De-mystifying Seasonal Adjustment: A visual tool to understand the process

Presented at the 3rd Seasonal Adjustment Practitioners Workshop

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Outline

- Context
- Seasonal Adjustment Dashboard
  - Objective
  - Approach and Content
  - Programming Platform
- Next Steps

Context

Seasonal Adjustment at Statistics Canada is done for many using X-12-ARIMA

- According to published Quality Guidelines (revision strategy, raking, …)
- Analysis in Win X-13, X13graphjava, Production using SAS PROC X12

Responsibilities:

- Time Series Research and Analysis Centre - Responsible to develop and maintain processing environment for Seasonal Adjustment
  - Regularly scheduled update of Seasonal Adjustment Options
  - Periodic review of diagnostics
  - Ongoing Support for Analysis and Interpretation of results

- Subject Matter Experts - Responsible for the statistical project
  - Co-ordinate with various groups (collection, statistical methods, dissemination)
  - Execute processing of steps
  - Validation, analysis and dissemination of statistical outputs

Seasonal Adjustment Dashboard - Objectives

- Build Capacity - to better interpret seasonally adjusted data
  - Help analysts to understand concepts - avoid treating process as a black box
  - Training tool for seasonal adjustment courses
  - Tool for briefing to senior management

- Increase Efficiency - Reduce resources needed to support seasonal adjustment
  - Automated tool, intended to respond to most common questions
  - Avoid effort to gather relevant info from listings

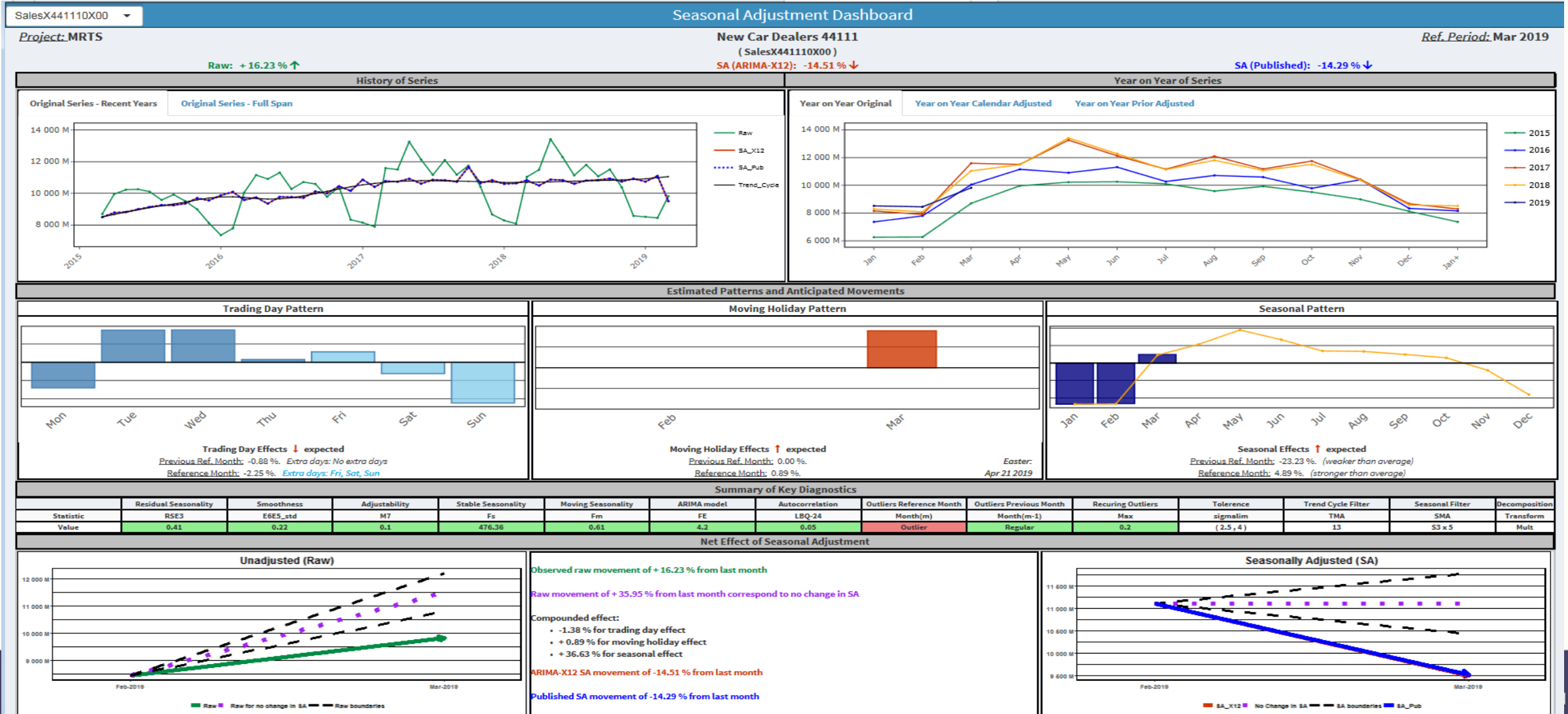# Seasonal Adjustment Dashboard - Approach

Guiding Principles:

One automated page:
- As intuitive and visual as possible (with supporting numeric detail)
- Avoid over-simplification and approximations

Respond to most common questions for a specific series:
- Is the seasonal adjustment process working as it should?
- Is the seasonal pattern changing?
- Why is the effect of seasonal adjustment different this year than last year?
- Do we see an effect from *<insert event here>* in our estimates

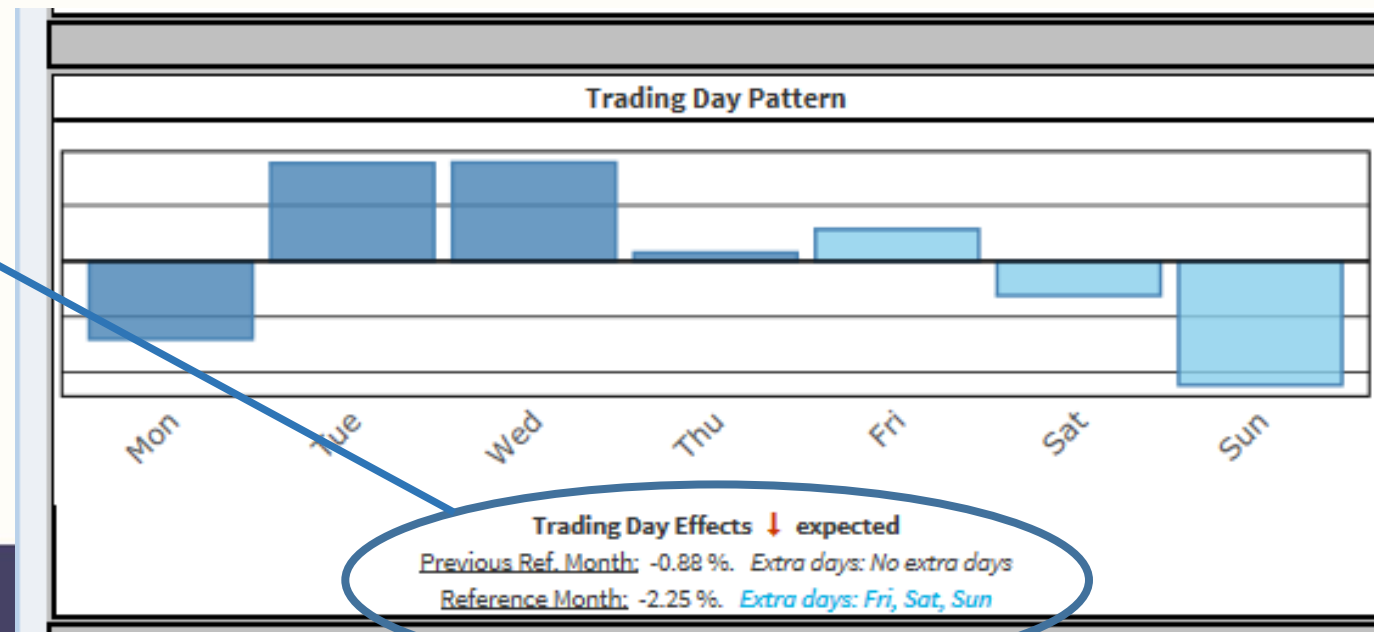# Seasonal Adjustment Dashboard - Content

Seasonal Adjustment Dashboard - Content

Trading Day Component (includes leap year effect)

▶ Populated from Regression Table (daily regression parameters) and A6 (monthly factors)

▶ Identifies "Extra days from each month" – lighter shading

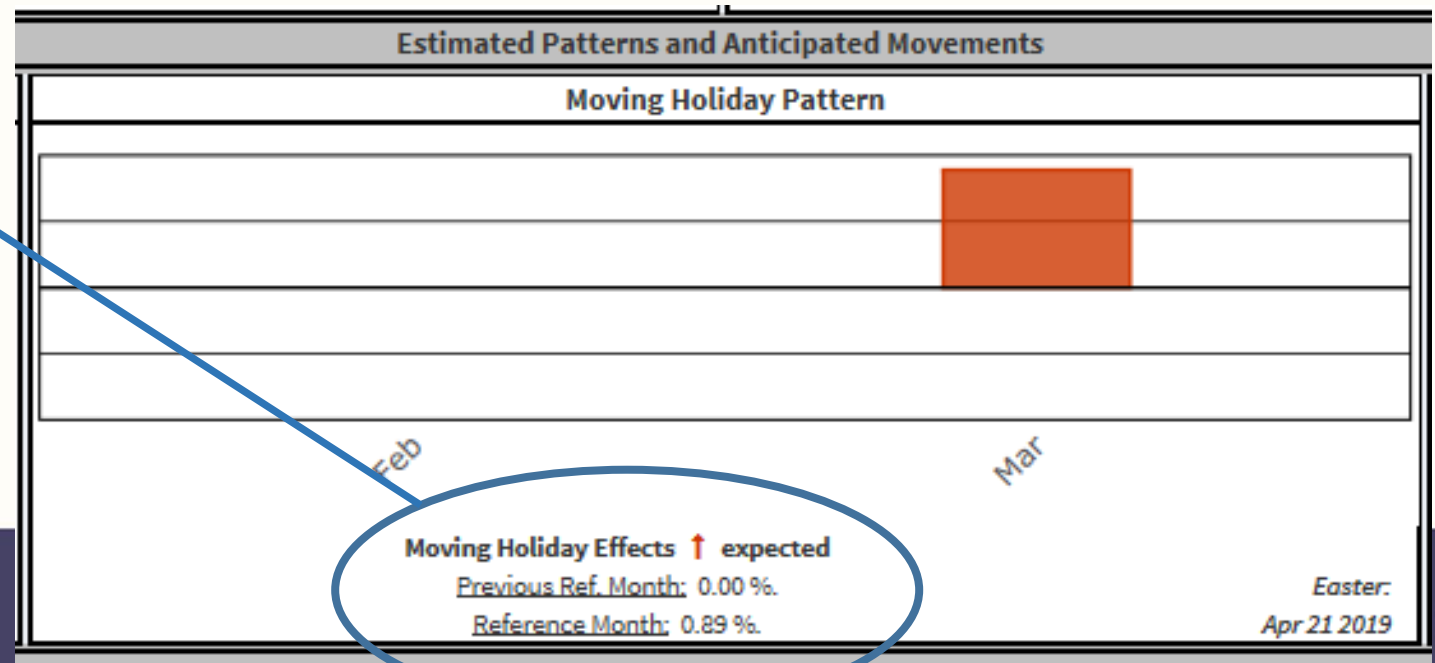*Effect of trading day component on month-to-month movement*

Trading Day Pattern

Mon Tue Wed Thu Fri Sat Sun

Trading Day Effects ↓ expected

Previous Ref. Month: -0.88 %. *Extra days: No extra days*

Reference Month: -2.25 %. *Extra days: Fri, Sat, Sun*

Seasonal Adjustment Dashboard - Content

Moving Holiday Component

▶ Populated from A7 (monthly factor)

▶ Developed for Easter, Labour Day

▶ Displays date of relevant holiday in current year

*Effect of moving holiday component on month-to-month movement*

Estimated Patterns and Anticipated Movements

Moving Holiday Pattern

Feb

Mar

Moving Holiday Effects ↑ expected
Previous Ref. Month: 0.00 %.
Reference Month: 0.89 %.

Easter:
Apr 21 2019

Seasonal Adjustment Dashboard - Content

Seasonal Component

▶ Populated from D10 (monthly factor)

▶ Line represents last complete year

▶ Bars represent months in current year

Effect of seasonal component on month-to-month movement
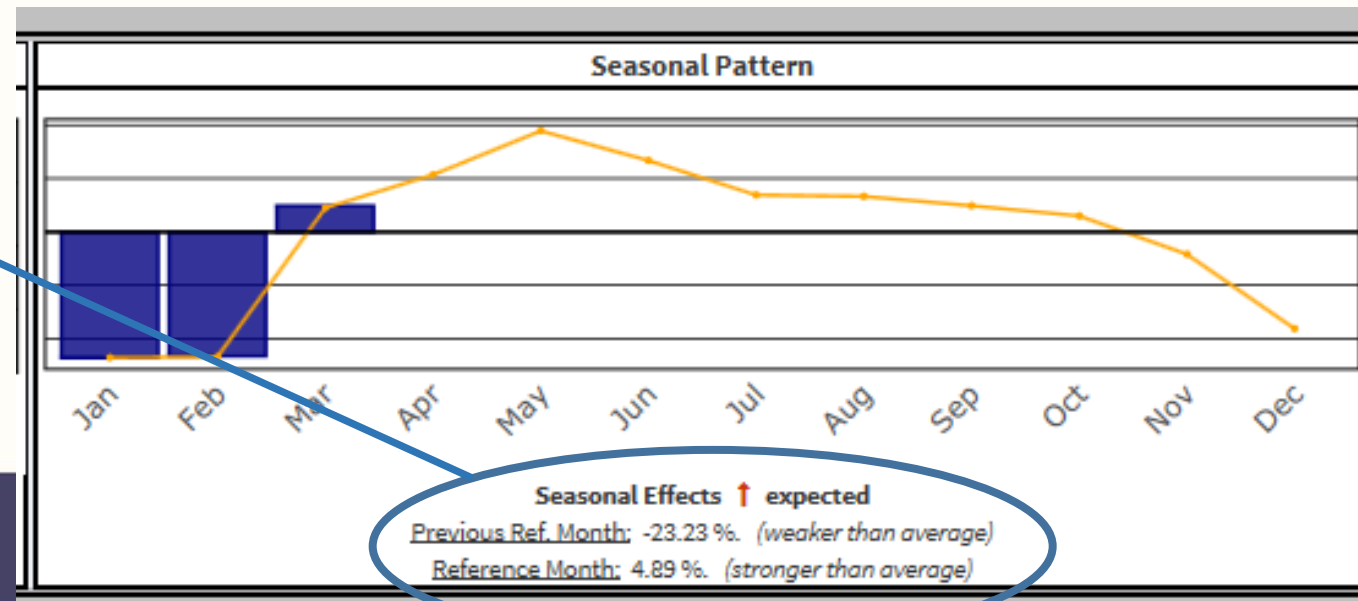
Seasonal Adjustment Dashboard - Content

Summary of Key Diagnostics – color coded to indicate acceptable ranges

- Primary diagnostics - Residual seasonality, smoothness relative to raw, presence and stability of seasonal pattern

	Residual Seasonality	Smoothness	Adjustability	Stable Seasonality	Moving Seasonality
Statistic	RSE3	E6E5_std	M7	Fs	Fm
Value	0.41	0.22	0.1	476.36	0.61

- Also includes forecast error, autocorrelation measures, outlier status for current and previous month

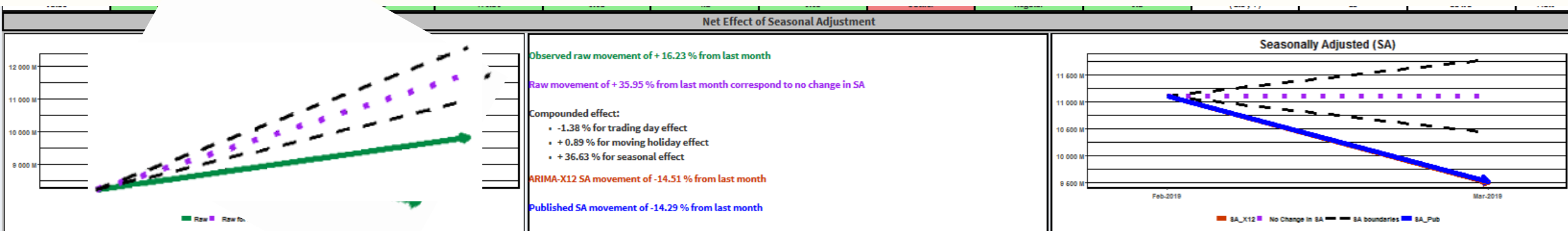| Summary of Key Diagnostics				
ARIMA model	Autocorrelation	Outliers Reference Month	Outliers Previous Month	Recuring Outliers
FE	LBQ-24	Month(m)	Month(m-1)	Max
4.2	0.05	Outlier	Regular	0.2

- Several X-12-ARIMA parameters (extreme value tolerances, length of seasonal and trend-cycle filter, decomposition mode)

Tolerence	Trend Cycle Filter	Seasonal Filter	Decomposition
sigmalim	TMA	SMA	Transform
(2.5 , 4)	13	S3 x 5	Mult

- Hover function for description of validation, statistic and desired ranges

Net Effect of Seasonal Adjustment

- Relationship between Raw and SA
  - Purple line represents no-change in SA
  - Black lines represent upper and lower bounds (correspond to sigmalimit)
  - Green line represents observed raw values
  - Red represents seasonally adjusted movement
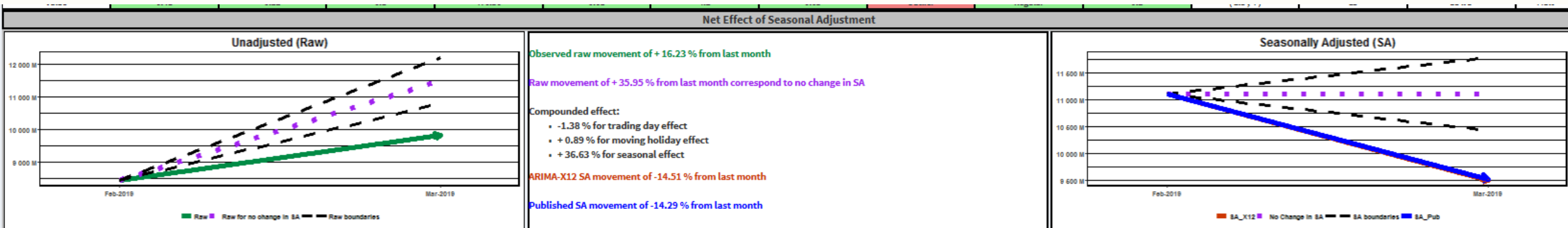 - Blue represents published SA movement (after raking)

Net Effect of Seasonal Adjustment

Observed raw movement of + 16.23 % from last month

Raw movement of + 35.95 % from last month correspond to no change in SA

Compounded effect:
- -1.38 % for trading day effect
- + 0.89 % for moving holiday effect
- + 36.63 % for seasonal effect

ARIMA-X12 SA movement of -14.51 % from last month

Published SA movement of -14.29 % from last month

Seasonally Adjusted (SA)

Net Effect of Seasonal Adjustment

How components are presented

- Multiplicative adjustment = compounded multiplicative factors
  - (1 + trading day) * (1 + moving holiday) * (1+ seasonal) = (1 + no change SA)
- Additive adjustment = additive factors
  - trading day + moving holiday + seasonal = (no change SA)

High and Low bounds are based on extreme value identification

Net Effect of Seasonal Adjustment

Unadjusted (Raw)

Observed raw movement of + 16.23 % from last month

Raw movement of + 35.95 % from last month correspond to no change in SA

Compounded effect:
- -1.38 % for trading day effect
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ARIMA-X12 SA movement of -14.51 % from last month

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Seasonally Adjusted (SA)

Programming Platform - Automation

Excel workbook (manual copy-paste of input data)

Excel workbook with VisualBasic Macros (reformat of input data)

Evaluated Power BI, SAS-JMP
- Issues with customizing, locking content, interactivity

Currently programmed in R-Shiny
- Automatic - draws directly from Time Series Processing System outputs
- Html format output – no user knowledge of special software required
- Interactive features – hover, zoom, series selector, tabs

Seasonal Adjustment Dashboard - Content
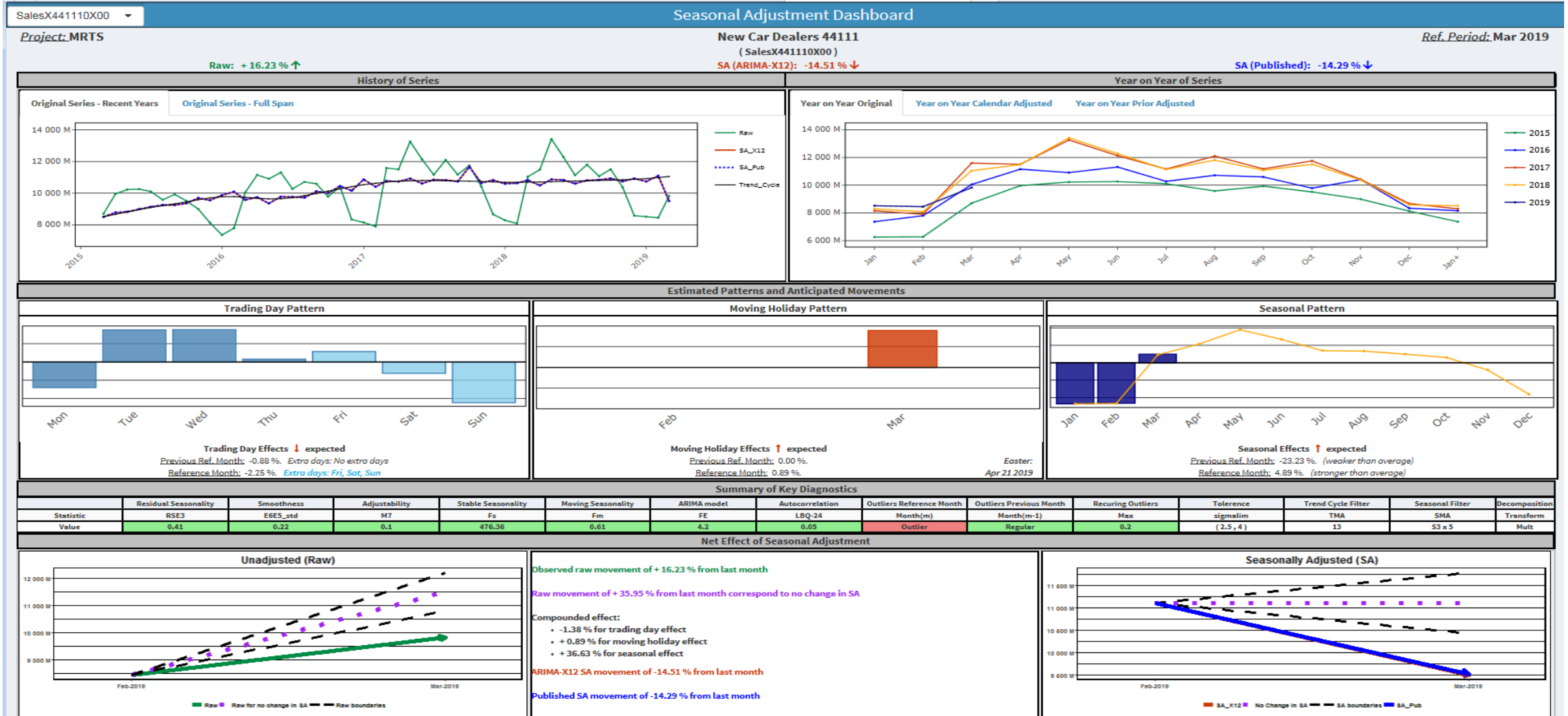
Next Steps

Gradual rollout to programs
- Pilot with four key monthly economic surveys

Ongoing content development
- Incorporate feedback from pilot
- Incorporate survey specific features
  - Reference week adjustment (Labor Statistics)
  - Additional calendar effects (Chinese New Year effects in International Trade Programs, …)
- Add second page for advanced users?

Thank you!

- For more information, please contact:

- Pour plus d'information, veuillez contacter :

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