Outlier Review During Concurrent Seasonal Adjustment of CES State and Area Series

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Disclaimer

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Introduction

Introduction

- Current Employment Statistics (CES) State and Area program
- Publish over 2,000 seasonally adjusted series each month
- Covering over 400 subnational geographic areas

Background

Background

Traditional Seasonal Adjustment

- Seasonal factors have traditionally been developed using historical employment data forecasted for one year

- Employ the “Two Step” adjustment method

- Outsized impact of various events can have a significant impact on localized areas.

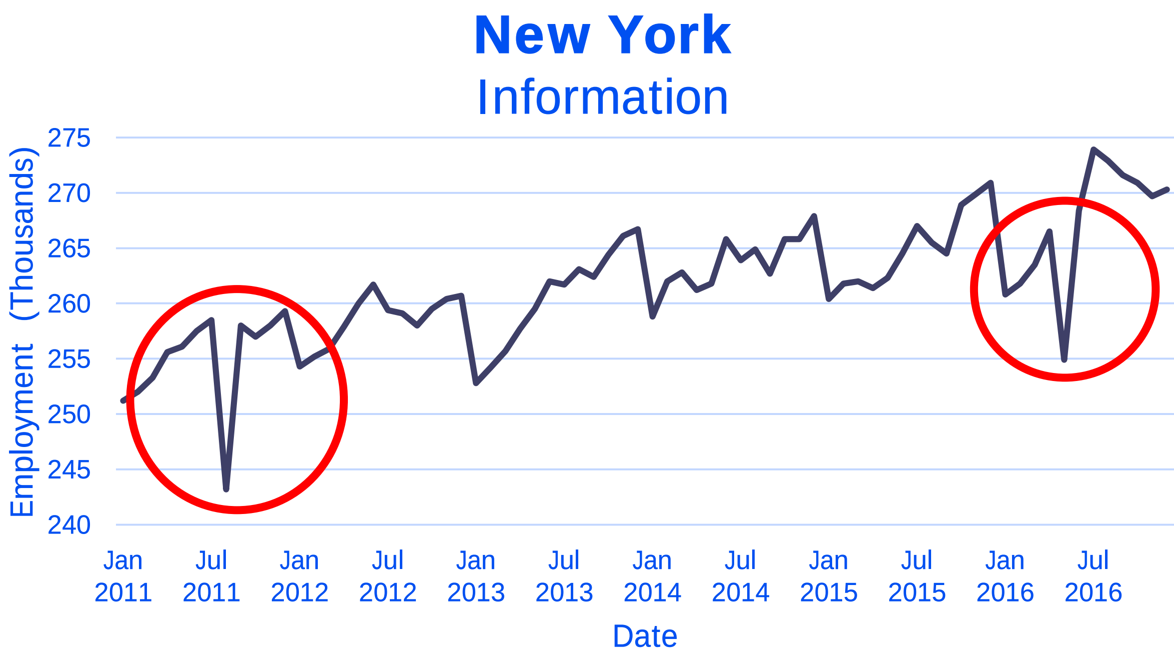
Background

Concurrent Seasonal Adjustment

- CES National has been conducting concurrent adjustment since 2003
- Research was done to investigate the viability of switching to a concurrent seasonal adjustment process in 2015
- Evidence showed that concurrent would make seasonally adjusted data **more accurate** and **less volatile**
  - *Mance (2015)*

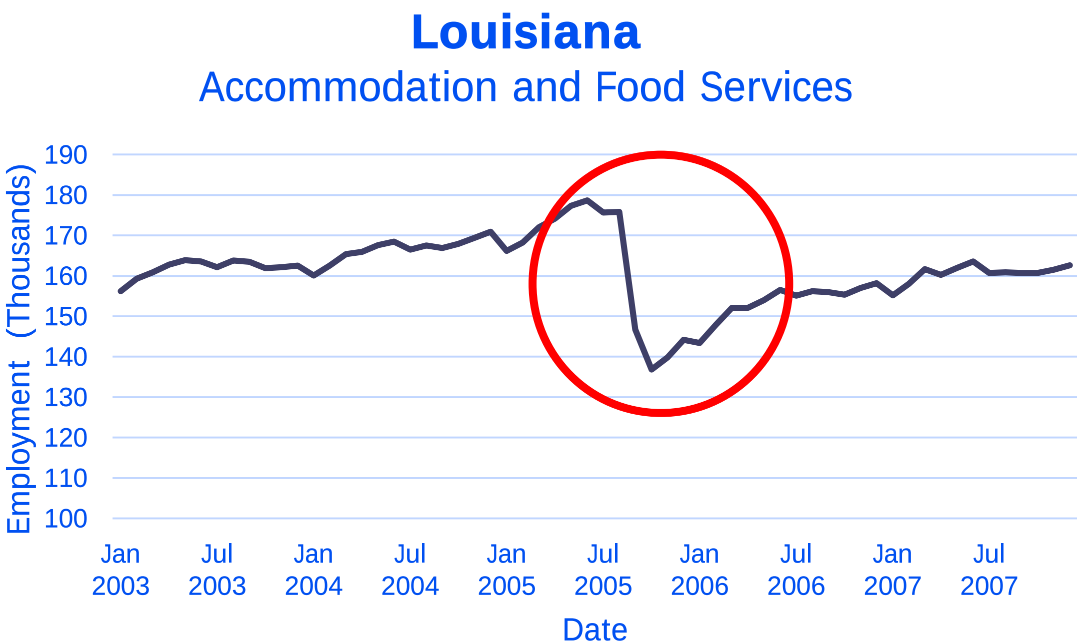
Background

- Additive Outlier
- New York – Information
- Aug. 2011: OTMC -15,300 (-6%)
- May 2016: OTMC -11,600 (-4%)



Background

- Level Shift
- Louisiana – Accom. and Food Service
- OTMC -29,100 (-17%)



Research Motivation

Research Motivation

- Enhance outlier detection capabilities during concurrent seasonal adjustment
  - McDonald-Johnson and Hood (2001)
- Gains from stricter Critical Value policy

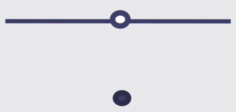
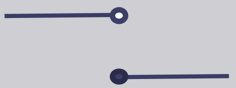
Simulations

ARIMA Models and Parameters

ARIMA Models and Parameters						
ARIMA Model	**AR**	**MA**	**AR12**	**MA12**	**d**	**d12**
(0,1,1)(0,1,1)	-	0.23	-	0.68	1	1
(0,2,1)(0,1,1)	-	0.72	-	0.71	2	1
(1,1,0)(0,1,1)	0.43	-	-	0.71	1	1
(0,1,0)(1,1,0)	-	-	-0.54	-	1	1

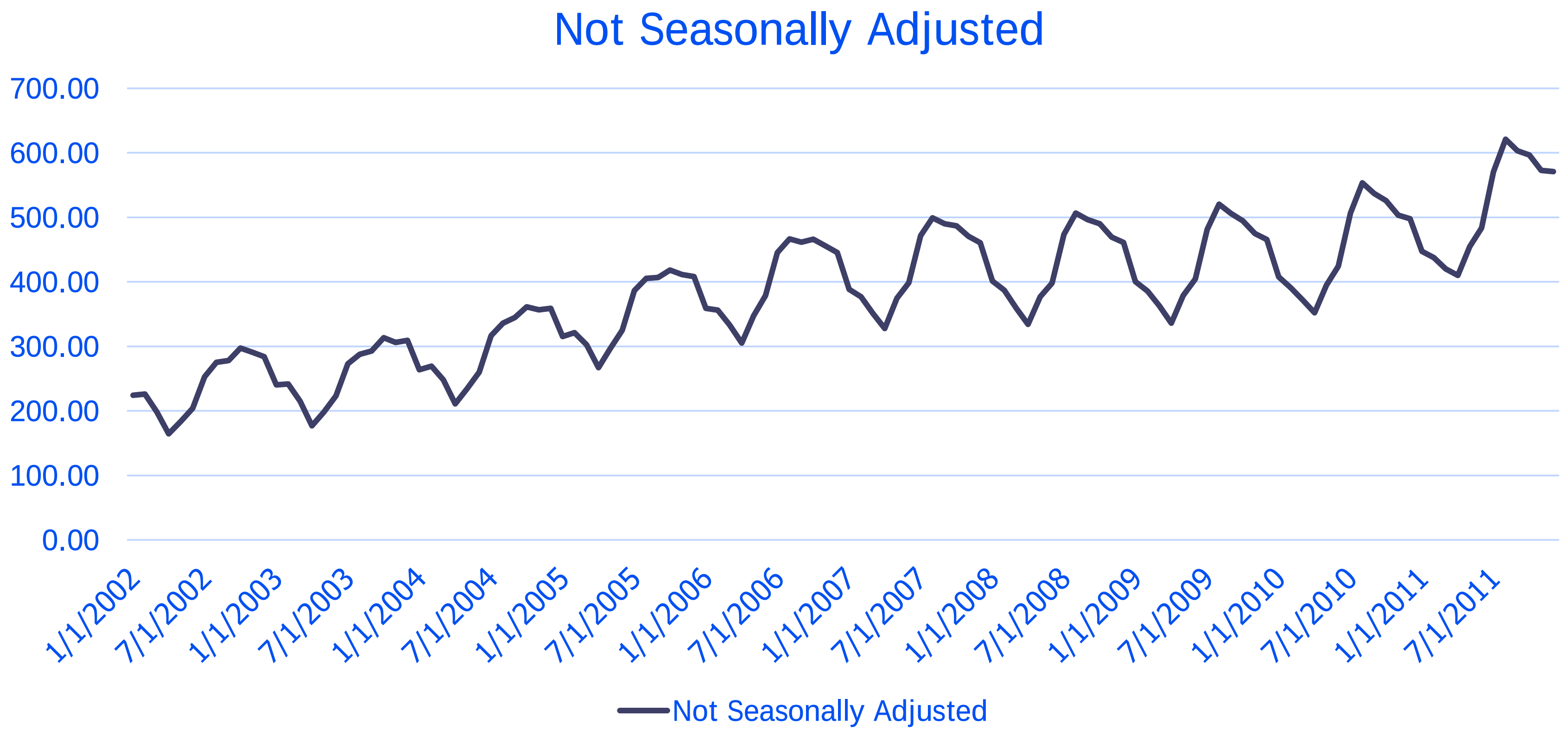
Exogenous Events

Exogenous Events

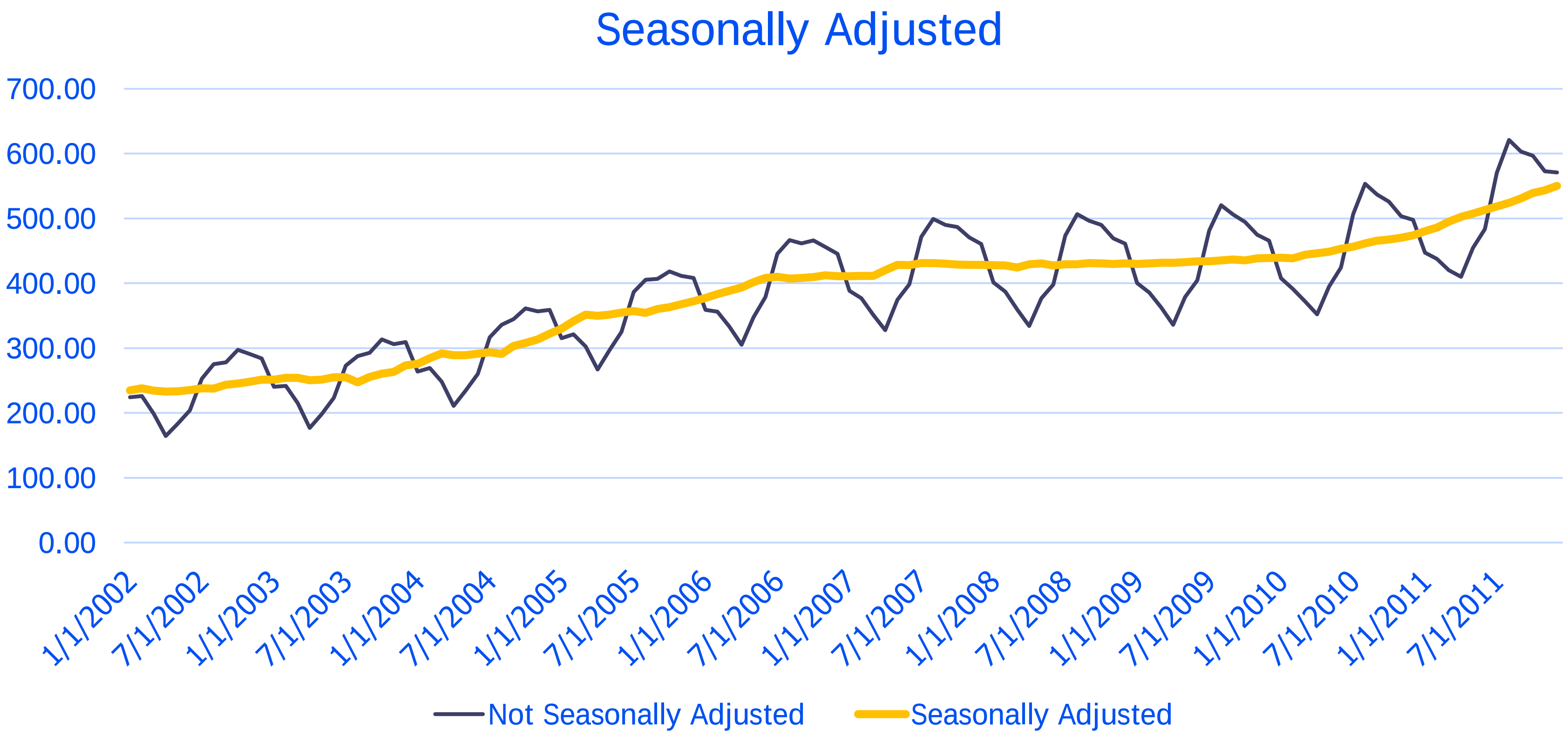
Event	Description	Scenario	Model	Graphic
Additive Outlier (AO)	Series is impacted at a single point in time (t)	Labor Strikes	1 for $t = t0$ 0 for $t \neq t0$	
Level Shift (LS)	Series is impacted and continues at new level	Hurricane Katrina	-1 for $t < t0$ 0 for $t \geq t0$	

- 1,000 series per model

Simulations



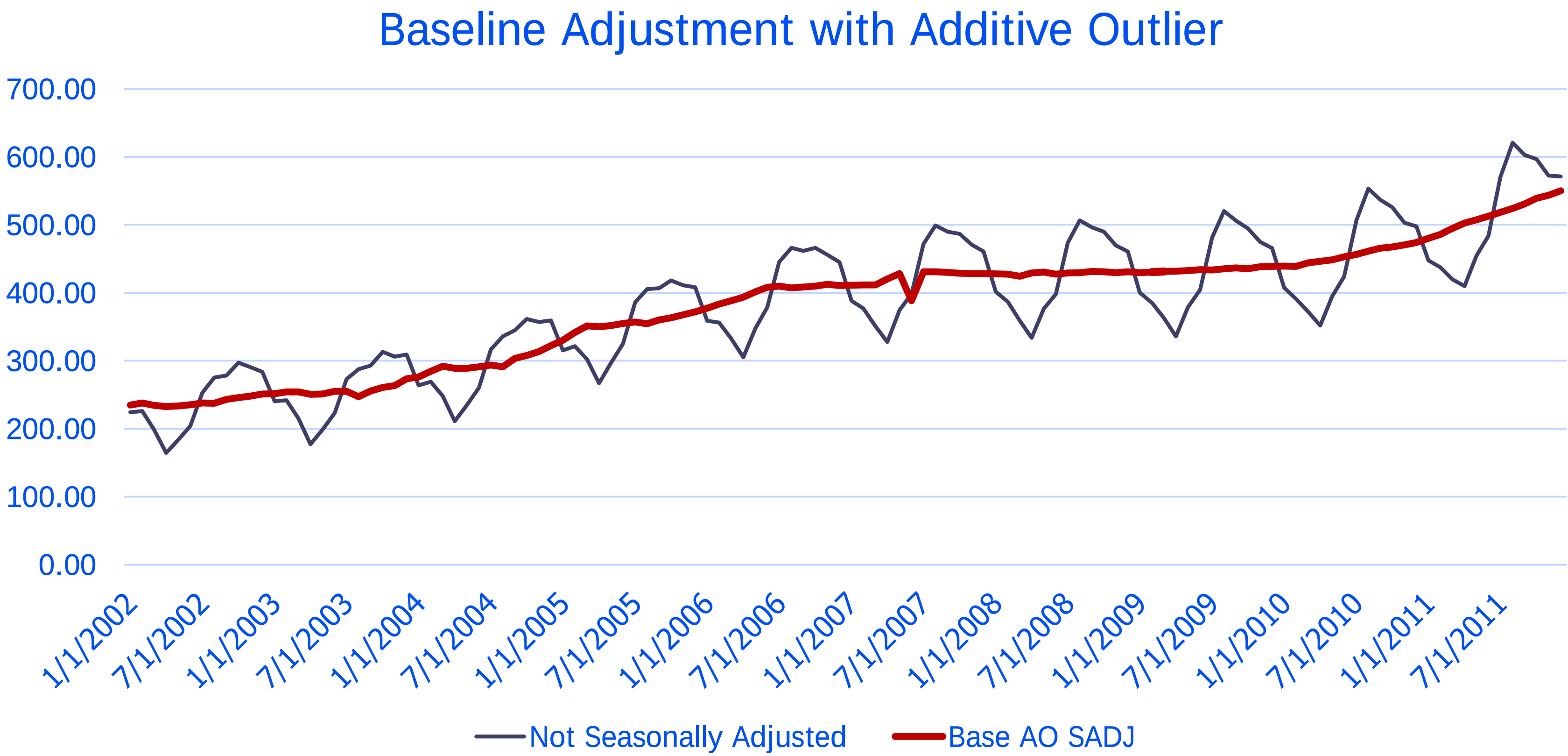
Simulations



Seasonally Adjusted:

where Z_t = ARIMA model noise component

Simulations



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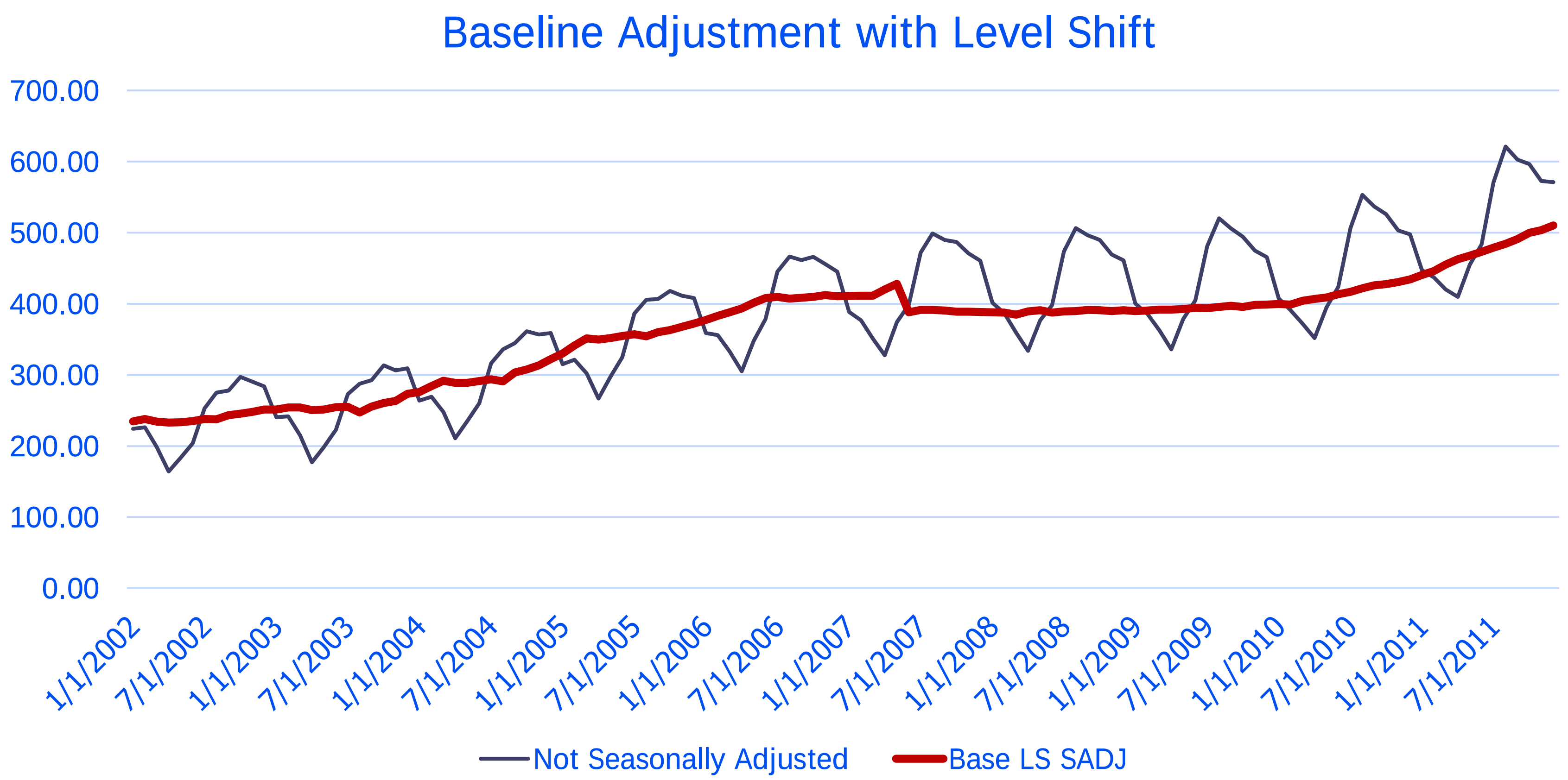

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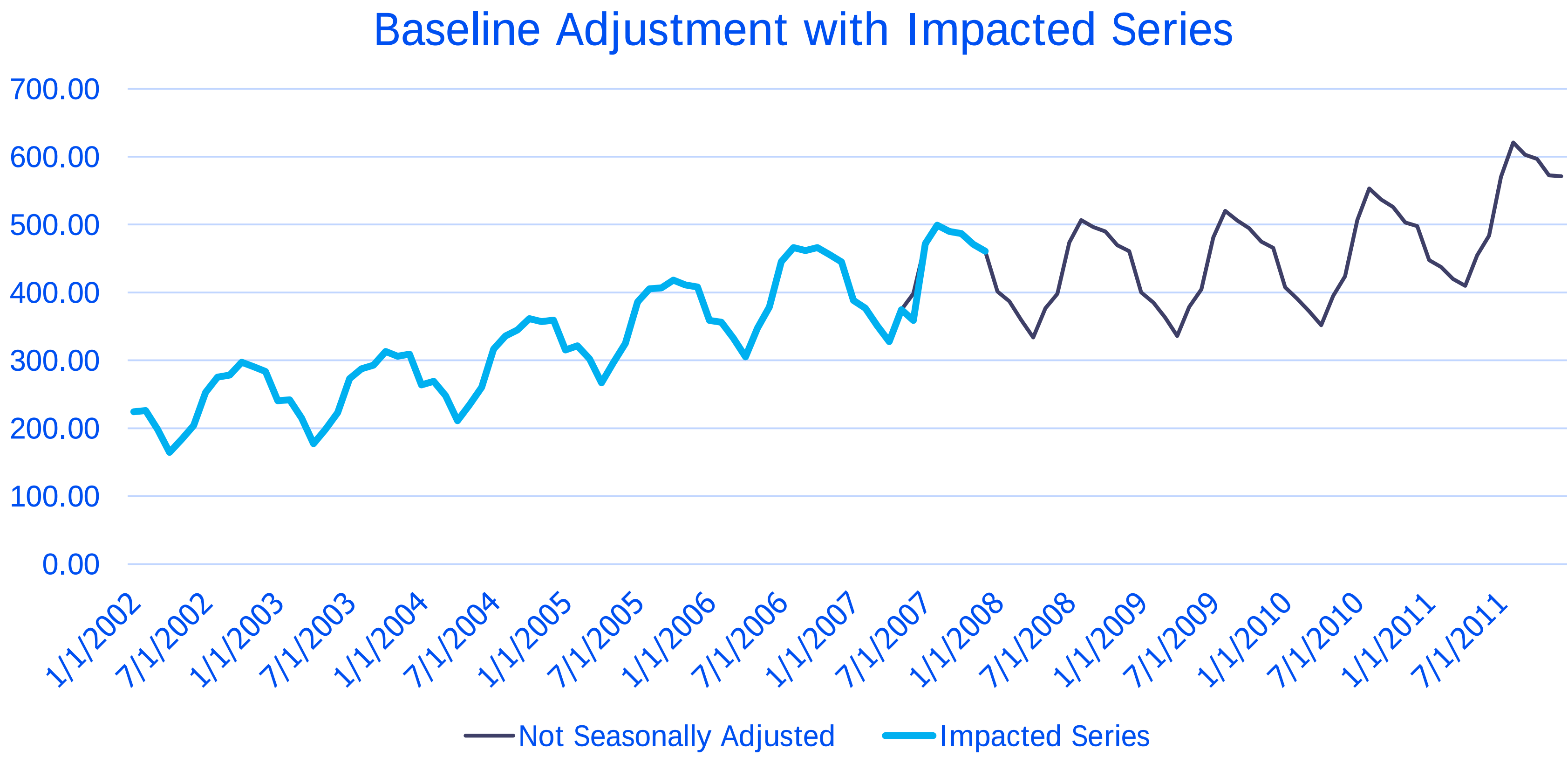
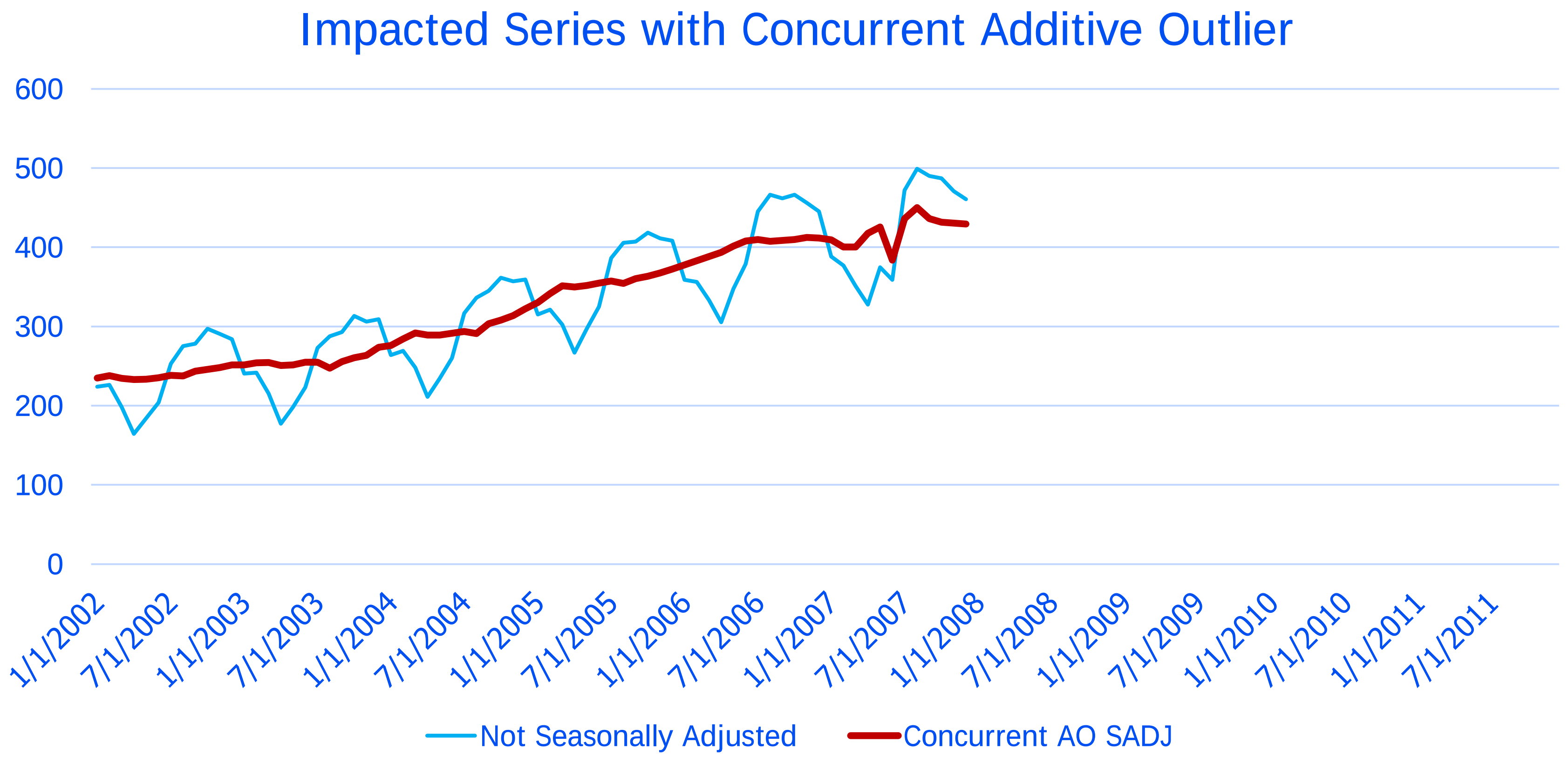


where Z_t = ARIMA model noise component
AO_t = Additive outlier detection parameter

Simulations



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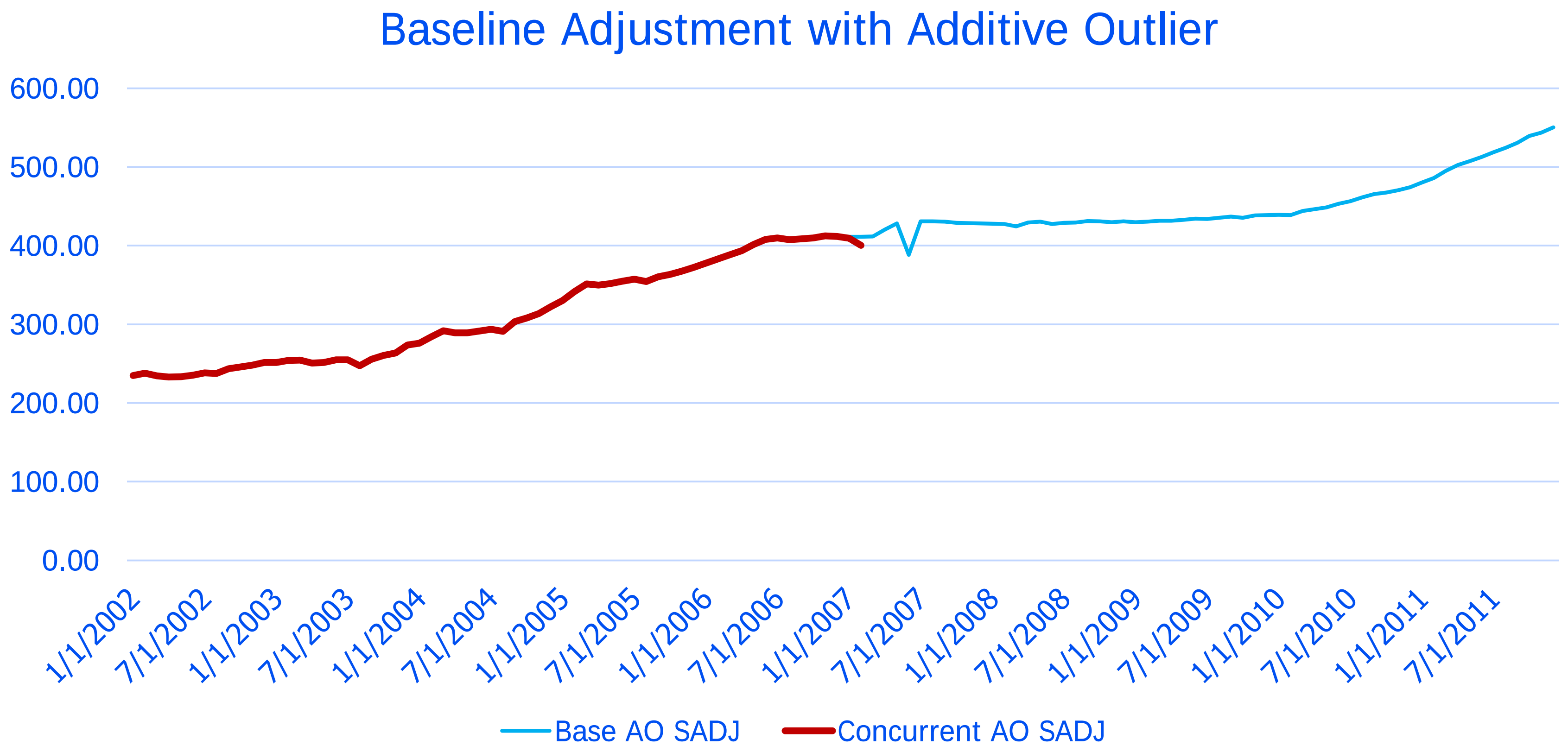

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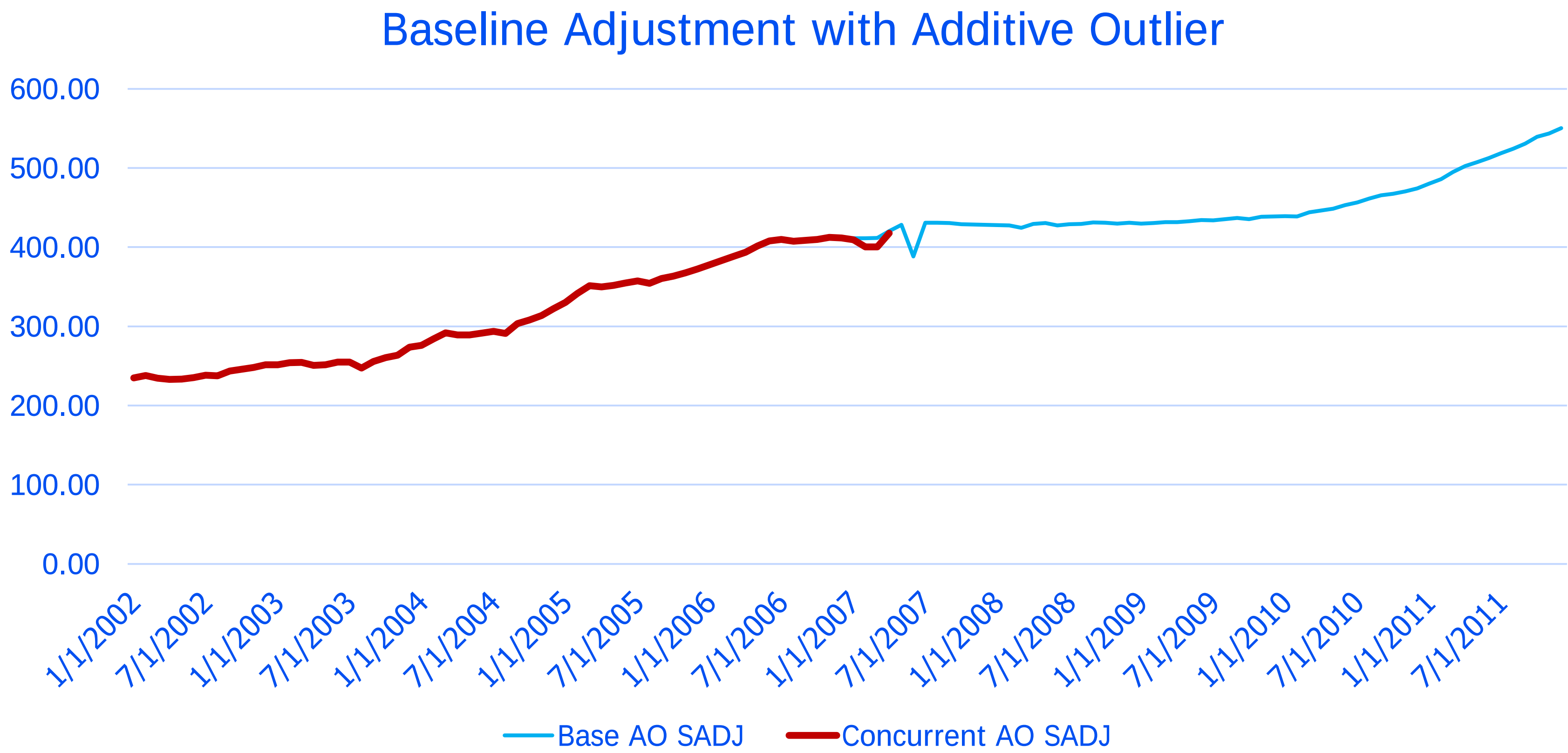

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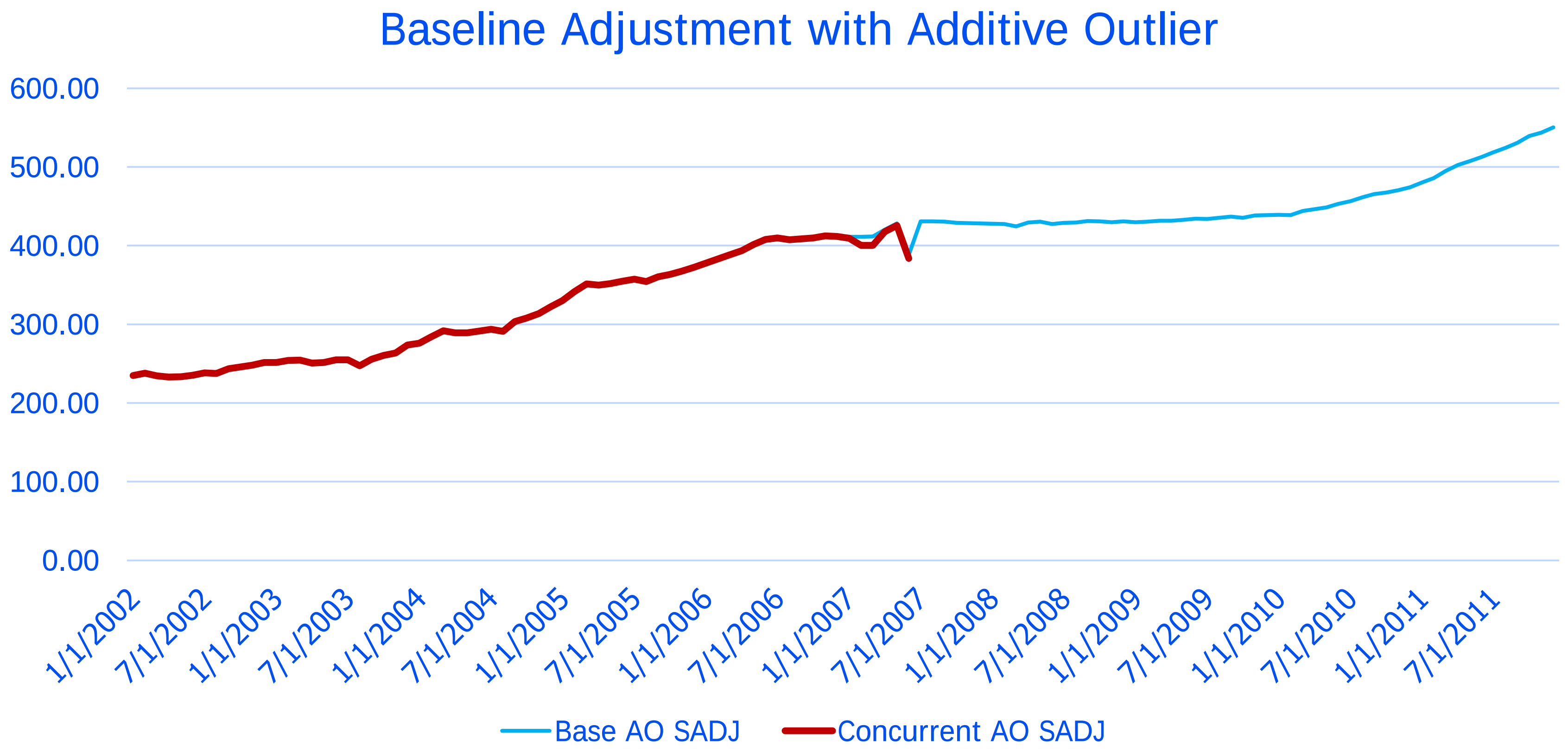

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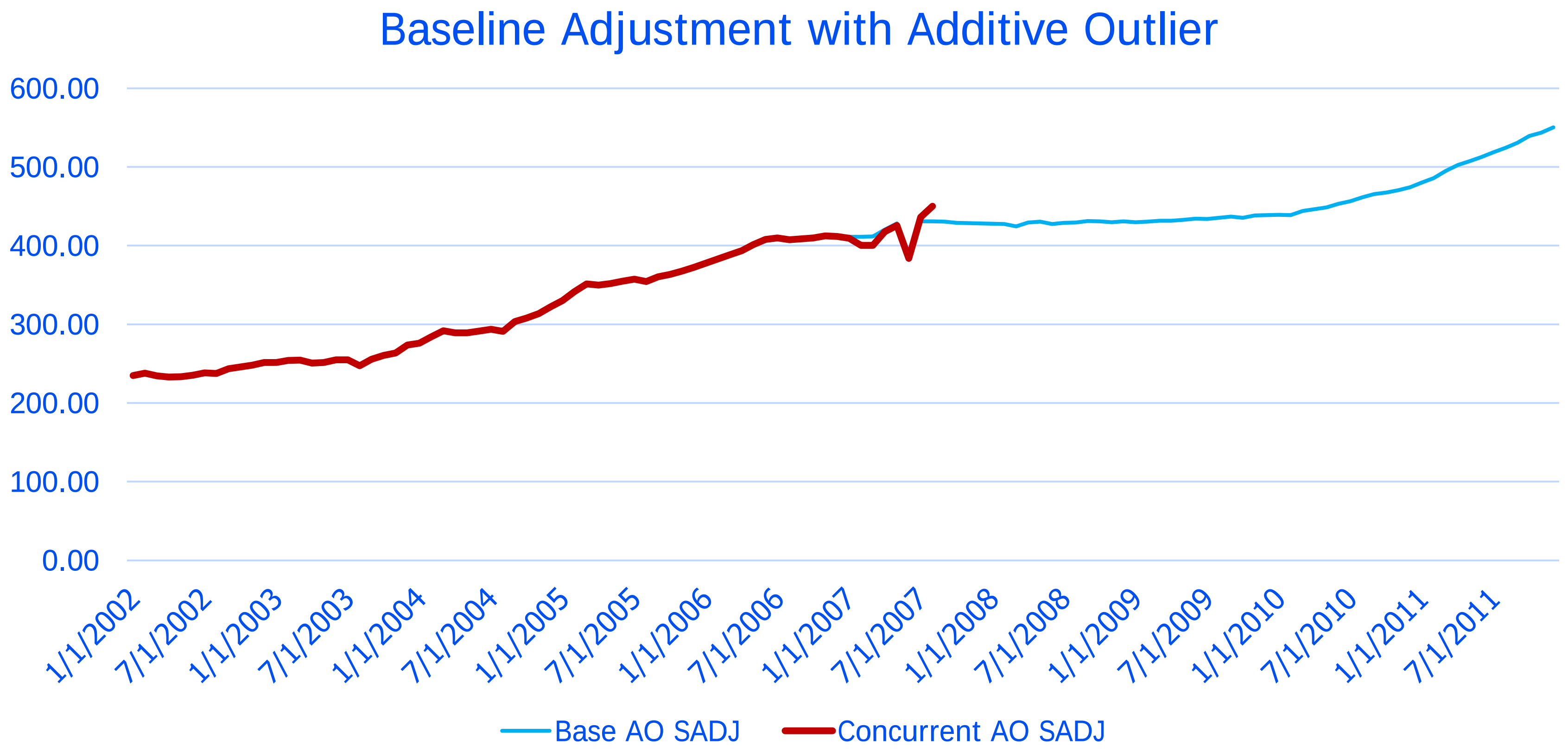

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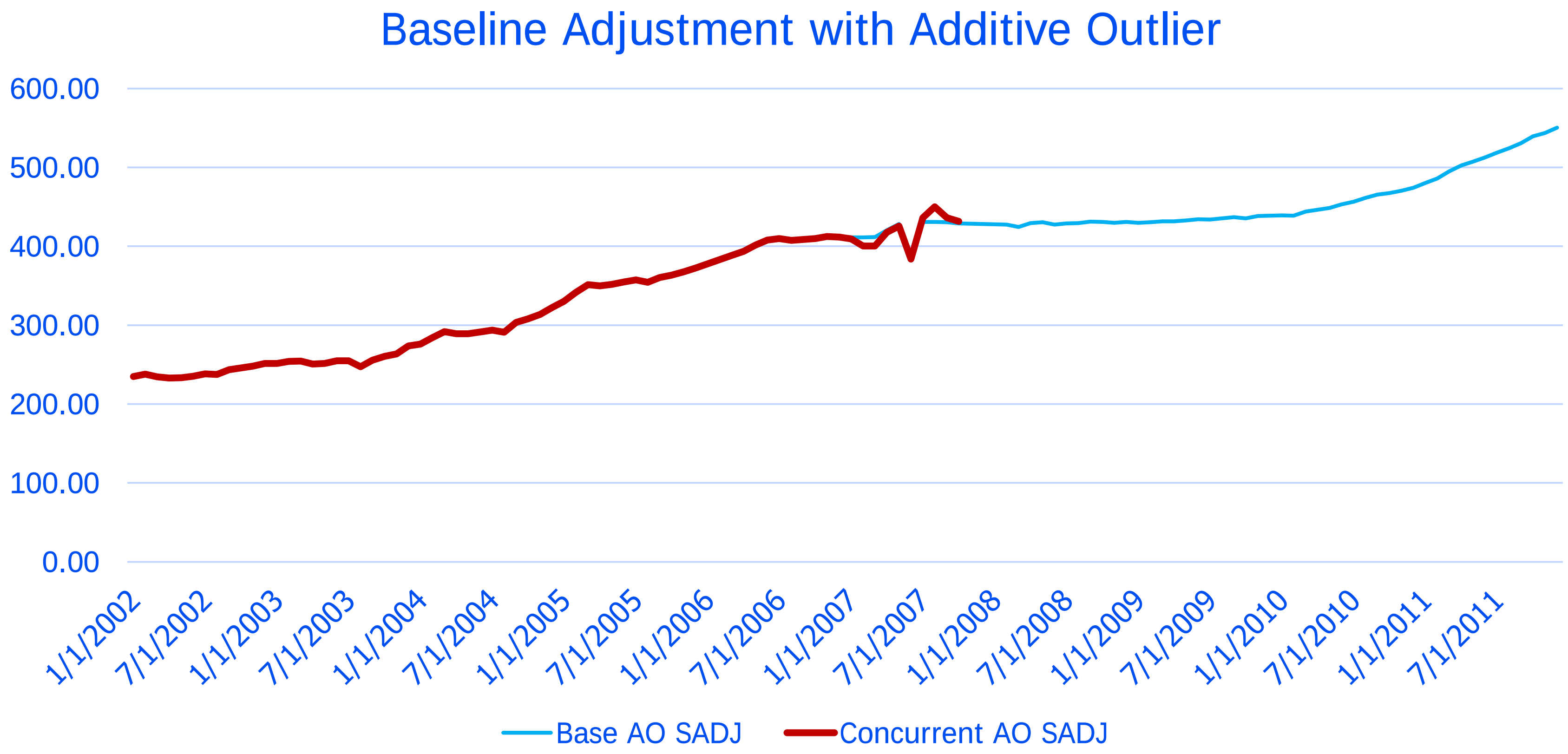
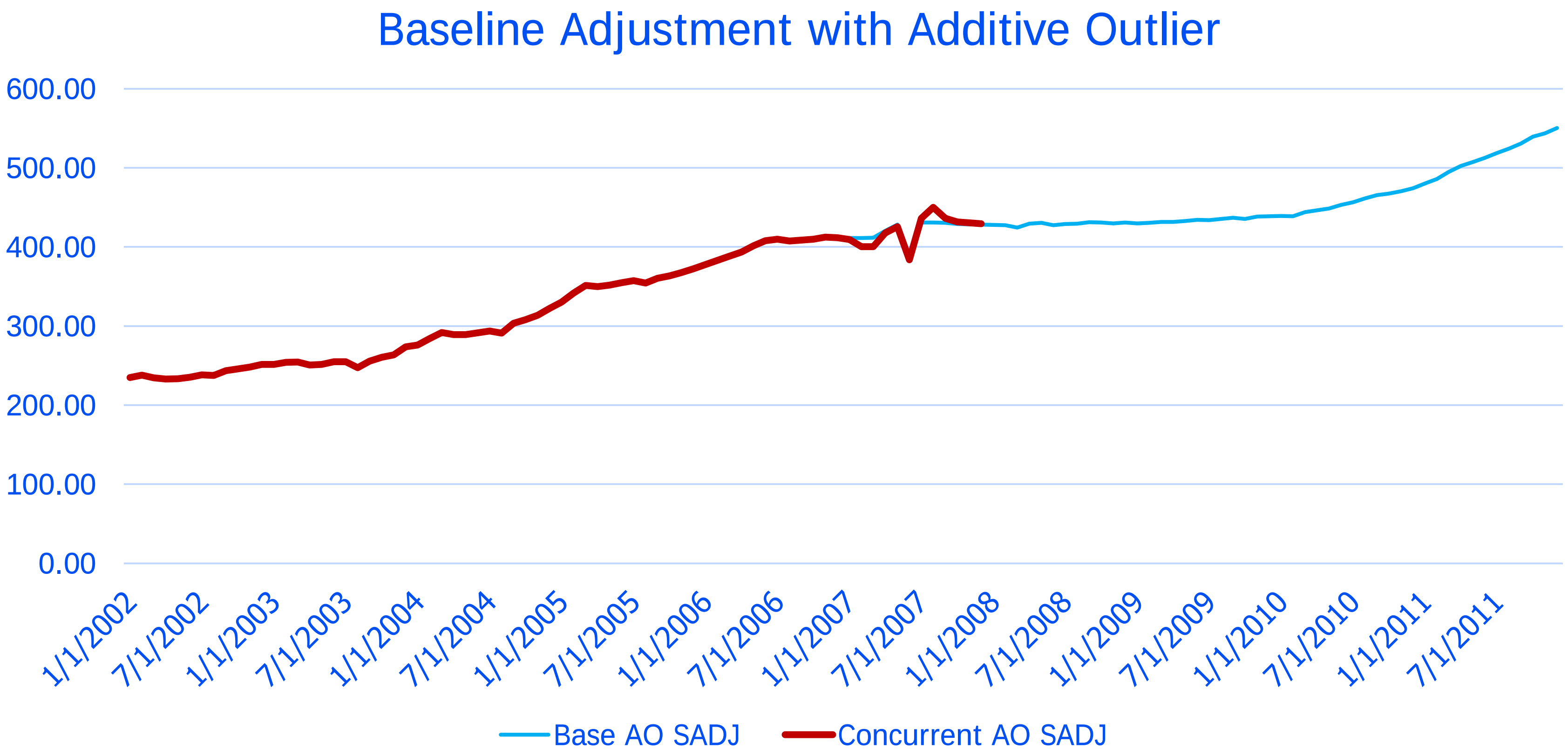


$$y_t = AOt\beta + Z_t$$

where Z_t = ARIMA model noise component
AO_t = Additive outlier detection parameter

Simulations



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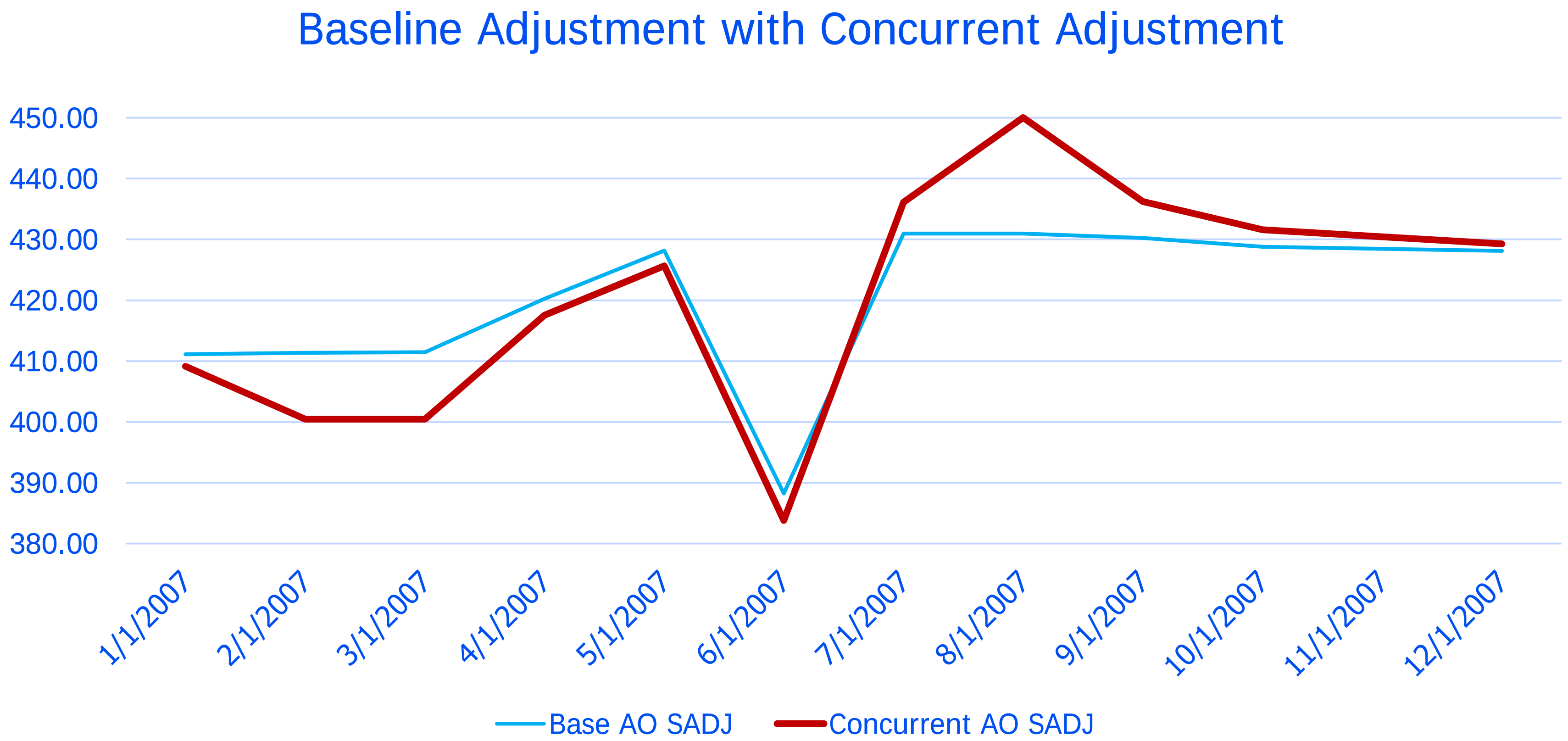

$$y_t = AOt\beta + Z_t$$

where Z_t = ARIMA model noise component
AO_t = Additive outlier detection parameter

Simulations

Event / Model		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85						
	5.00						
	8.00						
	10.00						
	No Detection						

Simulations

Event / Model		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85		X				
	5.00			X			
	8.00				X		
	10.00					X	
	No Detection						

Simulations

Event / Model		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85	X					
	5.00	X					
	8.00	X					
	10.00	X					
	No Detection	X					

Simulations

Event / Model		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85						
	5.00						
	8.00						
	10.00						
	No Detection	X	X	X	X	X	X

Simulations

Event / Model		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85						
	5.00						
	8.00						
	10.00	National CES					
	No Detection						

Results

Results

Gains from stricter Critical Value policy

AO (0,1,1)(0,1,1)		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85	4.386	4.579	4.480	4.429	4.430	4.430
	5.00	4.383	4.686	4.577	4.432	4.429	4.430
	8.00	4.383	4.857	4.939	4.671	4.480	4.430
	10.00	4.383	4.856	4.968	4.999	4.787	4.430
	No Detection	4.383	4.856	4.967	5.105	5.172	14.895

Results

Gains from stricter Critical Value policy

$$RMSE\ ratio_{e,m}(r) = \frac{RMSE(r_{e,m}^{sv})}{RMSE(r_{e,m}^{nv})}$$

$RMSE\ ratio_{e,m}(r) = \ 1$ "No Value"

Numerators = RMSE of stricter CV for event *e* and model *m*

Denominator = RMSE of no CV for event *e* and model *m*

Results

Gains from stricter Critical Value policy

AO (0,1,1)(0,1,1)		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85	1.001	0.943	0.902	0.868	0.857	0.297
	5.00	1.000	0.965	0.922	0.868	0.856	0.297
	8.00	1.000	1.000	0.994	0.915	0.866	0.297
	10.00	1.000	1.000	1.000	0.979	0.926	0.297
	No Detection	1.000	1.000	1.000	1.000	1.000	1.000

Results

Gains from stricter Critical Value policy

AO (0,1,1)(0,1,1)		Impact (In terms of equivalent t-value)					
		0.00	3.85	5.00	8.00	10.00	99.00
Critical Value	3.85	1.001	0.943	0.902	0.868	0.857	0.297
	5.00	1.000	0.965	0.922	0.868	0.856	0.297
	8.00	1.000	1.000	0.994	0.915	0.866	0.297
	10.00	1.000	1.000	1.000	0.979	0.926	0.297
	No Detection	1.000	1.000	1.000	1.000	1.000	1.000

Conclusion

Conclusion

- Transition to Concurrent Seasonal Adjustment
- Marginal gain from conducting outlier detection
- Model differences
  - No significant differences in terms of measure of gain