

Generating Reports From X-13ARIMA-SEATS Diagnostic Output, A Beginning

Kathy McDonald-Johnson

U.S. Census Bureau

Economic Statistical Methods Division

1st Seasonal Adjustment Practitioners' Workshop

2016-November-4

Outline

- Motivation
- Context
- Template approach
- Finding the information
 - Anticipation of surprises
- Pulling it together

Motivation

- I was looking for a way to create a report to document RegARIMA model selection (and changes from the previous model)
 - Outlier changes, particularly within a certain subspan
 - Also, note significance of trading day, length-of-month
 - Summarize some information like model span choice
 - *Flexible, adaptable to many situations*

Context

- General: Documenting research and evaluations
 - We often document suggestions for changes to any aspects of a seasonal adjustment
- Specific: Report on analysis of state-level Supplemental Nutrition Assistance Program (SNAP) time series for outlier and intervention effects, documenting regARIMA model changes

SNAP, Formerly Food Stamps

- Monthly counts of SNAP recipients
 - 51 series, stock
- Project includes modeling for outlier and intervention analysis
 - No seasonal adjustment
- Resulting outlier- and intervention-adjusted series are input for other models
 - Small Area Income and Poverty Estimation (SAIPE) can include SNAP 12-month average

Interventions

- Following a disaster, more people might be eligible for assistance
 - Disaster relief = D-SNAP issuance
- We use X-13ARIMA-SEATS automatic outlier identification over the model span
 - Critical value of t statistic depends on model span
- We add intervention effects for D-SNAP events that X-13A-S does not identify, if significant
 - Additive outliers (AO), $|t \text{ statistic}| \geq 2$

Final Report

- Focuses on new outliers/interventions in the 12-month subspan that is relevant for SAIPE
- Includes graphs of each series
- Provides a brief description of the review of each series
 - Informal notes, usually

Date September 9, 2016

Memorandum for the Record

From Kathleen McDonald-Johnson, Chief
Mary Choi, Mathematical Statistician
Time Series and Related Methods Staff
Economic Statistical Methods Division

Subject 2016 Supplemental Nutrition-Assistance Program (SNAP) Participant
Series Outlier and Intervention Adjustment

Introduction

This year we again reviewed the 51 state and District of Columbia Supplemental Nutrition Assistance Program (SNAP) time series for extreme effects that might interfere with the general series patterns. This year's review focused on 2014.Jul (July 2014) through 2015.Jun, the span that the Social, Economic, and Housing Statistics Division (SEHSD) has indicated will count toward Small Area Income and Poverty Estimates.

Fourteen series had outliers or intervention effects of some type, including level shifts in the span from 2014.Jul through the end of the series (2016.Jan), but only five series had additive outlier (AO) adjustments during the focus period, as shown in the table below.

Outlier/Intervention Adjustments in the Focus Span, in Alphabetical Order

	Series	Region	Division	Outlier/Intervention	t statistic
1	Hawaii (HI)	West	Pacific	AO2014.Aug	t=-5.17
2	North Carolina (NC)	South	South Atlantic	AO2014.Nov	t=-5.47

For every series, we modeled the stock length-of-month effect. For most series, this regressor is not significant, but for 11 series it was greater than 1.96 in absolute value; shown in the table below. Like the stock trading day effect, we did not adjust for this effect, but it was part of all models.

Series With Significant Length-of-Month Regressors, in Order by t Value

	t statistic	Series
1	4.49	Nevada
2	4.45	Washington
3	2.77	Idaho
4	2.59	Nebraska
5	2.35	Oklahoma
6	2.25	New Hampshire
7	2.10	Maryland
8	2.08	California
9	1.99	Wisconsin
10	-1.99	Arizona
11	-9.62	Oregon

The appendix contains graphs of the series; a full outlier/intervention comparison list from last year to this year is available.

Series Notes in Alphabetical Order Within Region/Division

49. Hawaii (HI)

Model span started: 1999.Jan

(3 1 0)(0 1 1) +stockLOM +stockTD[1] +10 outliers including 1 recent,
in focus span

AO2014.Aug $t=-5.17$

Some not-recent outliers changed; see notes below.

Outlier critical value=3.961

The model changed this year.

The model span changed to 1999.Jan from 1982.Jan.

The ARIMA model changed to (3 1 0)(0 1 1) from (5 1 0)(0 1 1).

Series notes:

For Hawaii, we have been using a model span starting at 1982. Because most of the outliers were in the 1980s and 1990s, we tried a new....

Template Approach

- Despite their usefulness, templates can be confusing for contributors
 - Confusion: Report template with space to show the current model and the new suggested model – some contributors entered the same model twice if they had no recommended changes
 - Preference: Show a suggested model only if it is different from the current model

Template Approach (cont'd)

- Templates might allow more variation than what you want in a consolidated report
 - Variation: Some contributors wrote outliers in a numeric format: AO2009.10, others in an alphabetical format: AO2009.Oct (some used a mixture)
 - Preference: Confine formatting to one style for the final report (could be a hybrid format: AO2009.10Oct, although this is not valid for spec file use)

Template Approach (cont'd)

- Variation: Some contributors showed models in different ways
- Preference: Display models in the report consistently

$(0 \ 1 \ 1)(0 \ 0 \ 0)$ vs. $(0 \ 1 \ 1)$

$(0, 1, 1)(0, 1, 1)$ vs. $(0 \ 1 \ 1)(0 \ 1 \ 1)$

$(0 \ 1 \ [1 \ 2 \])(0 \ 1 \ 1)$ vs. $(0 \ 1 \ 2)(0 \ 1 \ 1)$

$(0 \ 1 \ 1)1 \ (0 \ 1 \ 1)12$ vs. $(0 \ 1 \ 1)(0 \ 1 \ 1)$

Skeletal Template

IX. West: Pacific

47. Alaska (AK)

. . .

48. California (CA)

. . .

49. Hawaii (HI)

Model span started: 1999.Jan

(3 1 0)(0 1 1) +stockLOM +stockTD[1] +10 outliers including 1 recent,
in focus span

A02014.Aug t=-5.17

Some not-recent outliers changed; see notes below.

Outlier critical value=3.961

The model changed this year.

The model span changed to 1999.Jan from 1982.Jan.

The ARIMA model changed to (3 1 0)(0 1 1) from (5 1 0)(0 1 1).

Series notes:

Location of the Information

Need saved information from last year

- Nearly all of the information for the final report is in the .udg files
 - Model parameters, coefficients, diagnostics
 - *Seasonal filters, diagnostics*
- Additional information comes from comparing the original series
- Graphs

Diagnostics File (*.udg)

- Text file
- Colon-delimited
 - Keyword: Value** (text or numeric)
 - Subdivided with dollar signs
 - Keyword\$Key2: Value**
- Varying line lengths
- Keywords can become variable names with use of SAS[®] Proc Transpose
 - Some renaming required

Layout of the Diagnostics File

```
. . .  
AutoOutlier$LS2006.Aug: +0.315192234354138E-01 ...  
AutoOutlier$A02008.Nov: -0.665071045004301E-01 ...  
AutoOutlier$A02014.Aug: -0.215914020330288E-01 ...  
nregderived: 1  
Stock Trading Day[1]$Sun: +0.564966358587320E-03 ...  
chi$Stock Trading Day[1]: 6 ...  
chi$Combined Trading Day and Length of Month ...  
. . .
```

Compare Values

- Anticipate surprises: X-13ARIMA-SEATS allows some flexibility, look for values that might require standardizing
 - Outliers
 - ARIMA models
 - If treat as a character string, allow sufficient length
 - Can reinforce with checks on coefficients
 - Even if it is the same as last year, it might look different because it might have gone through several iterations

Compare Values (cont'd)

- Anticipate the typical
 - Same model but different model span
 - Differing outliers in the earliest part of the series

Pulling It Together

- Still working on it



- Currently separate pieces of code
 - Compare the original series
 - Compare and summarize models and diagnostics
 - Create table of all outliers/interventions, but this is not part of the body of the report
 - Graph the original and outlier-adjusted series
 - X-13-Graph

Pulling It Together (cont'd)

- Much of the introductory text requires a summary and overall description of this year's findings
 - Less automation
 - General template
- Not yet using SAS/ODS®

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

Disclaimer

Any views expressed are those of the author and not necessarily those of the U.S. Census Bureau.

Contact

kathleen.m.mcdonald.johnson@census.gov