	0	0	0
Jun-16	0	0	0	0	0	0	0	0	0	0	0
Jul-16	0	0	0	0	0	0	0	0	0	0	0
Aug-16	0	0	0	0	0	0	0	0	0	0	0
Sep-16	0	0	0	0	0	0	0	0	0	0	0
Oct-16	0	0	0	0	0	0	0	0	0	0	0
Nov-16	0	0	0	0	0	0	0	0	0	0	0
Dec-16	0	0	0	0	0	0	0	0	0	0	0
Jan-17	0	0	0	0	0	0	0	0	0	0	0
Feb-17	0	0	0	0	0	0	0	0	0	0	0
Mar-17	0	0	0	0	0	0	0	0	0	0	0
Apr-17	0	0	0	0	0	0	0	0	0	0	0
May-17	0	0	0	0	0	0	0	0	0	0	0
Jun-17	0	0	0	0	0	0	0	0	0	0	0
Jul-17	0	0	0	0	0	0	0	0	0	0	0
Aug-17	0	0	0	0	0	0	0	0	0	0	0
Sep-17	0	0	0	0	0	0	0	0	0	0	0
Oct-17	0	0	0	0	0	0	0	0	0	0	0
Nov-17	0	0	0	0	0	0	0	0	0	0	0
Dec-17	0	0	0	0	0	0	0	0	0	0	0
Jan-18	0	0	0	0	0	0	0	0	0	0	0
Feb-18	0	0	0	0	0	0	0	0	0	0	0
Mar-18	0	0	0	0	0	0	0	0	0	0	0
Apr-18	0	0	0	0	0	0	0	0	0	0	0
May-18	0	0	0	0	0	0	0	0	0	0	0
Jun-18	0	0	0	0	0	0	0	0	0	0	0
Jul-18	0	0	0	0	0	0	0	0	0	0	0
Aug-18	0	0	0	0	0	0	0	0	0	0	0
Sep-18	0	0	0	0	0	0	0	0	0	0	0
Oct-18	0	0	0	0	0	0	0	0	0	0	0
Nov-18	0	0	0	0	0	0	0	0	0	0	0
Dec-18	0	0	0	0	0	0	0	0	0	0	0
Jan-19	0	0	0	0	0	0	0	0	0	0	0
Feb-19	0	0	0	0	0	0	0	0	0	0	0
Mar-19	0	0	0	0	0	0	0	0	0	0	0
Apr-19	0	0	0	0	0	0	0	0	0	0	0
May-19	0	0	0	0	0	0	0	0	0	0	0
Jun-19	0	0	0	0	0	0	0	0	0	0	0
Jul-19	0	0	0	0	0	0	0	0	0	0	0
Aug-19	0	0	0	0	0	0	0	0	0	0	0