Economic Statistical Methods Division
International Trade Statistics

How Long Is Too Long:
Shortening International Trade Time Series

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Disclaimer

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

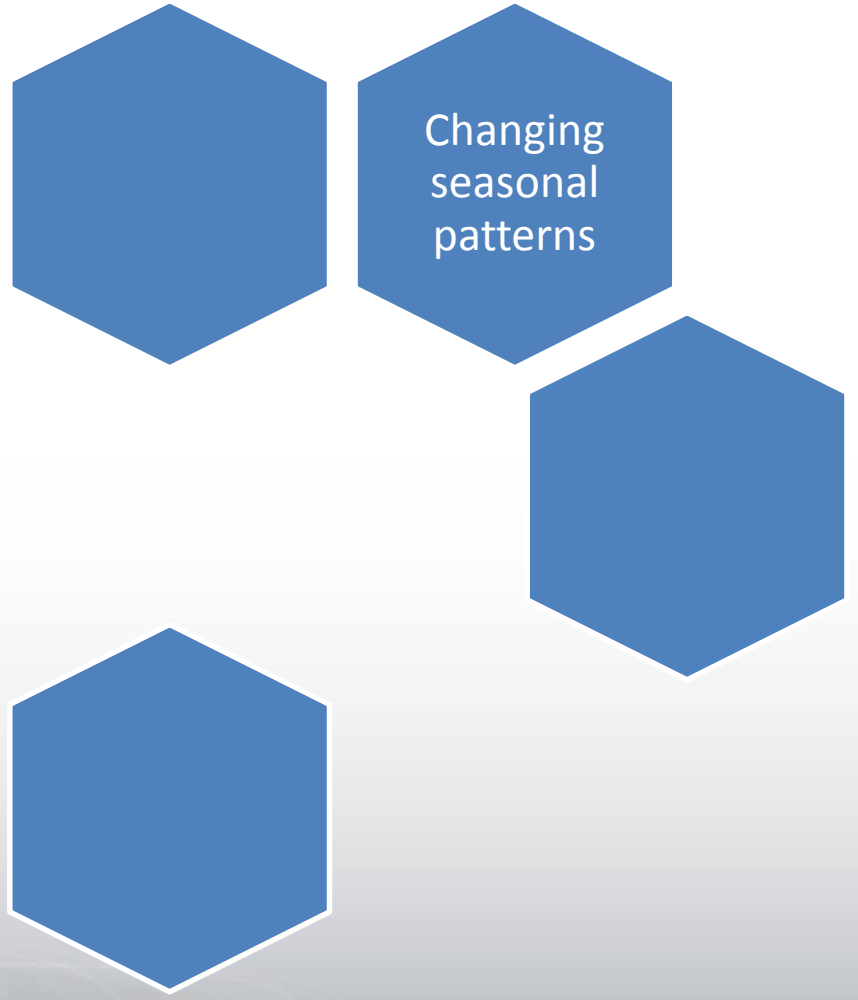
Overview

- Background
- Why
- Methods
- Questions

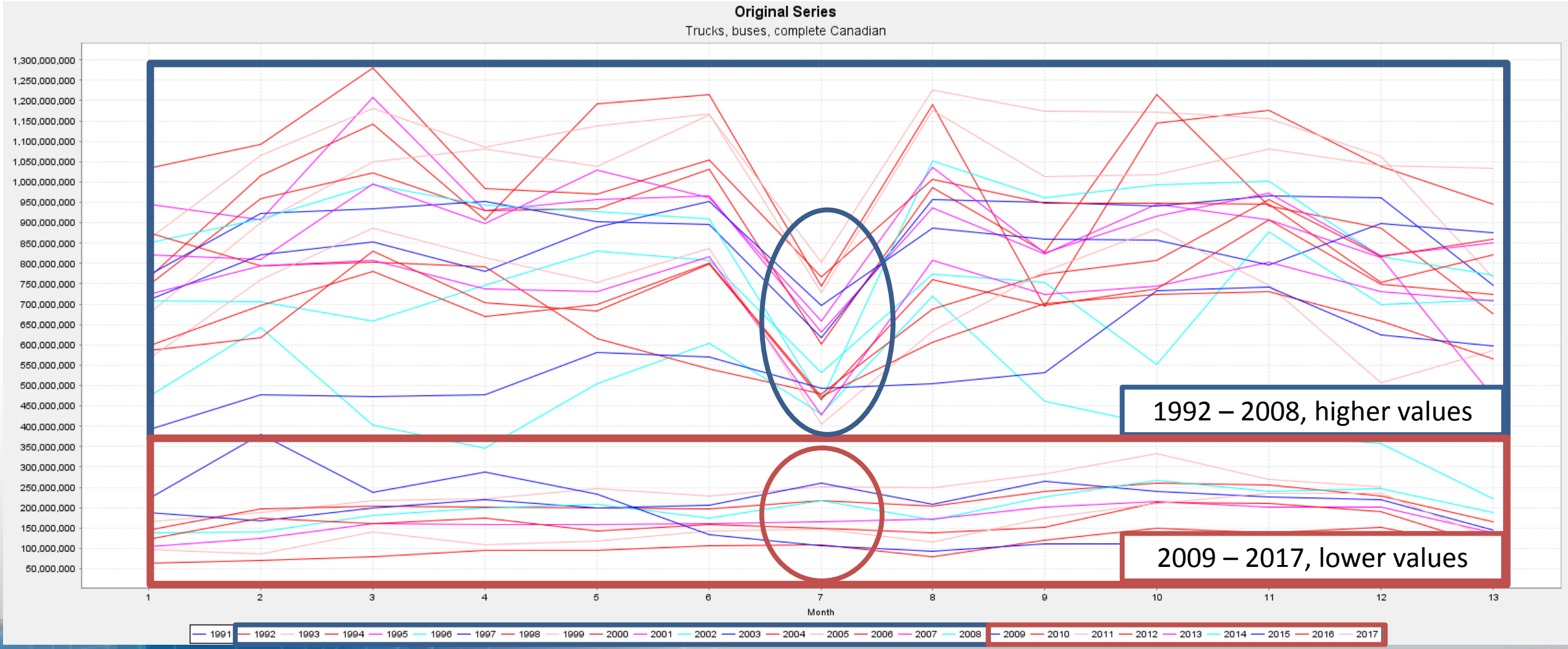
Background

- Release *U.S. International Trade in Goods and Services Report (FT-900)* jointly with BEA
- Seasonally adjust data to identify and remove seasonal patterns in:
  - Import and export value data by commodity
  - Deflators for chained dollars
  - Import and export value data by geographical area
- Produce monthly factors using X-13ARIMA-SEATS
- Annual revisions to seasonal factors
  - Factors projected for upcoming year (April – March)
- Seasonally adjusted data revised back three years

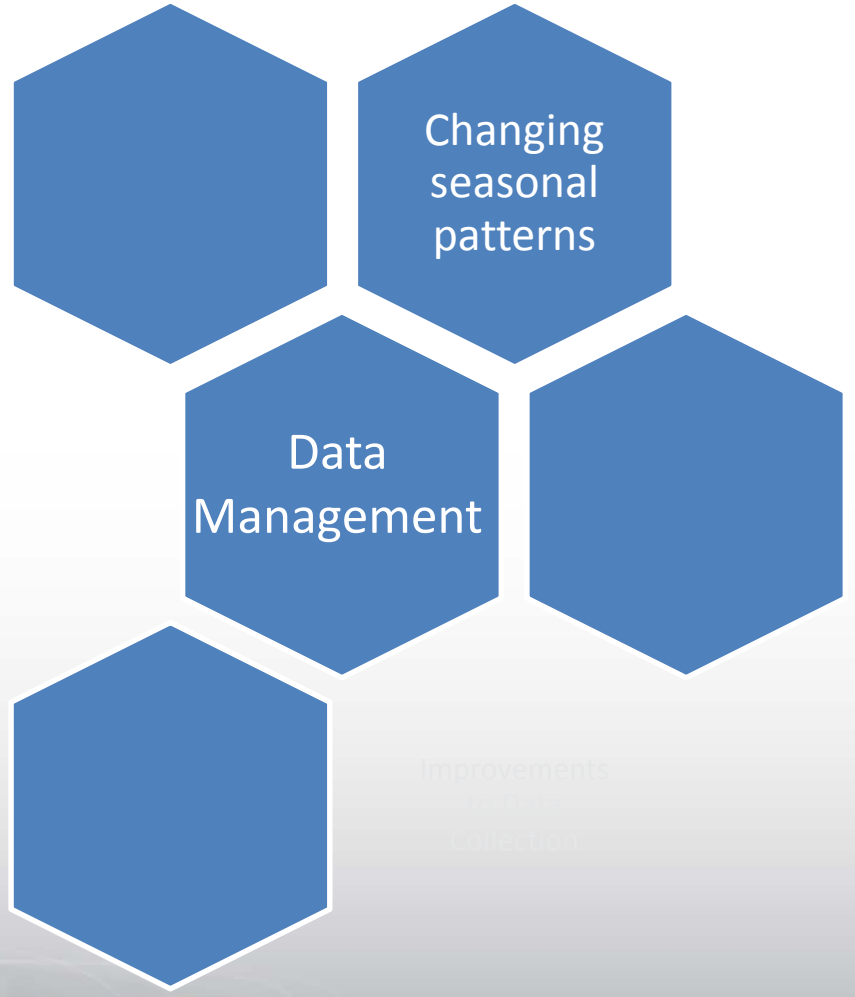
Why?



Changing Seasonal Patterns



Why?



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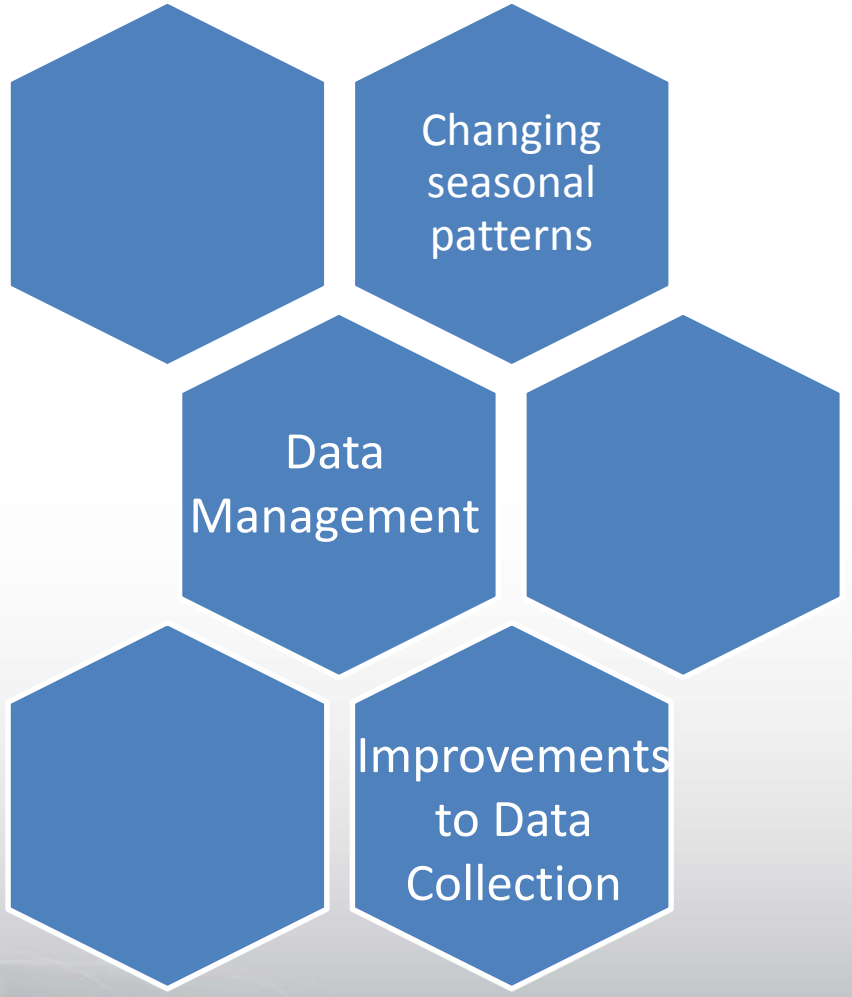
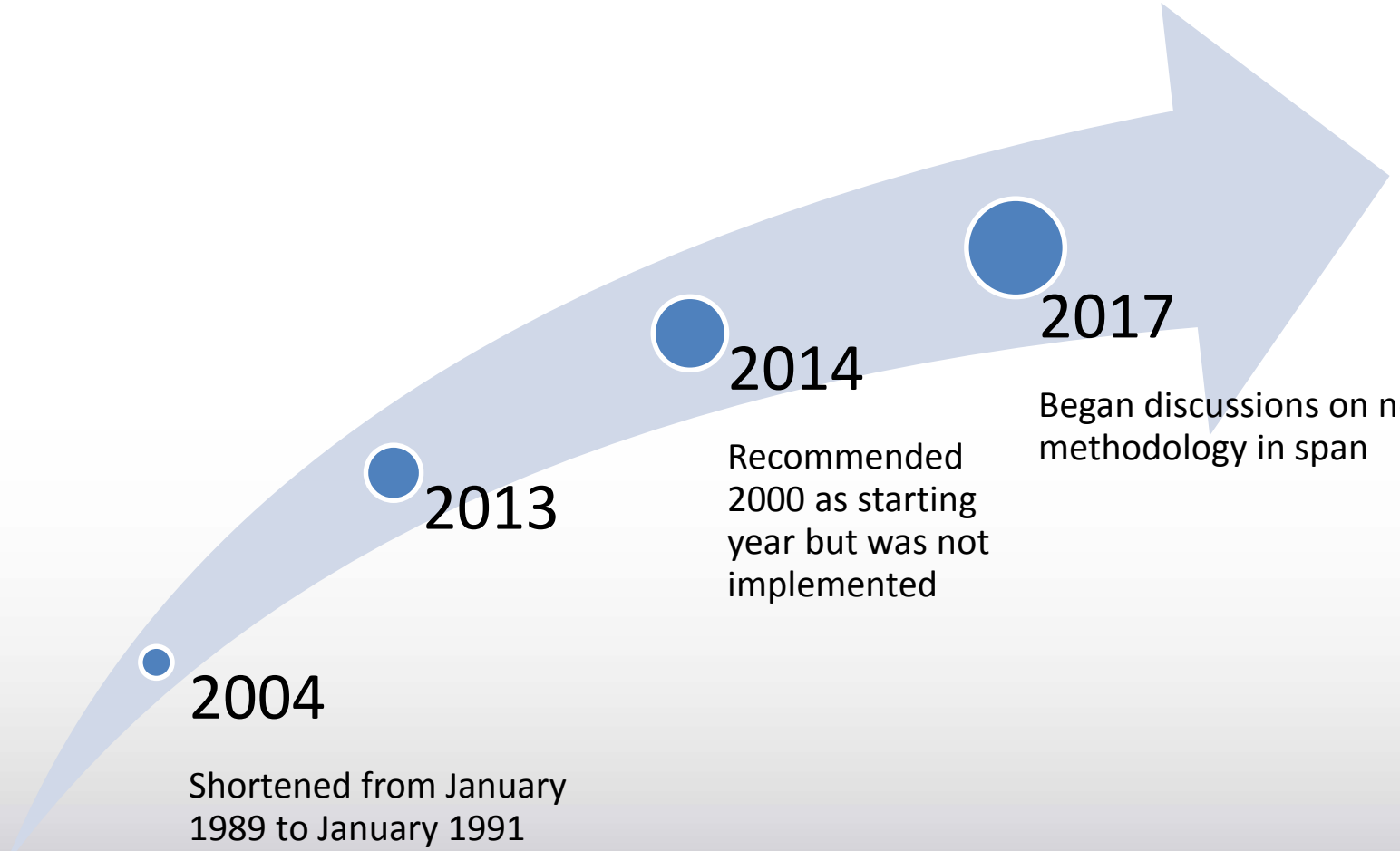

Changing seasonal patterns
Data Management
Improvements to Data Collection

Previous Research



Top 10 Imports and Top 10 Exports

Year Selection	• 2004 Research: 1989 - 1993 • 2013 Research: 1992 - 1995 • 2014 Research: 1998 - 2001
Modify specs	• Removed all out of range outliers
Process	• Evaluated output • Remodeled as necessary

Best Year

- Determined year which performed best overall
- Generated supporting statistics and graphs
- Evaluated watch-listed series of previous annual review

Supporting Documentation

Graphs

Original and prior adjusted original series of select series

Aggregated original and indirect seasonally adjusted series for current starting year and recommended starting year

Monthly average absolute difference and monthly average percent difference for each series

Monthly and quarterly adjusted values for each series

Factors for selected series

Updates and Modifications Required

Modify all spec files

Request changes to seasonal processing programs that produce datasets and factors

Ask BEA to exclude years when they deliver data

Future Span Shortening Methodology

- Choose series and spans to evaluate
  - Geographic series (40 series)
  - Will eventually need to examine value series/deflators (few top ranked series)
- Analysis Options
- Supporting Documentation

Spans

Choose a few years

- e.g. 1998, 1999, 2000, 2001

Examine current model spans and choose most common

Moving constant span

Graphs

- Year over year: changing seasonal patterns
- Original series and prior adjusted original series

Analysis Options:
Run with Shortened Spans

- Previous Research
  - Evaluate diagnostics and remodel as necessary
  - Choose year with best models/best diagnostics/fewest outliers
  - Large changes to TD [f-pval], SR[f-pval], filter, ARIMA
  - Spectrum of the prior adjusted original series for seasonality
- New Research
  - Stability (SF%), revision (SA AR%), non-significant peaks
  - Look for a span that minimizes forecast error

Analysis Options: Seasonal COR Regressors

(0 1 1)12 series

- Test: is series becoming non-seasonal?
- Add SEASONAL//yyyy.mm/
- Record the p-value – compare to cut off (0.05? 0.10?)

Fixed seasonal series

- Test: Are seasonal patterns changing or is series becoming non-seasonal?
- Use SEASONAL/yyyy.mm/
- Record both p-values
- Compare coefficients

Example: Imports Trucks, buses from Canada (M3010C)

Year of Seasonal/yyyy.mm/	F Test P-value for Seasonal (after yyyy.mm)	F Test P-value for Seasonal (change for before yyyy.mm)
Null Hypothesis	Fixed seasonal effect is significant	Seasonal pattern in the early span matches the pattern in the later span
2000.01	0.00	0.01
2001.01	0.00	0.00
2002.01	0.00	0.00

Analysis Options: Cut Span in Two

Automodel shortened span and compare early span to later span

Look for changes or large differences in the following:

- ARIMA model
- TD
- Easter (for geographic series)
- For (011)12, record the change in MA parameter as well as SE
- Record changes in seasonal filter

Two Spans for M10000

	1991 to 1999	2000 to 2017	1991 to 2000	2001 to 2017	1991 to 2001	2002 to 2017
ARIMA Model	(0 1 1) (0 1 1)	(0 1 1) (0 1 1)	(0 1 0) (0 1 1)	(0 1 1) (0 1 1)	(0 1 0) (0 1 1)	(0 1 1) (0 1 1)
Trading Day	No TD	TD1coef	No TD	TD1coef	No TD	TD1coef
Seasonal Filter	3x5	3x5	3x9	3x5	3x9	3x5
Trend Filter	13	9	13	9	13	9
Seas MA parameter value	0.9995	0.8763	0.9996	0.8816	0.9993	0.8500

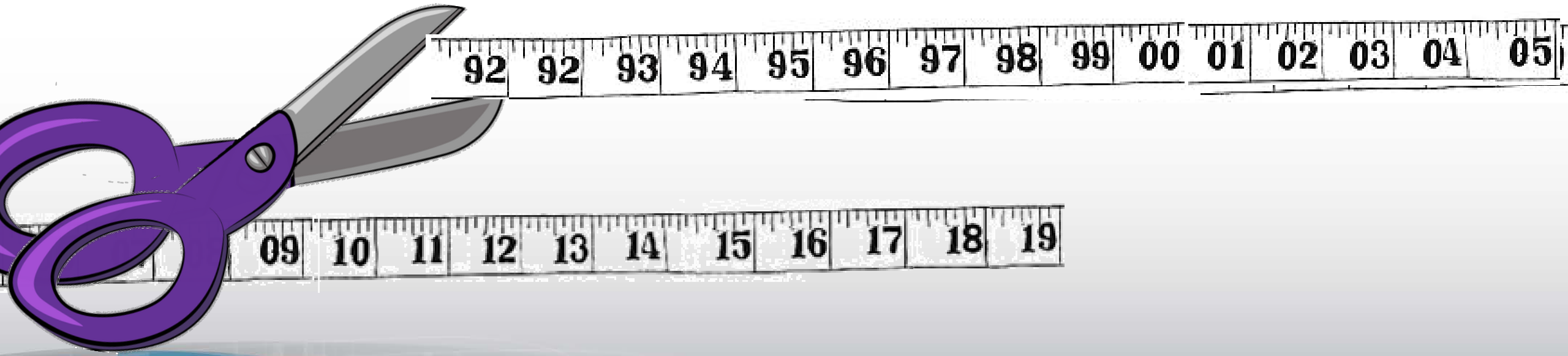
Analysis Options: Seasonal Factor Analysis

- Compare projected factors of shortened span and full span
- Let X-13 automodel both shortened and full span
- Note differences larger than 0.01
- Record direction changes

One Year Forecast Factor Changes for M10000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Full Span	1.0136	0.8213	0.9557	0.9557	1.0496	1.0491	1.0809	1.1110	0.9627	1.0400	1.0045	0.9529
2000 to 2017	1.0280	0.8283	0.9528	0.9514	1.0458	1.0449	1.0824	1.1153	0.9407	1.0473	1.0105	0.9578
2001 to 2017	1.0279	0.8152	0.9337	0.9375	1.0404	1.0464	1.0991	1.1360	0.9431	1.0642	1.0212	0.9476
2002 to 2017	1.0323	0.8131	0.9291	0.9368	1.0448	1.0505	1.1011	1.1341	0.9362	1.0630	1.0234	0.9485

Analysis Options:
Fixed Moving Span



Supporting Documentation

Percent change

- In months
- Full span vs shortened
- Highlight largest changes

Graphs

- Seasonally adjusted series of full span vs shortened
- Aggregated original and indirect seasonally adjusted series for current starting year and recommended starting year

Values

- Monthly and quarterly adjusted values for each series
- Factors

Questions

- How do you find the “best” cutoff year?
- What diagnostics have you used that were most successful?
- What does your area do when it comes to shortening the span?

Thank You!

Contact

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