

# ECMT 475 HW3 Schulman Solutions

cts

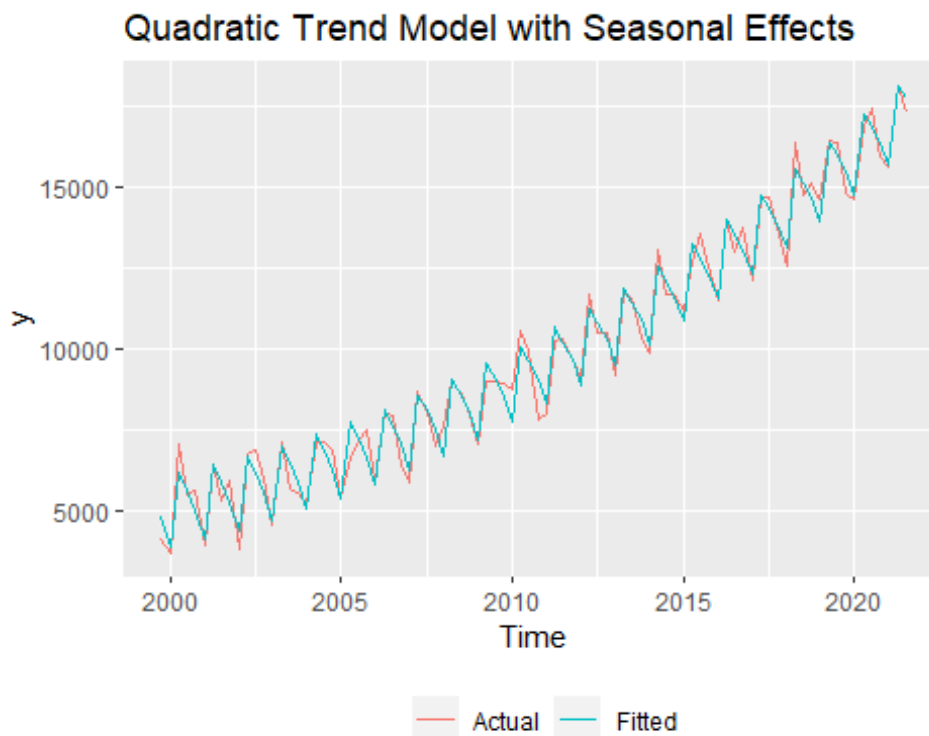
2024-02-14

## ECMT 475 HW3 Schulman Solutions

Vlad: These are my solutions and explanations for HW3. Let me know if you have any questions/suggestions

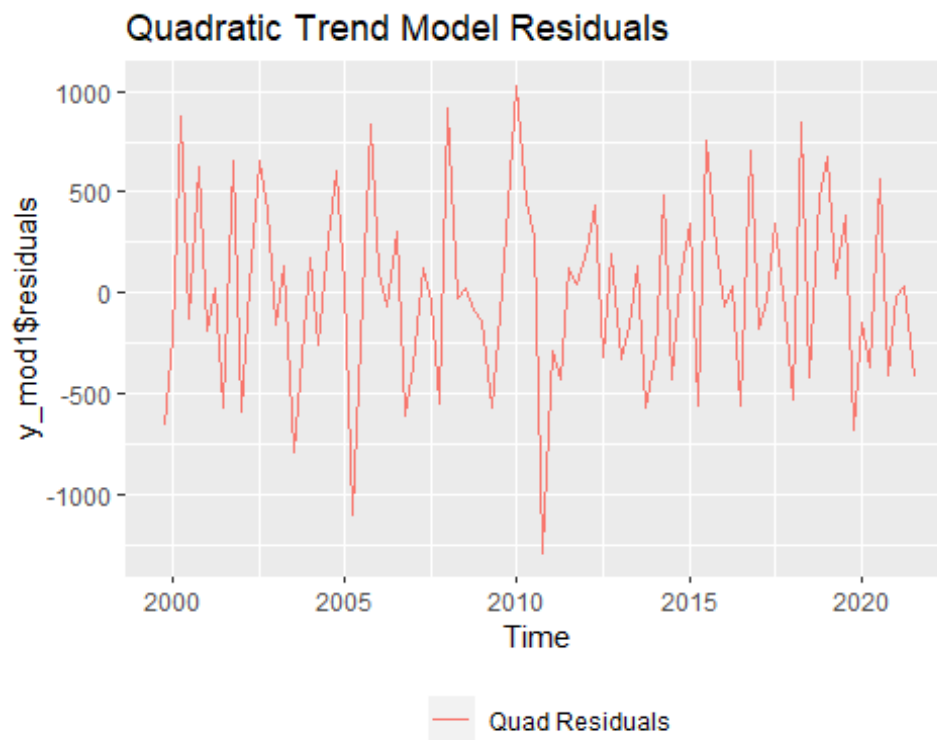
### Optional Actual-Fitted Plot

This actual-fitted plot is optional, it is not required.



## Quadratic model residual plots

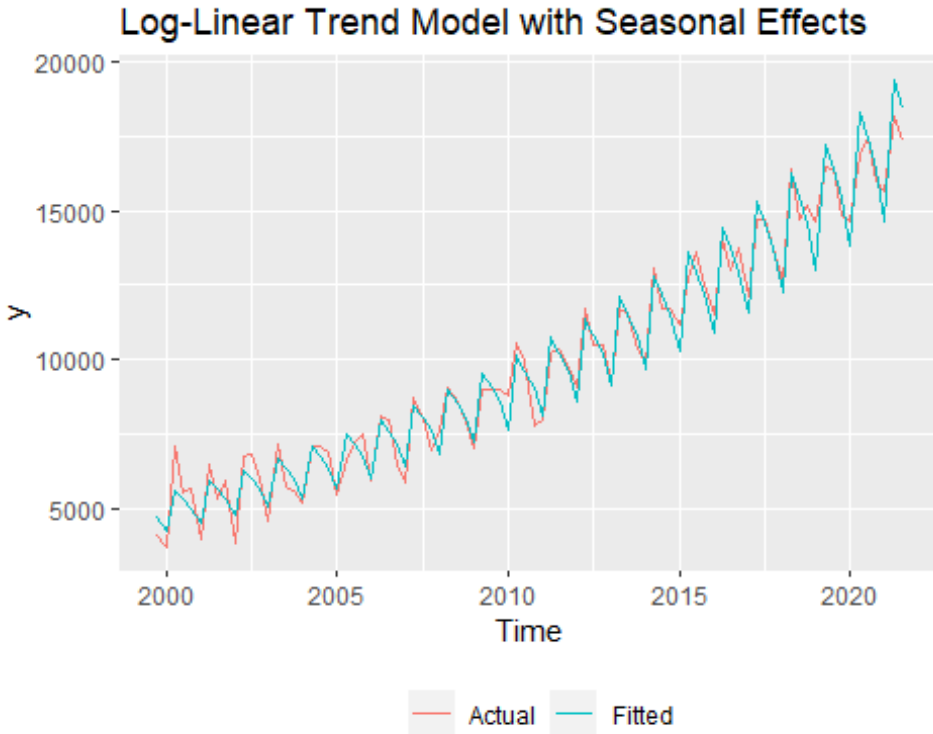
Part 1.2 - Quadratic model



## Quadratic Model Discussion

The residual pattern appears mostly uniform without heteroskedasticity. That is, errors appear to be additive.

Optional Log-Linear Actual-Fitted actual plot



## Log-Linear model residual plots

### Part 1.2 - Log-Linear Model

#### Log-Linear Trend Model Residuals



### Log-Linear Model Discussion

Residual pattern for the log-linear model shows residuals shrinking over time. This suggests the error term is NOT proportional.

### Answer to Part 1.3

Because the Quadratic model residual plots are uniform – no heteroskedasticity – and the Log-Linear model exhibits a decreasing residual pattern over time, the Quadratic model is more appropriate.

## Regression Output for Part 1.4

(Vlad: I took summary output from R into Excel to format as a table. Summary output from R is fine.)

Model: `tslm(formula = y ~ trend + I(trend^2) + season)`

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	3813.0	180.1	21.173	< 2e-16	***
trend	51.2	8.2	6.276	1.56E-08	***
I(trend^2)	1.006	0.1	11.34	< 2e-16	***
season2	2226.0	144.9	15.365	< 2e-16	***
season3	1633.0	144.9	11.272	< 2e-16	***
season4	939.6	144.9	6.486	6.23E-09	***

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 480.4 on 82 degrees of freedom

Multiple R-squared: 0.9848, Adjusted R-squared: 0.9839

F-statistic: 1064 on 5 and 82 DF, p-value: < 2.2e-16

## Answer for Part 1.4

Seasonal trough is Q1 – season effects for Q2 - Q4 are all positive. Seasonal peak is Q2 – season2 effect is the largest.

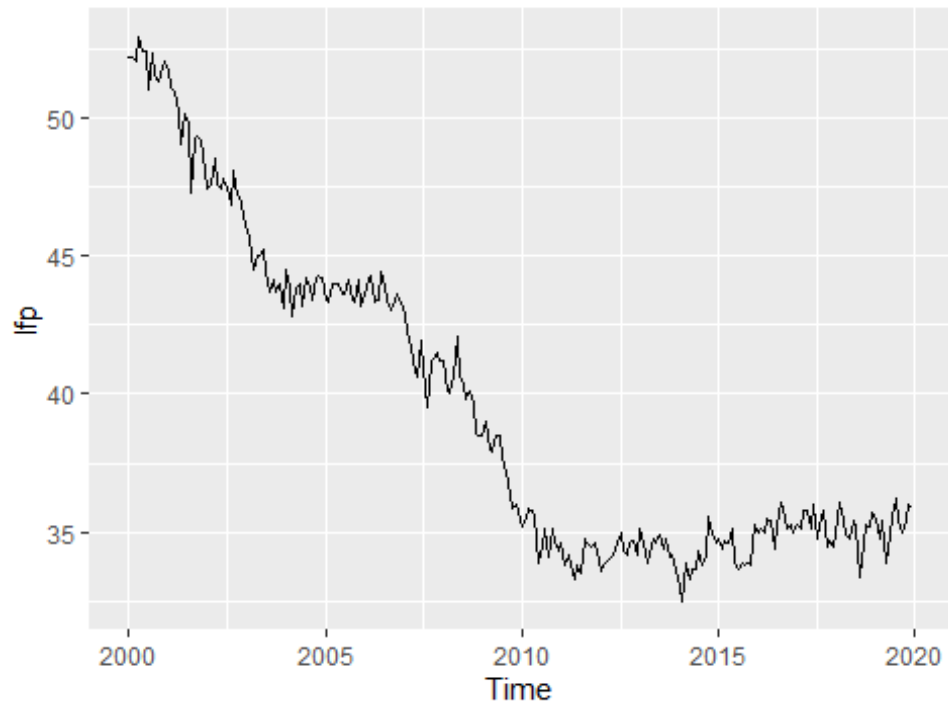
## Answer for Part 1.5

Given  $T = 88$  and ends in 3<sup>rd</sup> Quarter 2021, the  $T + 3$  forecast equation would be for 2<sup>nd</sup> Quarter 2022 and would be written:

$$Y_{T+3|T} = 3813 + (51.2 \times 91) + (1.006 \times 91^2) + 2226$$

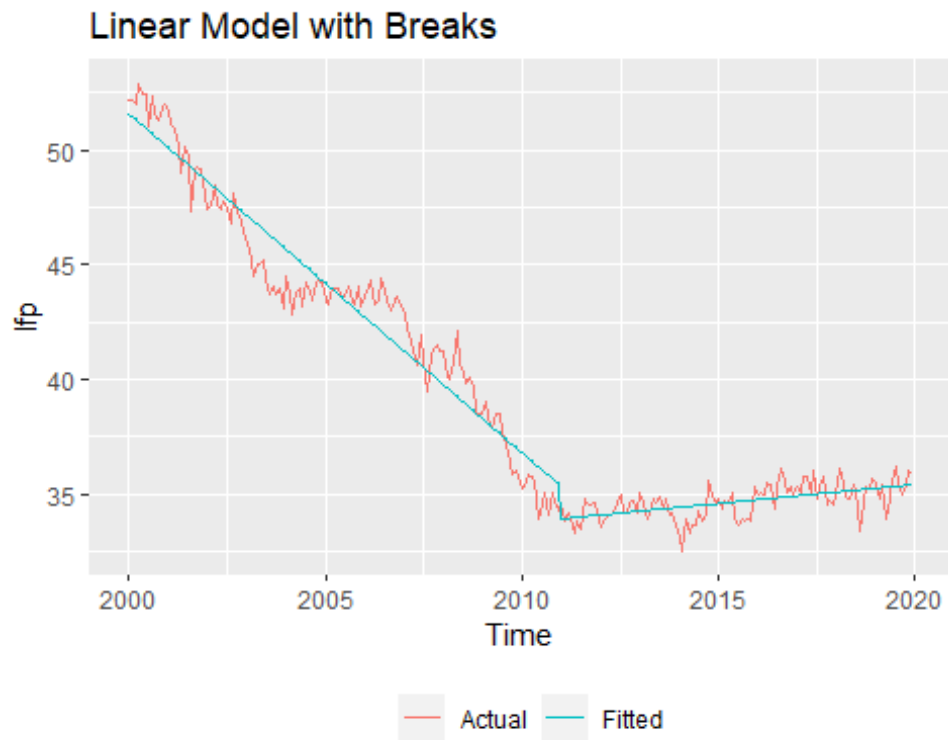
## Part 2.2

### Labor Force Participation Rate: Ages 16–19



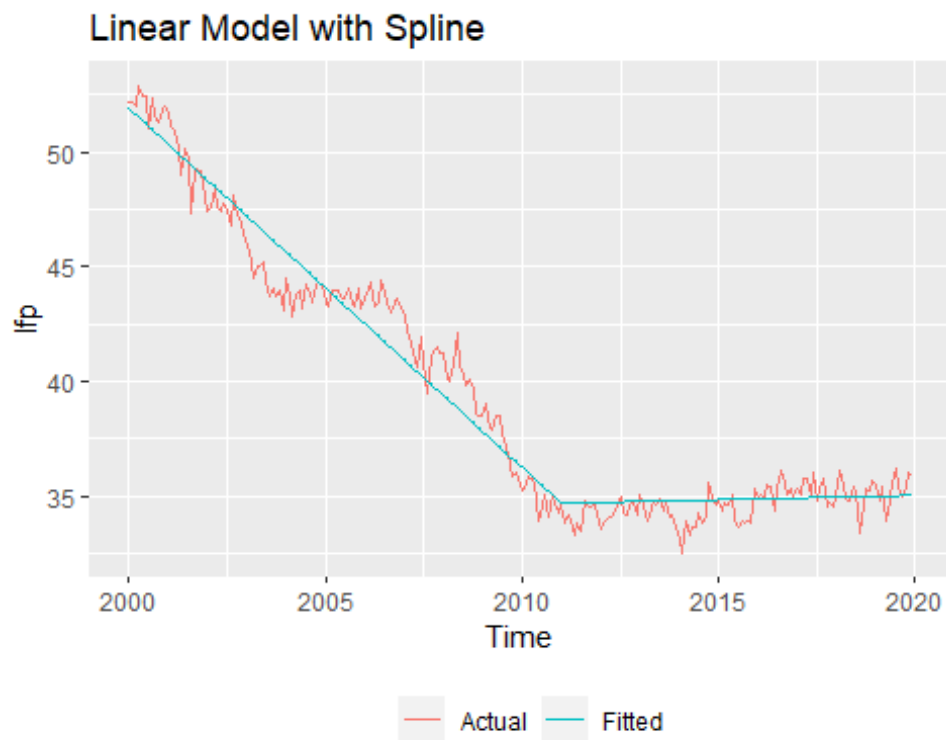
## Part 2.3

Actual-fitted plot with trend break at Jan. 2011.



## Part 2.4 Linear trend model with Spline

Actual-fitted plot with Spline break at Jan. 2011.



Vlad: Note that in my code, I included code that searches for an 'unknown' break point by allowing the break dummy to vary from Jan 2010 to Dec 2011 to find the minimum SSE model. This suggests the break occurred in June 2010. This portion is NOT required for the homework.