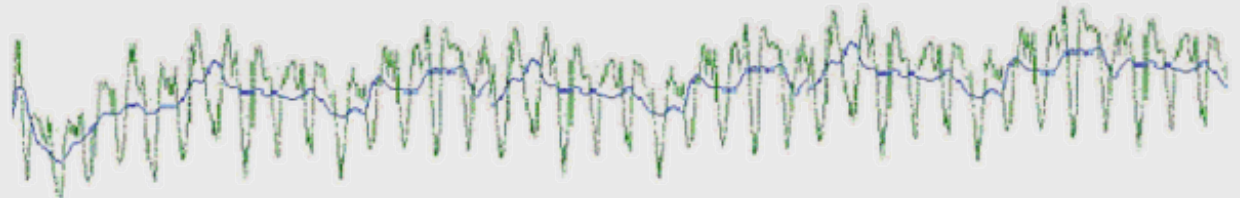# Using R to Teach
User-defined Holiday Effects

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Catherine Hood Consulting

At the 2nd SAPW, 26 Apr 2018

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C O N S U L T I N G

Inspiration

- The reasons we decided to start using R to teach X-13
  - Teaching in Mexico and difficulties with teaching both X-13 and GenHol
  - Social media and presentation-quality graphs
  - Inspiration from last SAPW to use R

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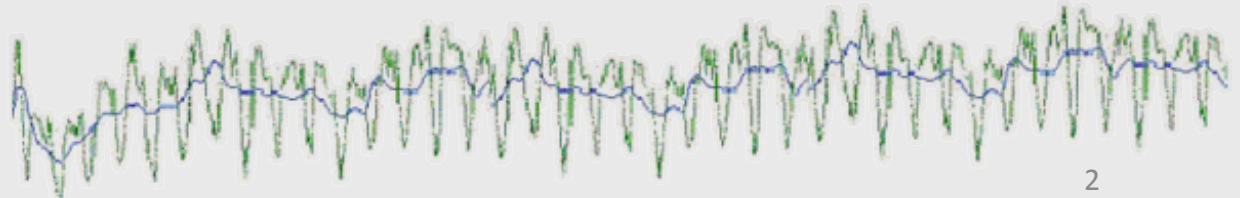
Our Solution

- Create a program in R that will
  - Run X-13
  - Include User-Defined Holidays and produce holiday files, similar to GenHol
  - Be user-friendly for new seasonal adjusters
  - Produce sleek graphs in R using the X-13 graphics mode
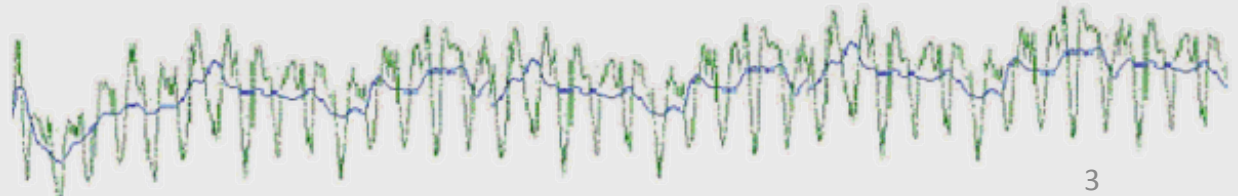
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Add Spec File

Upload Existing Spec File:

Browse...	No file selected

Or Create New Spec:

New Spec Title

Choose data to read:

Browse...	No file selected

Data Format

Datevalue ▼

Period

12 ▼

Run X-13

Add Spec File

Upload Existing Spec File:

Browse... | CanRS441.spc

Upload complete

Or Create New Spec:

New Spec Title

Choose data to read:

Browse... | No file selected

Data Format

Datevalue ▼

Period

12 ▼

```
#CanRS441.spc was created on 7/28/2017
series{
    title = "Motor vehicle and parts dealers 441"
    file = "CanRS441.dat"
    period = 12
    format = Datevalue
    comptype = add
}
spectrum {savelog=spk}
transform{ function = log }
regression{
    variables = ( td easter[1] AO2005.Feb
        RP2008.Oct-2008.Dec AO2010.Mar AO2009.Dec)
}
outlier{ types = ( AO )  span = (2016.Jan, ) }
arima{ model =  (3 1 0)(0 1 1) }
forecast{ maxlead = 12 print = all }
check{ print = all savelog = (lbq nrm) }
x11{
    sigmalim = (2.0 3.5)
    seasonalma = s3x5
    trendma = 13
    savelog = all
    save = (d10 d11 d16)
    appendfcst = yes
}
force{ type=regress }
```

Run X-13

Add Spec File

Upload Existing Spec File:

Browse...	No file selected

Or Create New Spec:

Electronic and Appliance Stores|

Choose data to read:

Browse...	CanRS443.dat

Upload complete

Data Format

Datevalue ▼

Period

12 ▼

Electronic and Appliance Stores

```
series{
    title = "Electronic and Appliance Stores"
    file = "CanRS443.dat"
    format = Datevalue
}
```

Run X-13

Transformation

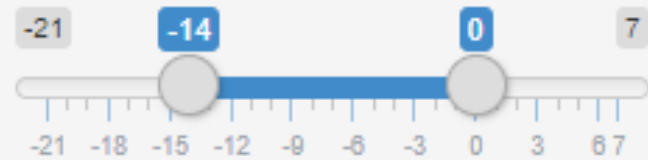- ( ) log
- ( ) none
- (•) auto

AIC test

- [ ] td
- [ ] easter

Regression Variables

- [ ] td
- [ ] Easter
- [ ] Labor Day
- [ ] Thanksgiving
- [ ] Diwali
- [ ] Chinese New Year
- [ ] Eid al-Fitr
- [ ] Talk Like a Pirate Day

Regression Variables

- [✔] td
- [✔] Easter

Days around Easter

-21		-14			0			7

-21 -18 -15 -12 -9 -6 -3 0 3 6 7

- [ ] Labor Day
- [ ] Thanksgiving
- [✔] Diwali

Days around Diwali

-21				-2	2			7

-21 -18 -15 -12 -9 -6 -3 0 3 6 7
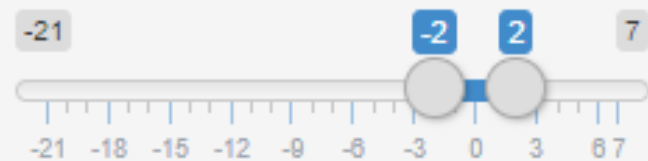
- [ ] Chinese New Year
- [ ] Eid al-Fitr
- [ ] Talk Like a Pirate Day

Test for Outliers

- ☐ ao
- ☐ ls
- ☐ tc

Arima model

- ○ auto
- ● specify

(011)(011)

Type of Adjustment

X-11 ▼

Aggregate

Not part of an aggregate ▼

Test for Outliers

- ☑ ao
- ☑ ls
- ☐ tc

Arima model

- ● auto
- ○ specify

Type of Adjustment

X-11 ▲

X-11
SEATS
Trading Day and Holiday Only
None

Add Spec File

Upload Existing Spec File:

Browse...	No file selected

Or Create New Spec:

Electronic and Appliance Stores

Choose data to read:

Browse...	CanRS443.dat
Upload complete	

Data Format

Datevalue	▼

Period

| 12	▼

Electronic and Appliance Stores

```
series{
    title = "Electronic and Appliance Stores"
    file = "CanRS443.dat"
    format = Datevalue
    period = 12
}
transform{ function = log }
regression{
    variables = ( td easter[14] )
    user=( Diwali )
    file="diwali.dat"
    format="datevalue"
    usertype=holiday
}
outlier{ types = ( AO LS )}
arima{ model =  (0 1 1)(0 1 1) }
x11{
    sigmalim = (2.5 3.5)
}
```

Run X-13

Usefulness of User-defined Holidays

- Countries other than the US often have more complicated Easter holidays than we have in the US

- As our cultures and economies expand, we can see the effect of other moving holidays increasing.

- While researching Diwali, we learned that it is a huge shopping holiday, so it might be possible to see a Diwali effect in retail sales series.

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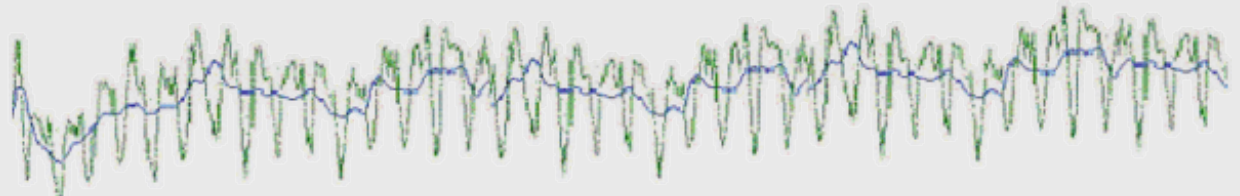
Diwali Effect in Canada

- Testing for a Diwali effect in Canadian Retail Sales at the national level

  - Eight days before the holiday: Effects in Electronic and Appliance Stores and Food Stores.

  - Three days before the holiday: Effects in Electronic and Appliance Stores, Food Stores, and Automobile Dealerships.

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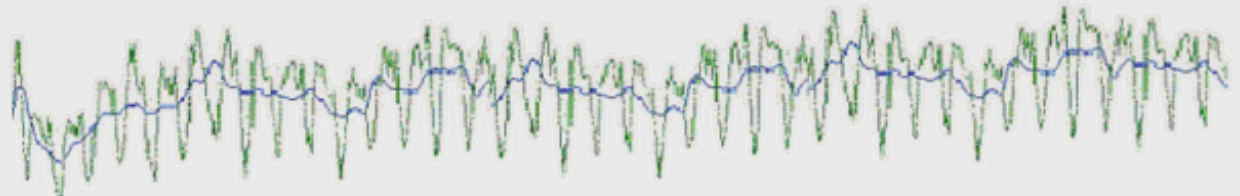
Output for Electronic and Appliance Stores

```
User-defined Holiday
  Diwali8                              0.0168           0.00583            2.89

Automatically Identified Outliers
  AO2017.Nov                           0.1052           0.02264            4.65
-----------------------------------------------------------------------------


Chi-squared Tests for Groups of Regressors
-----------------------------------------------------------------------------
Regression Effect                     df        Chi-Square          P-Value
-----------------------------------------------------------------------------
Trading Day                            6           101.91             0.00
User-defined Regressors                1             8.33             0.00
-----------------------------------------------------------------------------
```
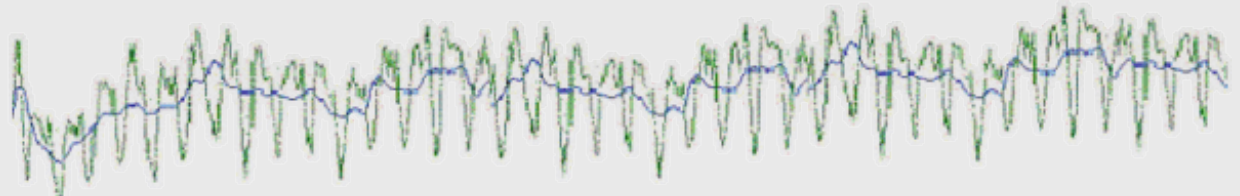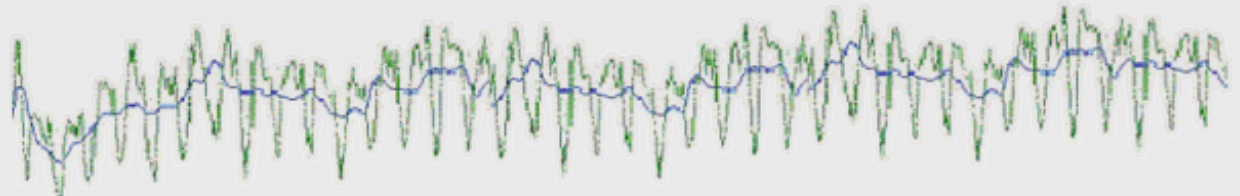
Output for Food and Grocery Stores

```
User-defined Holiday
  Diwali8                        0.0093          0.00340            2.73
-------------------------------------------------------------------------


Chi-squared Tests for Groups of Regressors
-------------------------------------------------------------------------
Regression Effect                     df        Chi-Square        P-Value
-------------------------------------------------------------------------
Trading Day                           6           1592.77            0.00
User-defined Regressors               1              7.47            0.01
-------------------------------------------------------------------------
```

Output for Automobile Dealers

```
User-defined Holiday
  Diwali3                        0.0165         0.00720              2.29
-----------------------------------------------------------------------


Chi-squared Tests for Groups of Regressors
-----------------------------------------------------------------------
Regression Effect                     df        Chi-Square        P-Value
-----------------------------------------------------------------------
Trading Day                           6           471.47            0.00
User-defined Regressors               1             5.26            0.02
-----------------------------------------------------------------------
```
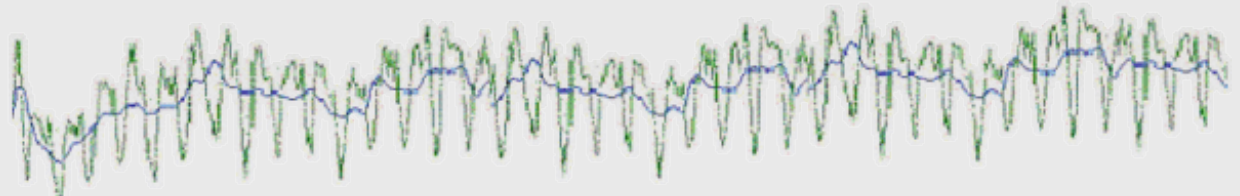
Diwali Effect in the US

- Testing for a Diwali effect in US Retail Sales (at the national level), we only saw weak effects in Food Stores, and only when we used a modelspan to limit the test to the last 12 years.
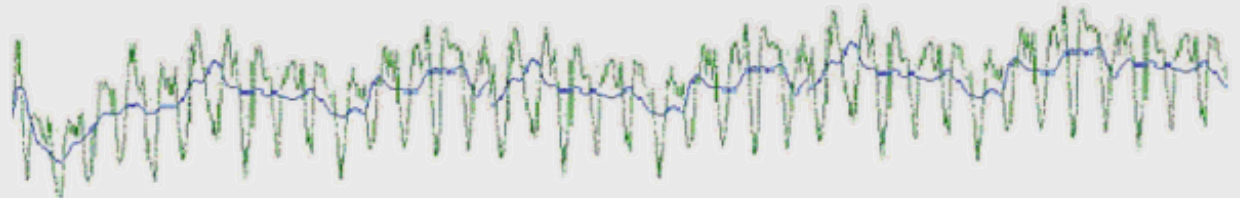
Output for US Food Stores

```
Easter[8]                         0.0213        0.00195        10.94
Thanksgiving[-1]                 -0.0398        0.01575        -2.53

User-defined Holiday
  Diwali8                         0.0032        0.00196         1.62
--------------------------------------------------------------------


Chi-squared Tests for Groups of Regressors
--------------------------------------------------------------------
Regression Effect                  df      Chi-Square       P-Value
--------------------------------------------------------------------
Trading Day                         6         518.36          0.00
User-defined Regressors             1           2.61          0.11
--------------------------------------------------------------------
```
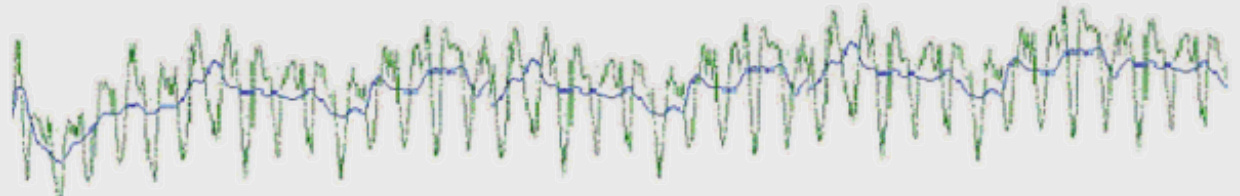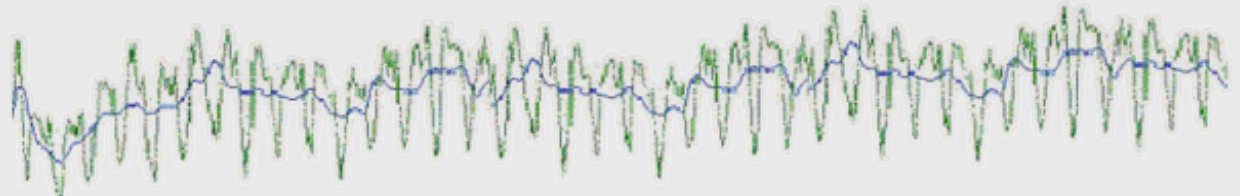
Output from the App

- When completed, we will see both the log file and the output file in the app after the X-13 run.

- We currently have a way to view certain graphs, and we are working to expand the list.

- We want to eventually have a diagnostics list, and maybe even have a way to print relevant diagnostics on certain graphs.

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