

An Introduction to Weekly Seasonal Adjustment

Thomas Evans

Statistical Methods Staff
November 4, 2016



Outline

- Background
- Why does weekly seasonal adjustment require a special program?
- Example of Unemployment Insurance claims series using our “MoveReg” program
- Comparison with a state-space approach
- Variances

Background

- Standard seasonal adjustment programs such as X-12-ARIMA, X-13ARIMA-SEATS, and TRAMO/SEATS are for monthly and quarterly data.
- These programs assume constant periodicity of the data.

Background

- Pierce, Grupe, and Cleveland (1984) offer deterministic and stochastic approaches to weekly seasonally adjustment using fixed regression with ARIMA errors. The key is allowing the seasonal component to adapt for leap years.
- Cleveland (1986) implements the above method with deterministic seasonal factors

Background

- Cleveland (1993) expands on the earlier approach by adding locally weighted regressions by year to allow for moving seasonal factors. BLS improved this program and call it “MoveReg.” A SAS interface was also added.
- Harvey, Koopman, and Riani (1997) propose a structural time series method with splines

Background

- BLS uses a modified version of Cleveland's program to seasonally adjust weekly initial claims and continued claims from the Unemployment Insurance program
- Who officially uses this program?
BLS, Federal Reserve, and the Bank of Canada

Why do we need a special program?

- Gregorian calendar has a 400-year cycle
- 97 leap years
- 329 52-week years
71 53-week years
- 53-week years occur every 5.634 years on average, ranging from 5-7 years apart

X-13ARIMA-SEATS wasn't designed for this

Why do we need a special program?

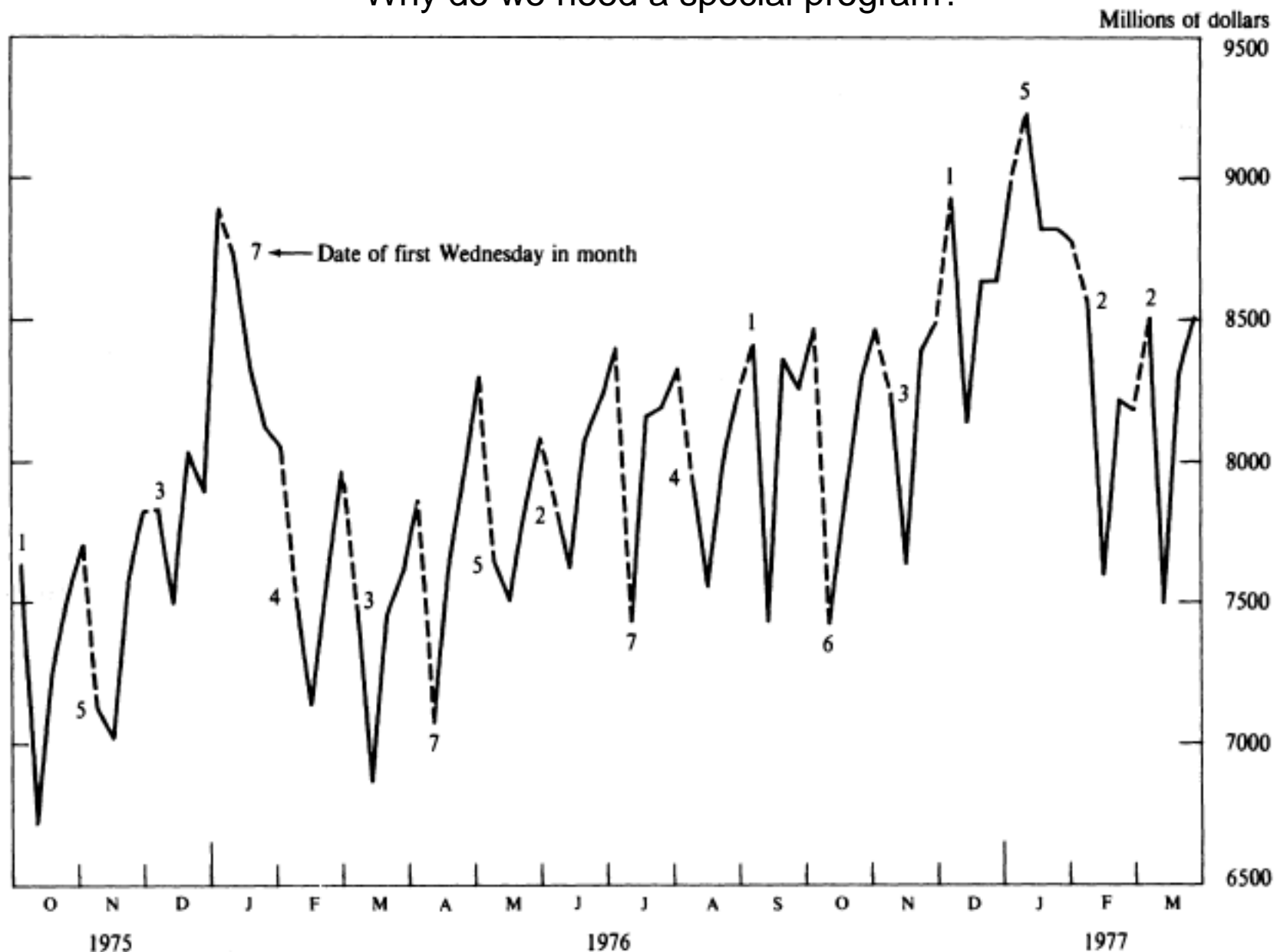


Figure 1. Weekly Average Member Bank Vault Cash for October 1, 1975–March 30, 1977.

Source: Pierce, Grupe, and Cleveland (1984)

Example

- BLS seasonally adjusts two unemployment insurance series for the Employment and Training Administration (Department of Labor) utilizing the MoveReg program: Initial Claims and Continued Claims
- Initial Claims is used here as an example

Example

- Some holidays are hard to specify with weekly data. They can move from one week to another.
- Holidays based on the lunar calendar can move across months
- Unlike many monthly series, weekly series can be affected by all holidays
- Some holidays may need special weighting, such as New Year's and Easter

Example

- Which settings do you have to determine in order to run the program?
 - 1) AR coefficient
 - 2) Variance ratio (signal-to noise-ratio)
 - 3) Number of terms in trig seasonal for annual effects ($2 \times$ number of frequencies)
 - 4) Holidays and their weights
 - 5) Outliers (AO and LS)
- See Cleveland and Scott (2006) for details

Example

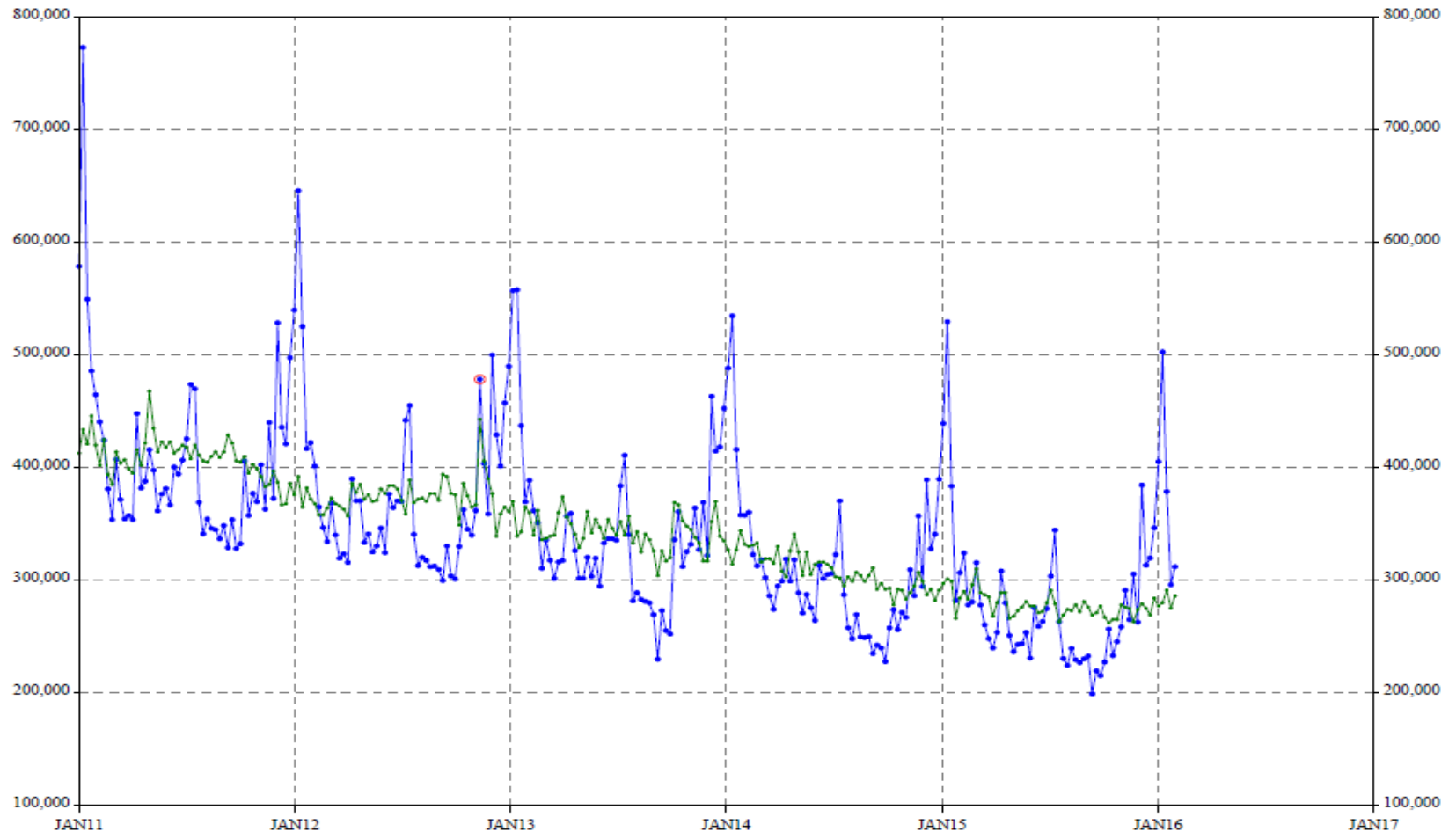
- There are 12 built-in holiday variables. We use 10.
- We also model July 4th on Wednesday, Xmas on Friday, and Xmas in week 53
- The data series starts in 1988
- Projected factors are used for the current year (but concurrent factors would be better)
- There are numerous diagnostics

Example

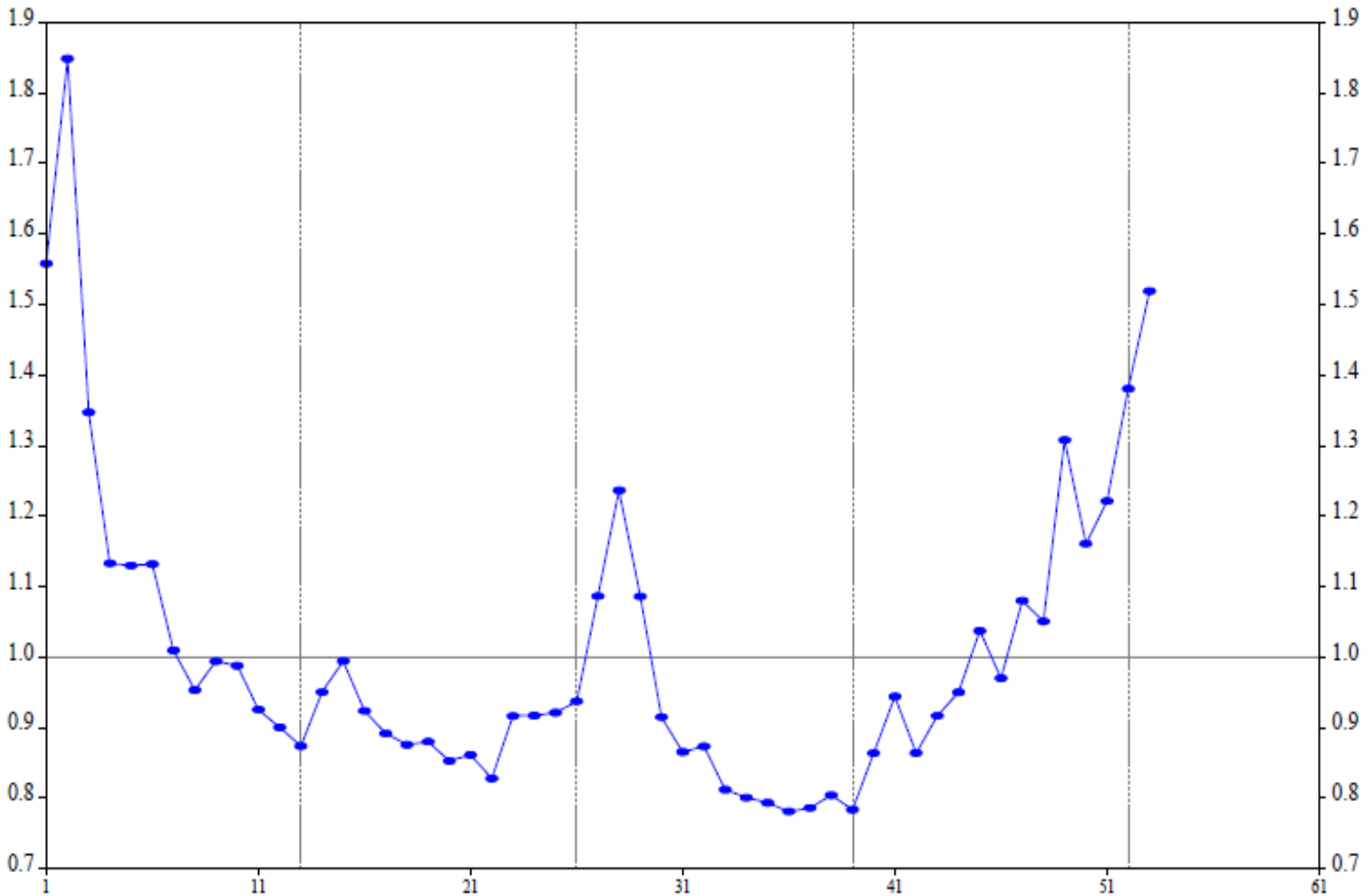
- Outliers can be hard to identify. There is no automatic outlier detection routine like that in X-13.
- We test AOs individually or in strings. We use a string of AOs for Hurricane Katrina and 9-11 which are like temporary LSs but variable.

Initial Claims

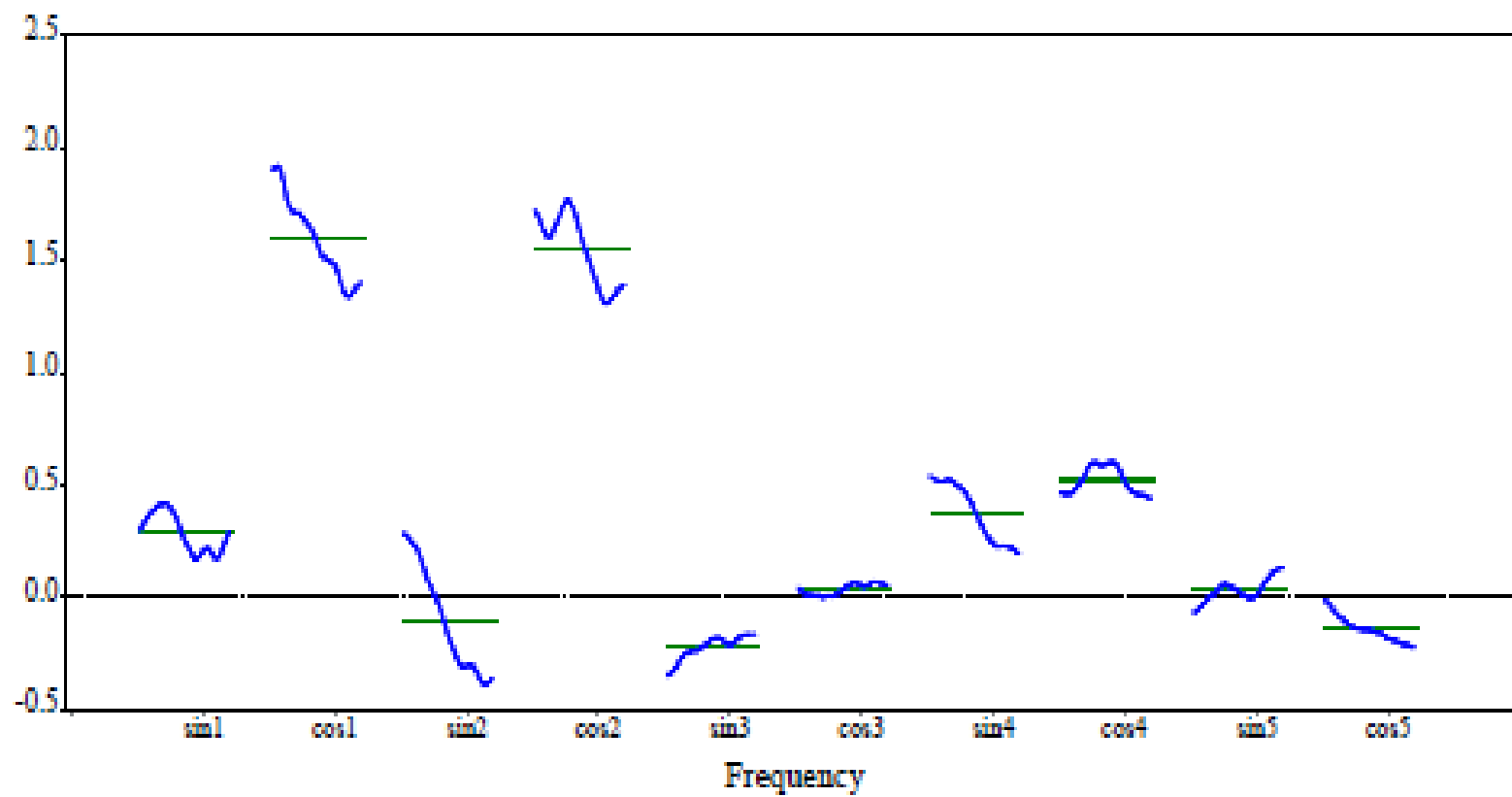
Unadjusted vs SA



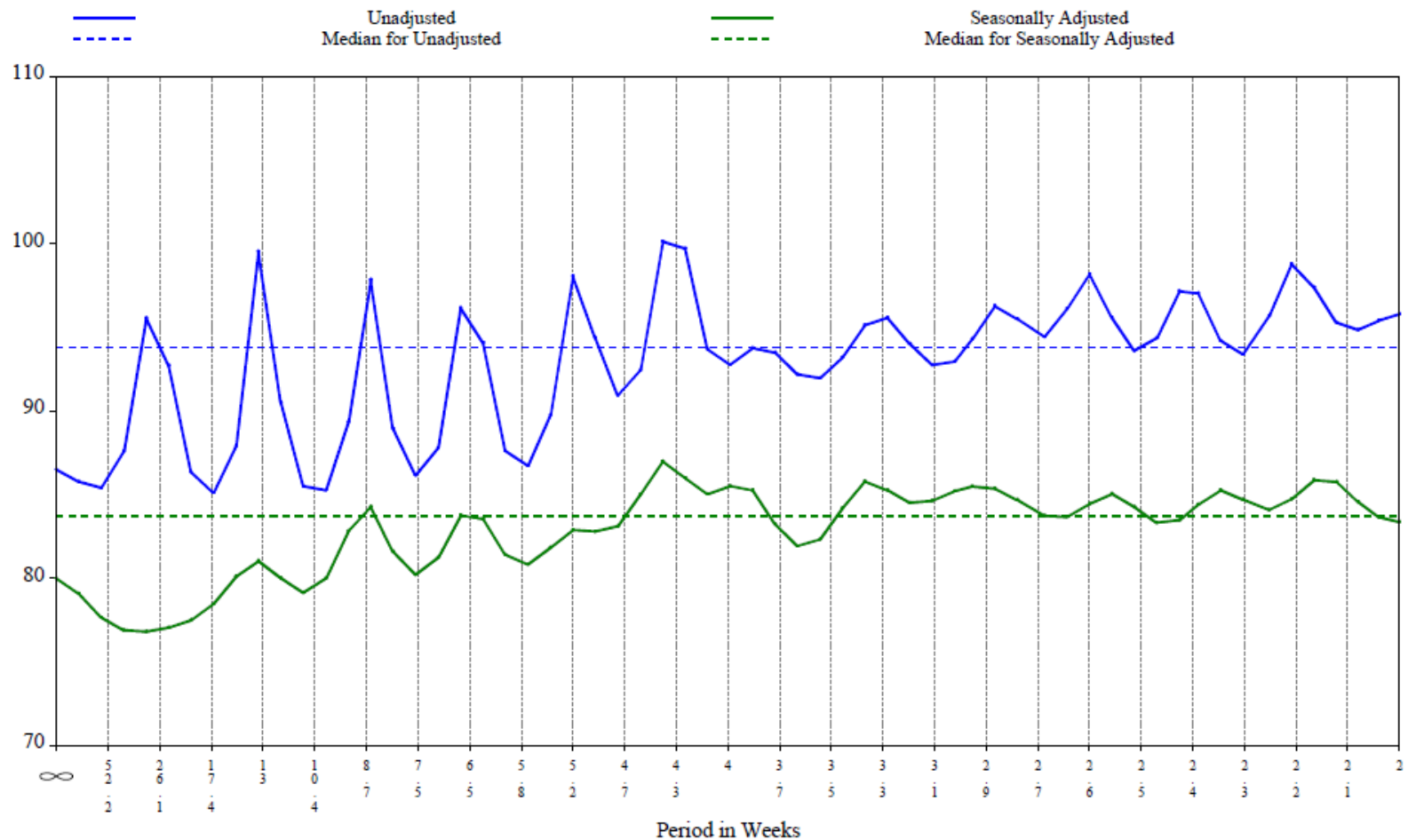
Average Seasonal Factors by Week



Trig-Subplots



Spectrum



State-Space Approach

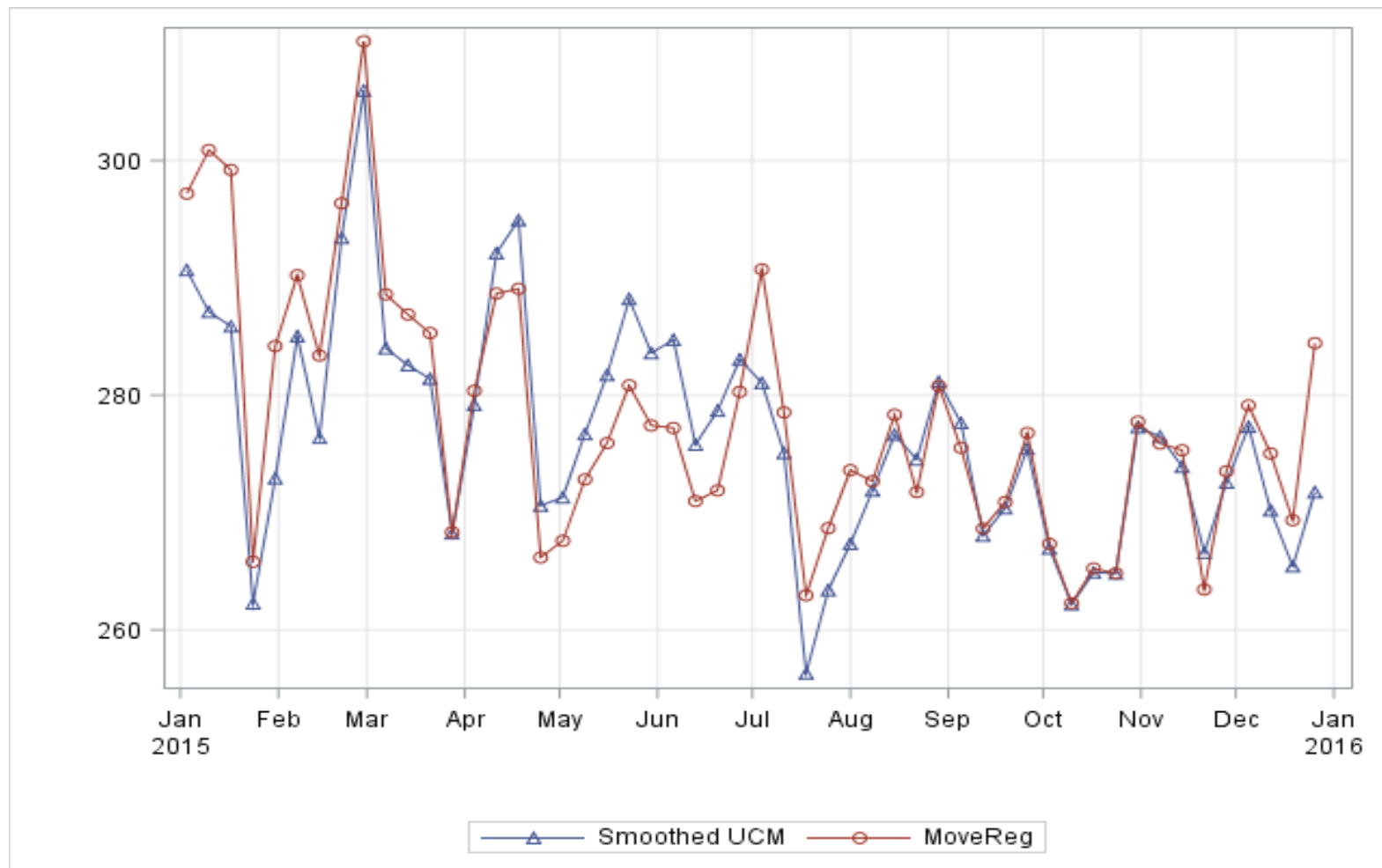
- Proc UCM (Selukar 2011) in SAS is similar to that described in Harvey, et al. (1997)
- There are some advantages over the regression method in MoveReg
- MoveReg only directly estimates the seasonal component—not trend and irregular

State-Space Approach

- Holidays can be estimated as stochastic components
- The seasonal and holiday components can also be fit with splines
- Proc UCM has outlier detection for AOs and LSs
- A disadvantage to Proc UCM is that it was not written primarily for seasonal adjustment

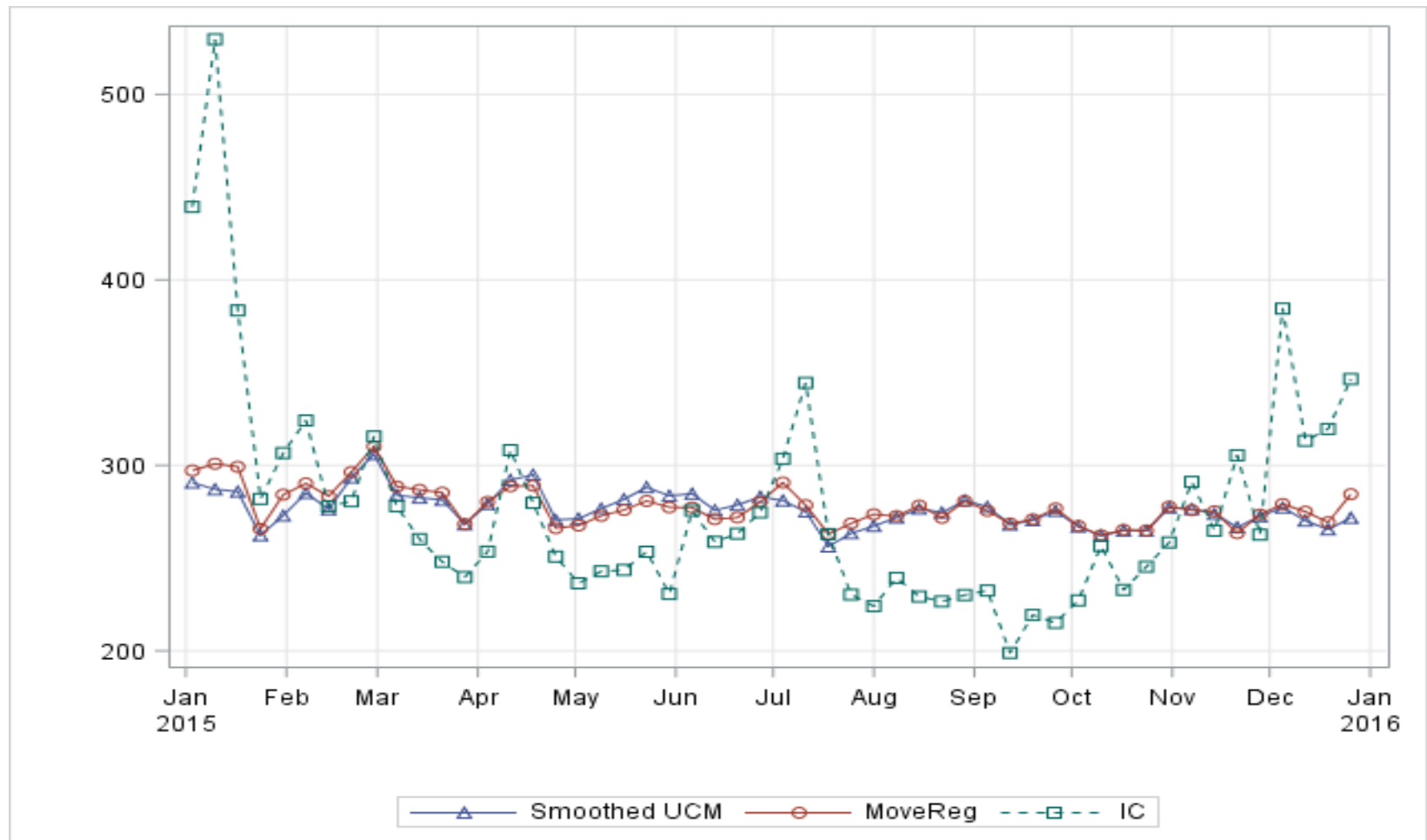
UCM vs MoveReg

UCM has Stochastic Holiday Effects



UCM vs MoveReg

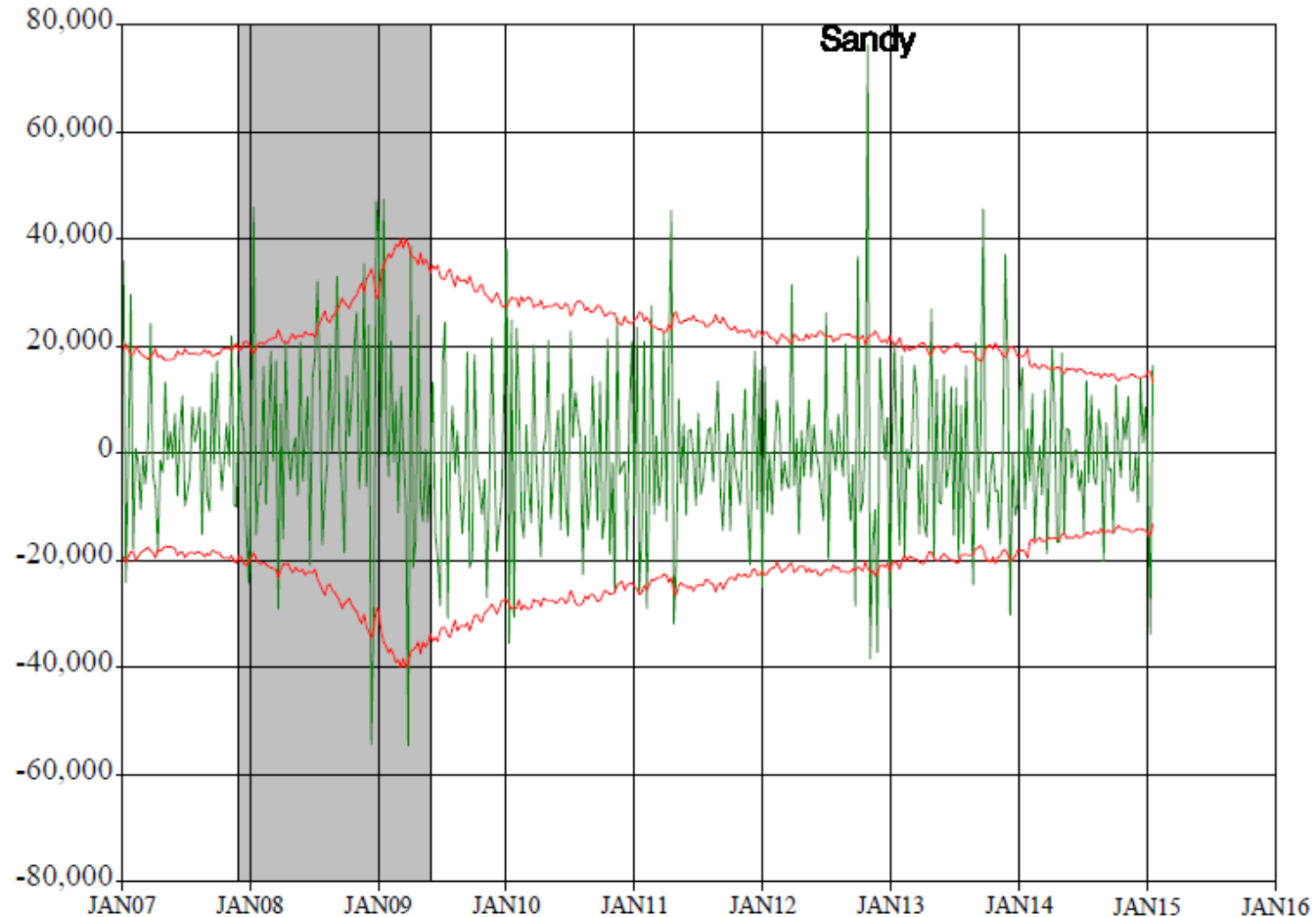
UCM has Stochastic Holiday Effects



Variances

- Week-to-week standard errors for MoveReg can be calculated with a parametric bootstrap as in Evans and Sverchkov (2016)
- Proc UCM has an option for bootstrap prediction standard errors

Week-to-Week Changes with 95% Bounds Initial Claims, (NBER Recession in Gray)



Contact Information

Tom Evans

1-202-691-6354

evans.thomas@bls.gov



www.bls.gov