Seasonal Adjustment Review of Construction (Output) Time Series for the Northern Ireland Statistics and Research Agency

2013-14

Final Report

Duncan Elliott and Neil Parkin

Office for National Statistics

June 2013

Tel: 01633 45 5620

Email: duncan.elliott@ons.gov.uk, neil.parkin@ons.gov.uk

Contents

1. Introduction

This is the report of a seasonal adjustment review of Construction (Output) time series for Northern Ireland. The reviewers were Duncan Elliott and Neil Parkin, of the UK Office for National Statistics (ONS). The review was carried out in June, 2013.

The review was performed in accordance to the specification agreed with the Northern Ireland Statistics Research Agency (NISRA).

2. Objectives of the review

The aim of the review was to ensure that seasonal adjustment for these series is appropriate and working well. The seasonal adjustment currently being used by NISRA was determined in a previous ONS review, carried out in July 2012.

The review focused on constant price series, the seasonally adjusted estimates of current price series using the same specification files as the corresponding constant price series were also quality assured.

The 19 constant price series reviewed are shown in table 1. The name is a code that is used to refer to each series throughout this report. The third column shows whether or not the current price series was reviewed. (Not all current price series were sent by NISRA to ONS.) The Constant price series are the same series that were reviewed in the last review.

Table 1. The 19 Current price series and 9 constant price series that were reviewed.

Name	Description	Current Prices
ANW	All New Work	Yes
ARM	All Repair and Maintenance	Yes
AW	All work	Yes
IH	Index of Housing	
II	Index of Infrastructure	
IOW	Index of Other Work	
NHPR	New Housing: Private	Yes
NHPU	New housing: Public	
ONWI	Other new work: Infrastructure	
ONWP	Other new work: Public	
ONWPC	Other new work: Private Commercial	Yes
ONWPI	Other new work: Private Industrial	Yes
XPRI	All work: private	
XPUB	All work: public	
RMHPR	Repair and Maintenance – Housing: Private	Yes
RMOWPR	Repair and maintenance – Other work: Private	
RMOWPU	Repair and Maintenance – Other work: Public	Yes
RMOWR	Repair and Maintenance – Other work: Roads	
RMHPU	Repair and Maintenance – Housing: Public	Yes

Any exact additive relations that hold between series before seasonal adjustment are not guaranteed to be preserved between the seasonally adjusted series. However, such relations will still hold approximately.

The seasonal adjustment of each series was reviewed by ONS using X-13ARIMA-SEATS version 1.0 build 149[1]. Other calculations, data processing tasks, and plotting were carried out in SAS for Windows version 9.3 TS and in Win X-13. Each review included:

- assessment of whether the series is seasonal
- choosing the appropriate decomposition type, that is additive or multiplicative
- calculating prior adjustments to be made to the series before seasonal adjustment. For example: temporary prior adjustments for outliers and level shifts; and permanent prior adjustments for trading days, Easter effects and seasonal breaks
- selecting the ARIMA forecasting model
- deciding the lengths of the seasonal and Henderson trend moving averages
- reviewing X-13ARIMA-SEATS diagnostics, both quantitative and visual
- plotting original and seasonally adjusted series

The first stage of a review is a "default" run where all the parameters choices (decomposition, ARIMA model, outliers, seasonal and trend moving averages) are made automatically by X-13ARIMA-SEATS. The outcome from the default run is then refined with the over-riding aim being to fit the simplest appropriate adjustment. The end result is then compared with the choices made in any previous review. A decision to alter previous recommendations or to introduce complications must be supported by evidence and reasonable argument.

This robust approach is taken to avoid uninformative revisions caused by minor changes to seasonal adjustment settings –changes that could easily revert back in the next review.

A detailed analysis for each series can be found later in sections 4.1 to 4.19, but first the time series as a group are described in a little more detail.

3. Time series data

There are 19 constant price series reviewed in this report, exactly matching those in the 2012 review. There were nine current price series reviewed, all were reviewed for the first time because there were no current price series reviewed in 2012.

Every time series is quarterly, starting in Q1 2000 and finishing in Q4 2012. The span of data used in the 2012 review was from Q1 2000 to Q3 2011. Thus there are five quarters of new data analysed in this review. Also, there have been some revisions to the data that were reviewed last time. The revisions were mostly in the last three quarters of data that were reviewed in 2012 (that is revisions to Q1 2011 – Q3 2011), but there were small revisions further back in time in some series. The revisions are shown in table 2.

The revisions are quite small, and have not much affected the choice seasonal adjustment parameters.

[1] Freely downloadable from US Census Bureau at http://www.census.gov/srd/www/x13as/

Table 2. Mean absolute revisions to constant price time series since the last review, shown for four different spans.

Mean Differences (p.p.)
NSA absolute levels

series	MEAN 2000Q1-2011Q3	MEAN 2008Q4-2011Q3	MEAN 2010Q4-2011Q3	2011Q3
anw	0.10	0.41	1.23	1.89
arm	0.07	0.29	0.87	1.54
aw	0.10	0.38	1.12	1.80
ih	0.19	0.75	2.21	4.23
ii	0.06	0.15	0.41	1.44
iow	0.07	0.23	0.61	0.20
nhpr	0.25	0.99	2.93	5.38
nhpu	0.06	0.25	0.75	1.43
onwi	0.05	0.18	0.54	0.77
onwp	0.11	0.43	1.28	2.15
onwpc	0.14	0.57	1.50	1.02
onwpi	0.30	1.19	2.63	2.44
rmhpr	0.03	0.10	0.30	0.34
rmhpu	0.45	1.76	5.29	12.08
rmowpr	0.16	0.63	1.90	2.65
rmowpu	0.13	0.50	1.49	0.33
rmowr	0.14	0.55	1.66	3.25
xpri	0.11	0.44	1.30	1.63
xpub	0.08	0.32	0.95	1.89

4. Analysis

There have been only minor changes to the recommendations for some of the series. The recommended seasonal adjustment is shown in table 3. There have been changes to the recommendations for five of the series: ONWP, ONWPI, RMHPR, RMOWPU, and RMOWR (shown in red in table 3, and described in sections 4.10, 4.12, 4.15, 4.17, and 4.18). This has resulted in revisions to these series right back to Q1 2000. The revisions are described later in section 5. We recommend applying whatever revisions policy NISRA has in place for these series, giving consideration to the ESS guidelines on revisions.

Table 3. The recommended seasonal adjustment parameters.

Name	Transform	Model	TMA*	SMA**	Regressors	Seasonal
ANW						N
ARM					ppp	Y
AW						N
IH	Log	(0 1 1)(0 1 1)	5	3x5		Y
II						N
IOW						N
NHPR	Log	(0 1 1)(0 1 1)	5	3x5		Y
NHPU						N
ONWI						N
ONWP	Log	(0 1 1)(0 1 1)	5	3x5	sb2003.1 Easter[15]	Y
ONWPC	Log	(0 1 1)(0 1 1)	5	3x5	sb2008.2 Easter[15]	Y
ONWPI	Log	(0 1 1)(0 1 1)	5	3x5	sb2006.2	Y
RMHPR	None	(0 1 1)(0 1 1)	5	3x5	sb2008.1 ao2005.1	Y
RMOWPR						N
RMOWPU	Log	(0 1 2)(0 1 1)	5	3x5	sb2008.1 Easter[15]	Y
RMOWR	Log	(0 1 1)(0 1 1)	5	3x9	sb2003.4 ao 2000.3 ao2001.2	Y
RMHPU					ppp	Y
Xpri	Log	(0 1 1)(0 1 1)	5	3x5	Easter[15]	N
Xpub	Log	(0 1 1)(0 1 1)	5	3x5		N

*TMA(Trend Moving Average) = Length of the Henderson Filter
**SMA(Seasonal Moving Average) = Order of seasonal moving average

4.1 All new work (ANW)

It is recommended to not seasonally adjust this series because there is no evidence that it is seasonal. This is the same as the recommendation in the last review.

4.2 All repair and maintenance (ARM)

It is recommended to apply a permanent adjustment for this series to adjust for seasonality in the early part of the series. The later part of the series is not seasonal and should not be seasonally adjusted. This is the same as the recommendation in the last review.

4.3 All work (AW)

It is recommended to not seasonally adjust this series, there is no evidence that it is seasonal. This is the same as the recommendation in the last review.

4.4 Index of housing (IH)

The recommendation is to seasonally adjust this series, the parameters remain the same as those recommended in the 2012 review.

4.5 Index of infrastructure (II)

The recommendation is to not seasonally adjust this series. This is the same as the recommendation in the 2012 review.

There may be some weak seasonality emerging in recent years. However the evidence is not strong enough to begin seasonally adjusting the series.

4.6 Index of other work (IOW)

The recommendation is to not seasonally adjust this series. This is the same as the recommendation in the 2012 review.

There may be some weak seasonality emerging in recent years. However the evidence is not strong enough to begin seasonally adjusting the series.

4.7 New housing: private (NHPR)

The recommendation is to seasonally adjust this series, using the same parameters that were recommended in the 2012 review.

4.8 New housing: public (NHPU)

The recommendation is to not seasonally adjust this series. This is the same as the recommendation in the 2012 review.

There appears to be weak seasonality in this series, with a suggestion of a seasonal break in 2008. The seasonal break was tested for but was found not to be significant. The series is so volatile that there would be little benefit from seasonally adjusting.

4.9 Other new work: infrastructure (ONWI)

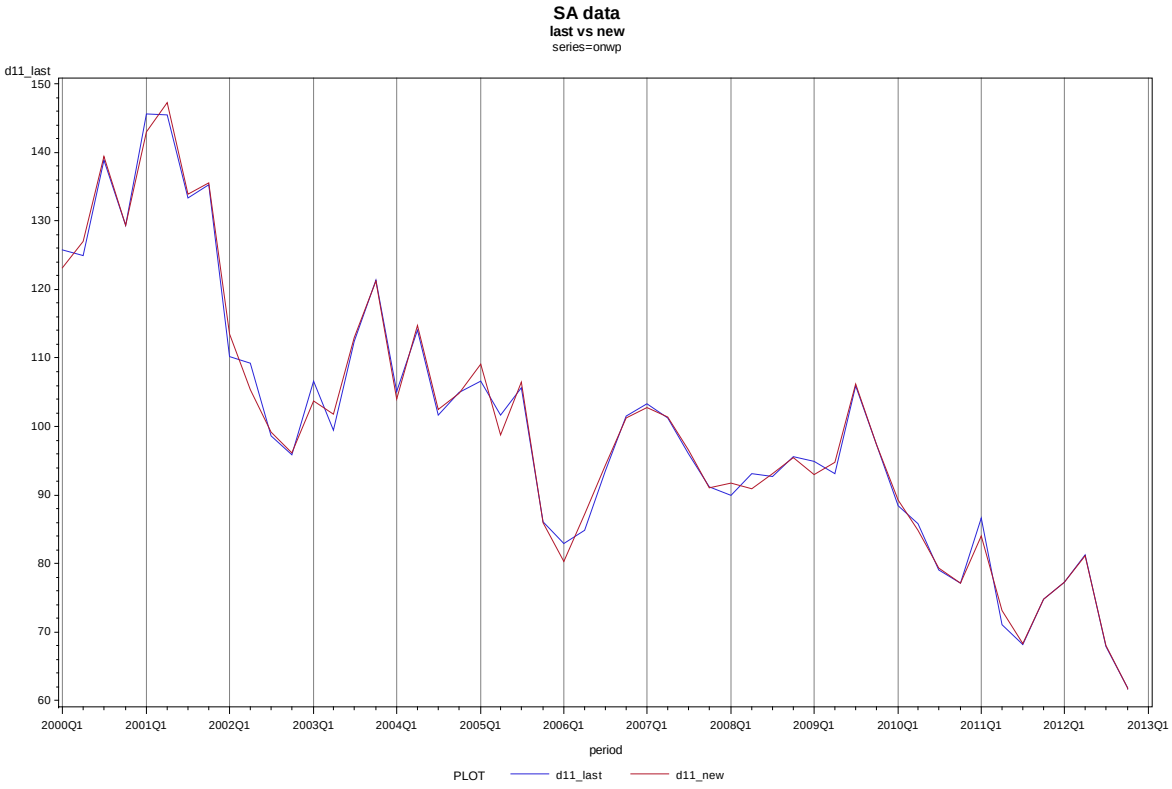
The recommendation is to not seasonally adjust this series, the same recommendation was made in the 2012 review.

4.10 Other new work: public (ONWP)

The recommendation is to seasonally adjust this series. The parameters are the same as those recommended in the 2012 review, except for the addition of a regressor to account for Easter.

The revisions caused by this change to the recommendations are illustrated in figure 1. The seasonally adjusted series (called ‘d11_last’) using the parameters in the last review is plotted together with the seasonally adjusted series (called ‘d11_new’) using the new recommended parameters.

Figure 1 – Comparison of the last and new seasonal adjustments for other new work: public (ONWP)



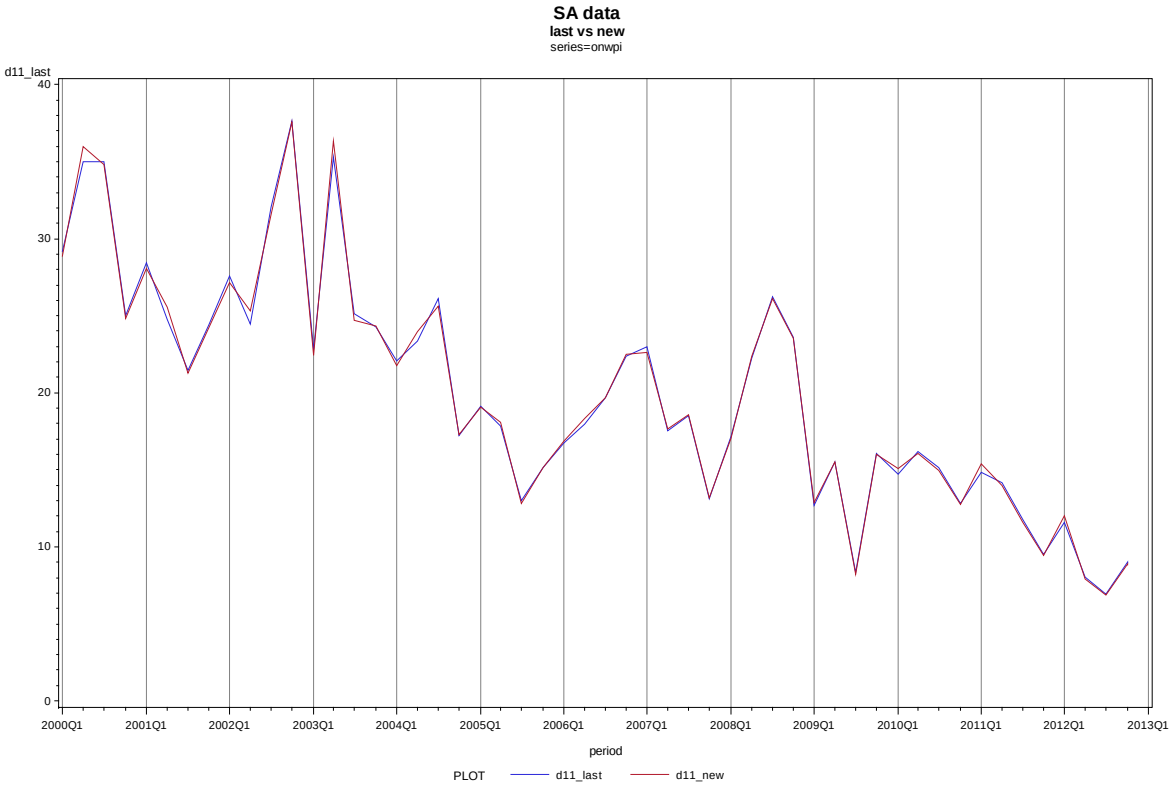
4.11 Other new work: private commercial (ONWPC)

The recommendation is to seasonally adjust this series, with the same parameters as those recommended in 2012.

4.12 Other new work: private industrial (ONWPI)

The recommendation is to seasonally adjust this series, with a change to one of the parameters used the 2012 review. The additive outlier recommended in the last review has been removed, because it is not significant.

Figure 2 – Comparison of the last and new seasonal adjustments for other new work: private industrial (ONWPI)



4.13 All work: private (PRI)

The recommendation is to seasonally adjust this series, with the same parameters used the 2012 review. The Easter regressor was not quite significant but it has been left in because it was found to be beneficial, as noted in the last review.

4.14 All work: public (PUB)

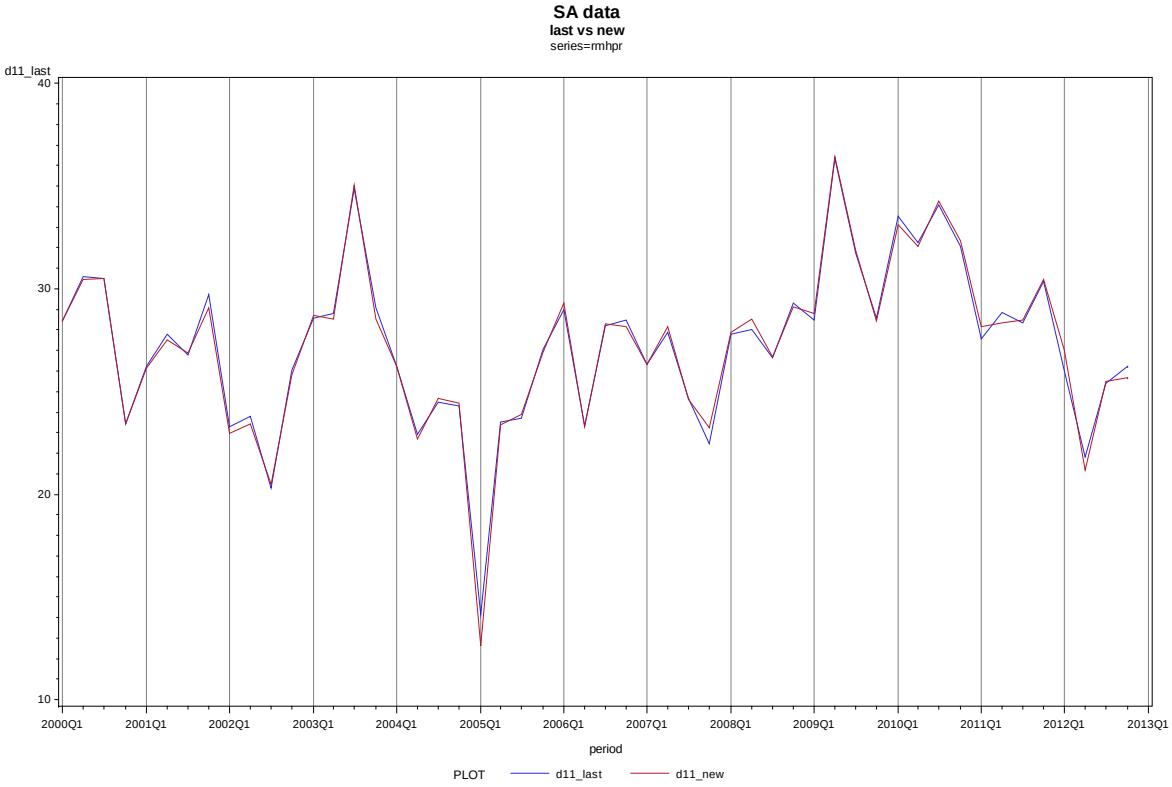
The recommendation is to seasonally adjust this series, with the same parameters used the 2012 review.

4.15 Repair and maintenance – housing: private (RMHPR)

The recommendation is to seasonally adjust this series one change to the parameters recommended in the 2012 review.

It is recommended to alter the specification recommended in the last review by simplifying the ARIMA model to the airline model. This will likely result in an improved adjustment by reducing the number of parameters needed to be estimated with each quarter of new data.

Figure 3 – Comparison of the last and new seasonal adjustments for repair and maintenance – housing: private (RMHPR)



4.16 Repair and maintenance – other work: private (RMOWPR)

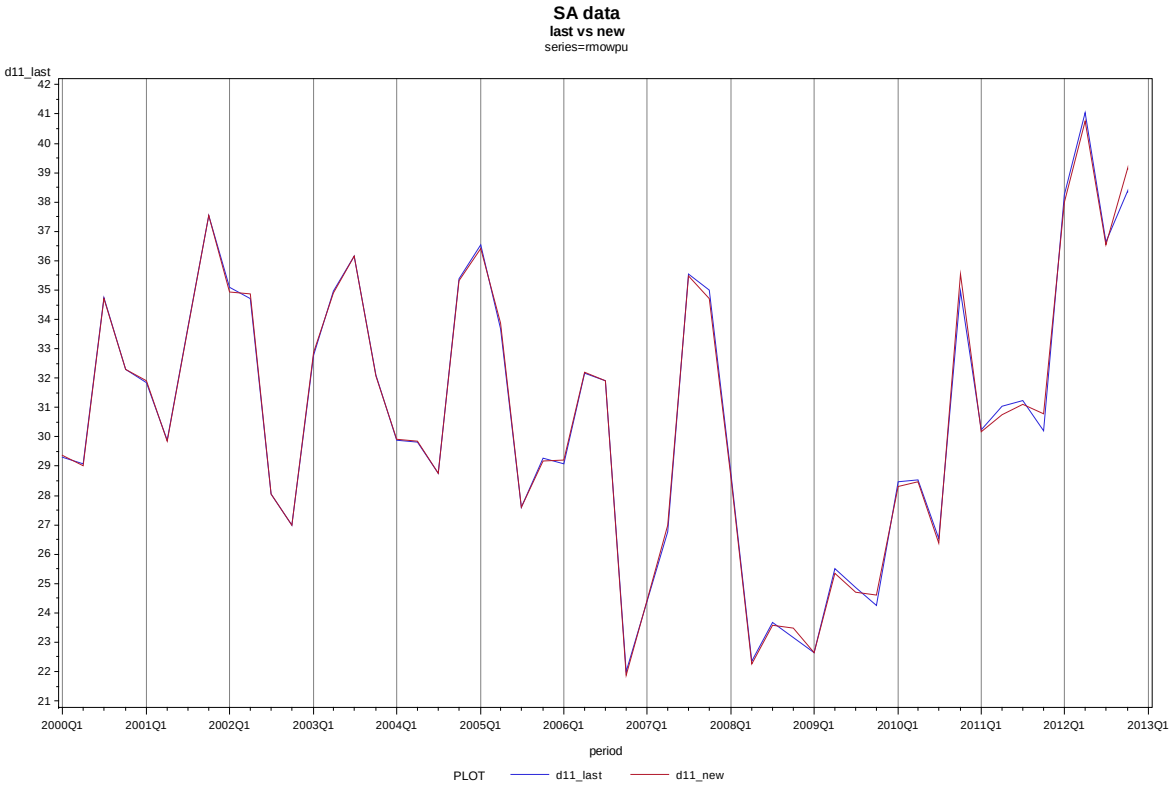
The recommendation is to not seasonally adjust this series, this is the same as the recommendation in the last review.

4.17 Repair and maintenance – other work: public (RMOWPU)

The recommendation is to seasonally adjust this series, with the same parameters recommended in the 2012 review except a change to the ARIMA model.

The recommendation is to use a slightly more complicated model, this significantly improves the quality of the seasonal adjustment.

Figure 4 – Comparison of the last and new seasonal adjustments for repair and maintenance – other work: public (RMOWPU)

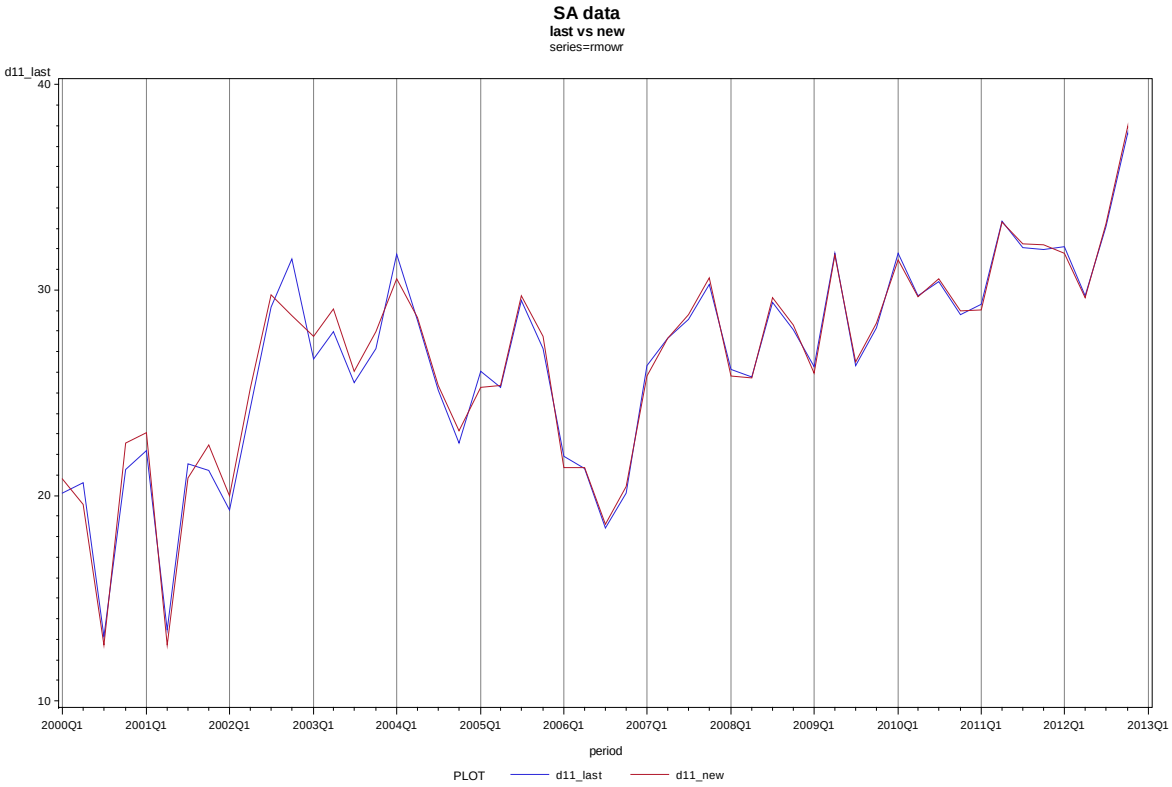


4.18 Repair and maintenance – other work: roads

The recommendation is to adjust this series using an altered specification.

The series has weak seasonality and the addition of new data has changed the assessment of this seasonality. The changes that have been made are to the position of the seasonal break. This has moved from Q12002 to Q32003, resulting in an improved adjustment prior to the break. The revisions to the most recent end of the series are small.

Figure 5 - Comparison of the last and new seasonal adjustments for repair and maintenance – other work: roads (RMOWR)



4.19 Repair and maintenance – housing: public

The recommendation is to adjust this series using a permanent prior, this is identical to the recommendation in the 2012 review.

5. Revisions

Revisions have been caused by the changes to the data for each series, and to the specifications for five series. The revisions are generally very small and are summarised in tables 2, and 4 to 8. All revisions are shown in percentage points.

The first three tables (2, 4, and 5) show mean absolute revisions to the data over the span 2000 to Q3 2011. The last three tables (6 to 8) show mean absolute revisions to the seasonally adjusted estimates for the span 2000 to Q4 2012, including the effect of data revisions and changes to the specifications.

The first of each set of three tables shows revisions for levels, the second for quarter on quarter growth rates, and the last of each trio shows revisions to annual growth rates.

Table 4. Mean absolute revisions to constant price time series since the last review, shown for four different spans, revisions to quarter on quarter growth rates

Mean Differences (p.p.)
NSA absolute Q on Q growths

series	MEAN 2000Q2-2011Q3	MEAN 2008Q4-2011Q3	MEAN 2010Q4-2011Q3	2011Q3
anw	0.04	0.16	0.47	0.36
arm	0.07	0.29	0.86	1.08
aw	0.05	0.18	0.54	0.56
ih	0.09	0.34	1.00	1.61
ii	0.07	0.16	0.42	1.59
iow	0.10	0.31	0.83	0.86
nhpr	0.11	0.41	1.19	1.33
nhpu	0.10	0.36	1.09	1.18
onwi	0.06	0.21	0.63	1.86
onwp	0.09	0.33	0.99	0.95
onwpc	0.20	0.75	2.03	3.11
onwpi	0.54	2.08	5.14	4.94
rmhpr	0.04	0.16	0.49	0.35
rmhpu	0.31	1.18	3.55	9.25
rmowpr	0.17	0.64	1.91	2.28
rmowpu	0.15	0.58	1.75	3.46
rmowr	0.08	0.30	0.91	1.50
xpri	0.04	0.15	0.42	0.11
xpub	0.05	0.21	0.63	1.08

Table 5. Mean absolute revisions to constant price time series since the last review, shown for four different spans, revisions to year on year growth rates

Mean Differences (p.p.)
NSA absolute annual growths

series	MEAN 2001Q1-2011Q3	MEAN 2008Q4-2011Q3	MEAN 2010Q4-2011Q3	2011Q3
anw	0.09	0.34	1.01	1.55
arm	0.09	0.31	0.92	1.71
aw	0.09	0.33	0.99	1.60
ih	0.16	0.59	1.74	3.33
ii	0.07	0.14	0.39	1.36
iow	0.08	0.23	0.63	0.16
nhpr	0.18	0.64	1.87	3.25
nhpu	0.10	0.37	1.10	2.35
onwi	0.04	0.15	0.45	0.71
onwp	0.11	0.39	1.17	1.87
onwpc	0.17	0.59	1.55	1.45
onwpi	0.35	1.25	2.17	0.95
rmhpr	0.02	0.08	0.25	0.29
rmhpu	0.45	1.61	4.82	12.77
rmowpr	0.26	0.95	2.84	4.00
rmowpu	0.15	0.55	1.64	0.38
rmowr	0.16	0.59	1.77	3.55
xpri	0.10	0.36	1.08	1.31
xpub	0.09	0.30	0.91	1.88

Table 6. Mean absolute revisions to seasonally adjusted time series since the last review, shown for four different spans.

Mean Differences (p.p.)
SA absolute levels

series	MEAN 2000Q1-2012Q4	MEAN 2010Q1-2012Q4	MEAN 2012Q1-2012Q4	2012Q4
anw	0.00	0.00	0.00	0.00
arm	0.00	0.00	0.00	0.00
aw	0.00	0.00	0.00	0.00
ih	0.06	0.20	0.28	0.07
ii	0.00	0.00	0.00	0.00
iow	0.00	0.00	0.00	0.00
nhpr	0.26	0.80	0.95	1.10
nhpu	0.00	0.00	0.00	0.00
onwi	0.00	0.00	0.00	0.00
onwp	1.09	0.78	0.16	0.00
onwpc	0.10	0.33	0.46	0.99
onwpi	1.25	1.67	1.91	0.89
rmhpr	1.11	1.42	2.27	1.99
rmhpu	0.00	0.00	0.00	0.00
rmowpr	0.00	0.00	0.00	0.00
rmowpu	0.44	0.83	0.91	2.04
rmowr	2.00	0.62	0.62	0.80
xpri	0.05	0.19	0.29	0.15
xpub	0.02	0.06	0.09	0.15

Table 7. Mean absolute revisions to seasonally adjusted time series since the last review, shown for four different spans, revisions to quarter on quarter growth rates

Mean Differences (p.p.)
SA absolute Q on Q growths

series	MEAN 2000Q2-2012Q4	MEAN 2010Q1-2012Q4	MEAN 2012Q1-2012Q4	2012Q4
anw	0.00	0.00	0.00	0.00
arm	0.00	0.00	0.00	0.00
aw	0.00	0.00	0.00	0.00
ih	0.09	0.31	0.43	0.24
ii	0.00	0.00	0.00	0.00
iow	0.00	0.00	0.00	0.00
nhpr	0.37	1.01	1.07	0.13
nhpu	0.00	0.00	0.00	0.00
onwi	0.00	0.00	0.00	0.00
onwp	1.96	1.42	0.28	0.31
onwpc	0.13	0.40	0.56	1.27
onwpi	2.12	2.36	2.48	0.49
rmhpr	1.93	2.12	3.69	2.44
rmhpu	0.00	0.00	0.00	0.00
rmowpr	0.00	0.00	0.00	0.00
rmowpu	0.69	1.39	1.51	2.33
rmowr	2.68	0.91	0.89	0.34
xpri	0.06	0.23	0.36	0.06
xpub	0.03	0.10	0.17	0.22

Table 8. Mean absolute revisions to seasonally adjusted time series since the last review, shown for four different spans, revisions to year on year growth rates

Mean Differences (p.p.)
SA absolute annual growths

series	MEAN 2001Q1-2012Q4	MEAN 2010Q1-2012Q4	MEAN 2012Q1-2012Q4	2012Q4
anw	0.00	0.00	0.00	0.00
arm	0.00	0.00	0.00	0.00
aw	0.00	0.00	0.00	0.00
ih	0.02	0.06	0.08	0.05
ii	0.00	0.00	0.00	0.00
iow	0.00	0.00	0.00	0.00
nhpr	0.08	0.17	0.15	0.31
nhpu	0.00	0.00	0.00	0.00
onwi	0.00	0.00	0.00	0.00
onwp	1.64	1.62	1.63	0.02
onwpc	0.03	0.09	0.13	0.32
onwpi	0.56	0.48	0.17	0.33
rmhpr	1.67	1.18	1.09	1.96
rmhpu	0.00	0.00	0.00	0.00
rmowpr	0.00	0.00	0.00	0.00
rmowpu	0.34	0.36	0.39	0.21
rmowr	1.65	0.04	0.01	0.00
xpri	0.02	0.07	0.09	0.04
xpub	0.01	0.03	0.05	0.05

Revisions are an inevitable part of the seasonal adjustment process. It is recommended to revise the seasonal adjustment parameters (as done above) when there are revisions to the unadjusted estimates over more than two years and to inform users of the revisions. Where revisions occur due to additional data at the current end of the time series parameters do not need to be revised but revisions are expected to the seasonally adjusted estimate and should ideally be made to the past three years of the seasonally adjusted estimates. Revisions to the seasonally adjusted estimates should be made in accordance with NISRA's published policy on revisions for this dataset. Revisions policies for seasonally adjusted estimates should be informed by the ESS Guidelines on Seasonal Adjustment.(See box.) Users should be informed of the revisions policy.

Box A: European Guidelines on Revisions

Below are sections of the ESS Guidelines on Seasonal adjustment referring to revisions of seasonally adjusted estimates. The preferred approach under each heading is given.

General revisions policy
A) Revisions to seasonally adjusted data are published in accordance with a coherent, transparent and officially published revision policy and release calendar, that is aligned with the revision policy and the revision calendar for the unadjusted data. Revisions to the seasonally adjusted data should not be released more often than releases of the raw /unadjusted data. The public are informed about the average revisions of important seasonally adjusted macroeconomic variables which have been observed in the past.

Horizon for published revisions
A) The revision period for the seasonally adjusted data must at least cover the extent of the raw data revision period. Due to the property of filters, it is normally acceptable to revise the seasonally adjusted data from a point 3-4 years before the beginning of the revision period of the unadjusted data; earlier data should be frozen.

6. Current price series

There are some large differences between the current price series and the constant price series. See for example the difference for the series all repair and maintenance (ARM) shown in figure 6. In all cases however the differences are almost entirely differences in trend. This is illustrated in figure 7 for ARM, the plot compares quarter on quarter growth rates for the current price and constant price series.

Figure 6 – levels for All repair and maintenance, current prices (blue and labelled cp) and constant prices (red and labelled
cvm)

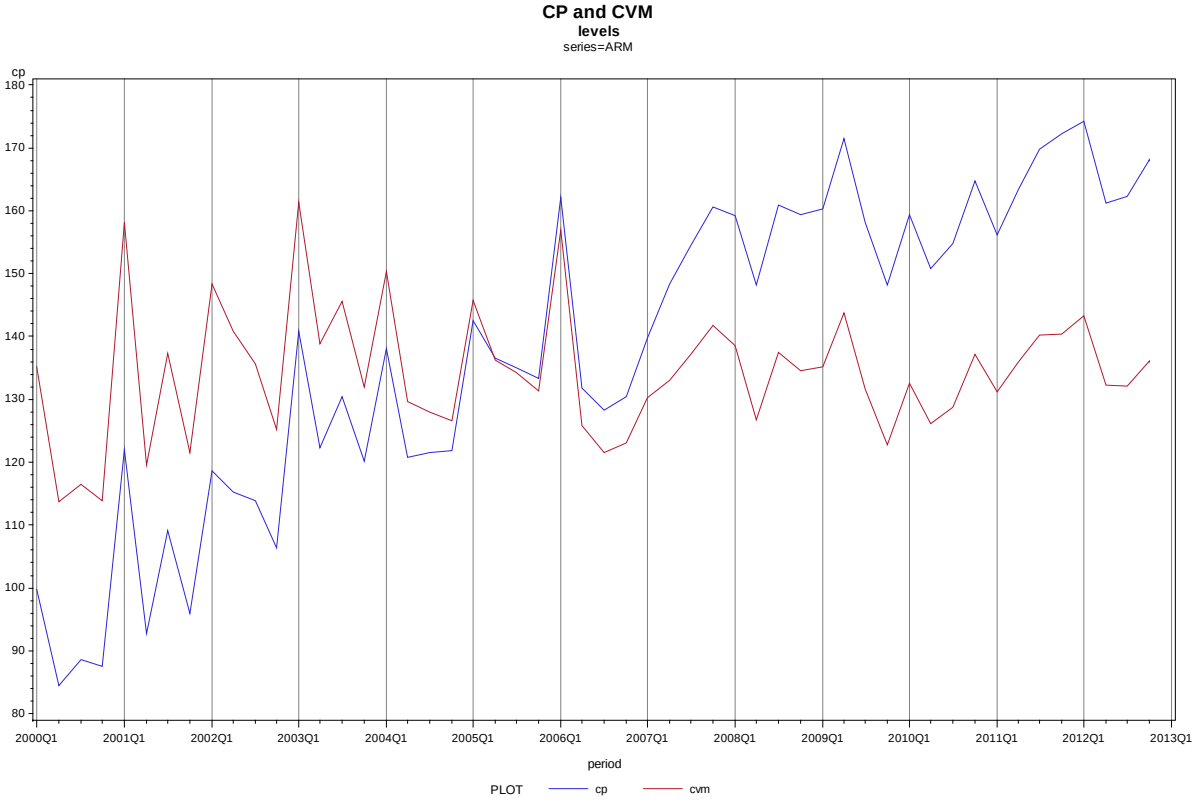
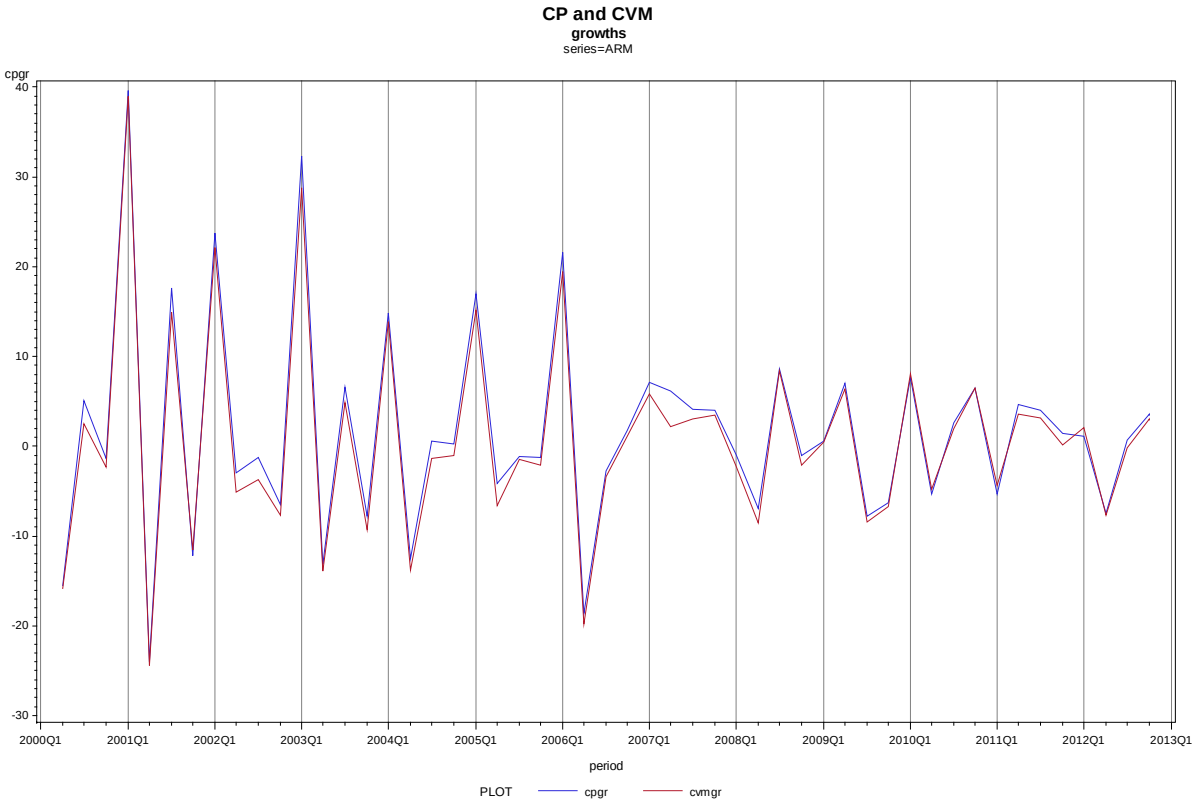


Figure 7 – quarter on quarter growths in percentage points for All repair and maintenance, current prices (blue and labelled cp) and constant prices (red and labelled cvm)



The differences in levels have no effect on seasonal adjustment – so all of the current price and constant price series are practically identical as far as seasonal adjustment is concerned.

This was tested by comparing a default run of X-13ARIMA-SEATS on each current price series to the specifications recommended for the constant price series. In all cases the results were very similar.

Each current price series should be seasonally adjusted using the same specification file as the corresponding constant price series. This has the added benefit that it aids interpretation, because differences between the seasonally adjusted constant and current price series will not be due to differences in the specification files. It will also tend to produce better estimates for the implied deflators.

7. Recommendations

a) The seasonal series should be adjusted according to the parameters specified in Table 3. The specification files, and associated files, provided should be used for this purpose.
b) All of the series should be run using a single command by calling the program with the data meta file as input. The data meta file has been supplied – it is called *construction.mta*

c) Non-seasonal series will not be seasonally adjusted – if they were then artificial distortions might be introduced that would make interpretation of movements more difficult. The specification files for the non-seasonal series are designed to output a seasonally adjusted series that is identical to the input series. *The user should run these specification files along with those for the seasonal series – this provides a record of what has been done for every series*. The data meta file will do this automatically.
d) The current price series should be seasonally adjusted using the same spec files as the corresponding constant price series. These have been provided.
e) Seasonal adjustment models and parameters should be reviewed annually. The starting point for subsequent reviews should be the current parameter settings.
f) Revisions should be dealt with by applying whatever revisions policy NISRA has in place for the seasonally adjusted series. Revisions to the seasonally adjusted estimates should be made in accordance with NISRA's published policy on revisions for this dataset. Revisions policies for seasonally adjusted estimates should be informed by the ESS Guidelines on Seasonal Adjustment.(See box. in section 5)

Reference

ESS guidelines on seasonal adjustment: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-006/EN/KS-RA-09-006-EN.PDF