

EXERCISE 4
KEY

Purpose: To learn how to build a suitable UCM model for some real economic data. You are to hand in this exercise in class on **Tuesday, September 27**.

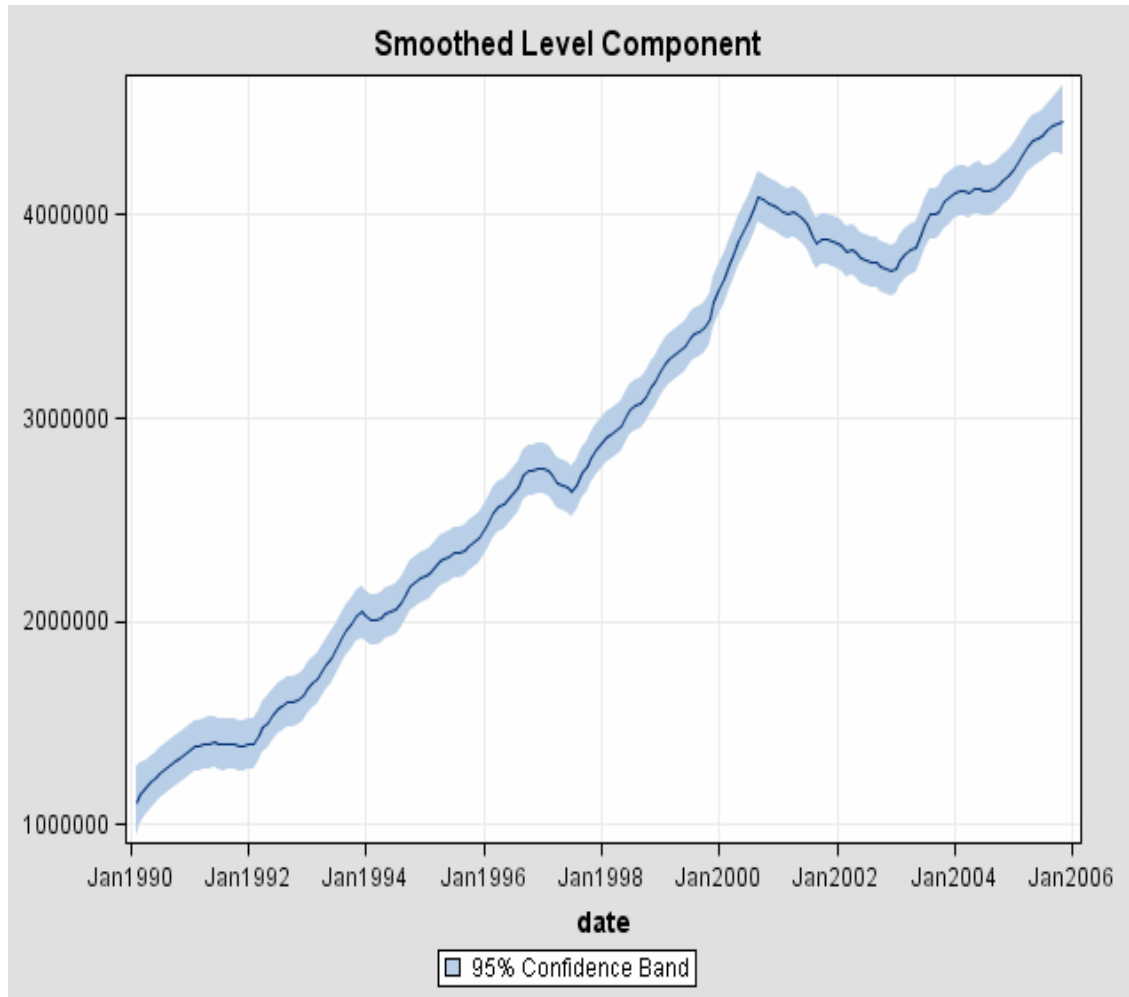
a) I want you to download the SAS program UCM_Plano.sas from the class website. This is a “shell” program to help you in completing this exercise. In particular you are to fill in the table on the next page by adding the appropriate SAS Code to the program and then running it. What you should do is cut and paste the relevant sections from the program BSM.sas that we have discussed in class and modify it slightly to use “rev” as the “model” variable in each Proc UCM step you use. Moreover, the data set where the data is to be found is in “Plano” as compared to “Airline” in the BSM.sas program. When you fill out the Goodness-of-fit table on the next page you should be able to figure out which of the UCM models is to be preferred for the Plano Sales Tax Revenue data. That model is **BSM2** . Explain to me why you have chosen this model. **BSM2, because it has the lowest AIC and BIC and number of error autocorrelations outside of the 95% confidence intervals is within threshold 3. See the Variance Components table below:**

Model	Description	Variance Components	AIC	BIC	Residuals w. n. *
BSM	stochastic level	$\sigma_{\eta}^2 > 0$	4891.3	4904.0	3
	stochastic slope	$\sigma_{\xi}^2 > 0$			
	stochastic dummy season	$\sigma_{\omega}^2 > 0$			
BSM2	stochastic level	$\sigma_{\eta}^2 > 0$	4889.3	4898.9	3
	fixed slope	$\sigma_{\xi}^2 = 0$			
	stochastic dummy season	$\sigma_{\omega}^2 > 0$			
BSM3	stochastic level	$\sigma_{\eta}^2 > 0$	4966.3	4972.7	7
	fixed slope	$\sigma_{\xi}^2 = 0$			
	non-stochastic dummy season	$\sigma_{\omega}^2 = 0$			
BSM4	stochastic level	$\sigma_{\eta}^2 > 0$	4893.7	4912.8	2
	fixed slope	$\sigma_{\xi}^2 = 0$			
	stochastic dummy season	$\sigma_{\omega}^2 > 0$			
	one stochastic cycle	$\sigma_{\nu}^2 > 0$			
BSM5	stochastic level	$\sigma_{\eta}^2 > 0$	4898.6	4927.2	2
	fixed slope	$\sigma_{\xi}^2 = 0$			

	stochastic dummy season	$\sigma_{\omega}^2 > 0$			
	two stochastic cycles	$\sigma_{v_1}^2 > 0, \sigma_{v_2}^2 > 0$			
BSM6	stochastic level	$\sigma_{\eta}^2 > 0$	4893.3	4909.2	3
	fixed slope	$\sigma_{\xi}^2 = 0$			
	stochastic dummy season	$\sigma_{\omega}^2 > 0$			
	one non-stochastic cycle	$\sigma_v^2 = 0$			
BSM7	stochastic level	$\sigma_{\eta}^2 > 0$	4893.3	4909.2	3
	fixed slope	$\sigma_{\xi}^2 = 0$			
	stochastic dummy season	$\sigma_{\omega}^2 > 0$			
	Autoregressive part	$\sigma_u^2 > 0$			

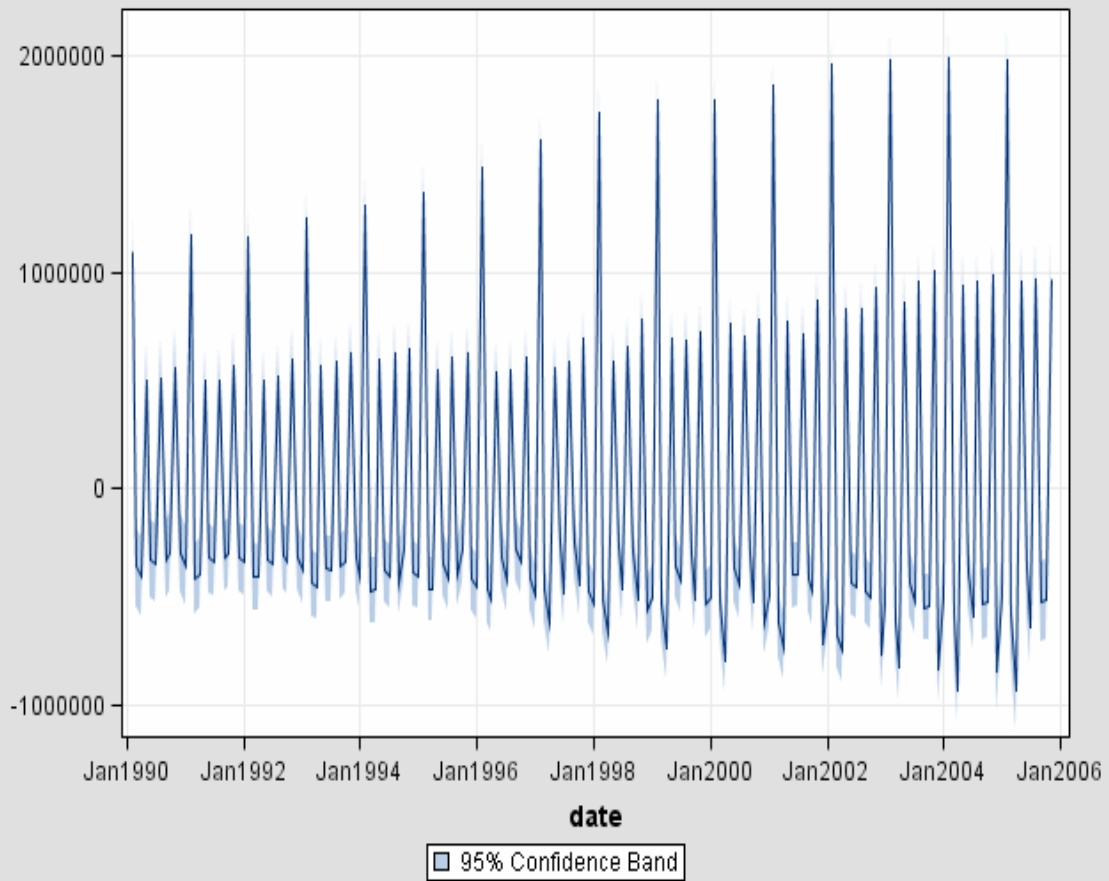
* Number of autocorrelations that are outside of their 95% confidence intervals. Remember, don't count the autocorrelation at lag = 0 because it is equal to one **by definition**. Any number above 3 occurrences would indicate the lack of white noise residuals.

b) For the model you have chosen in part a), I want you to print out the graphs of the smoothed versions of the unobserved components that make up the model and hand them in with this exercise.

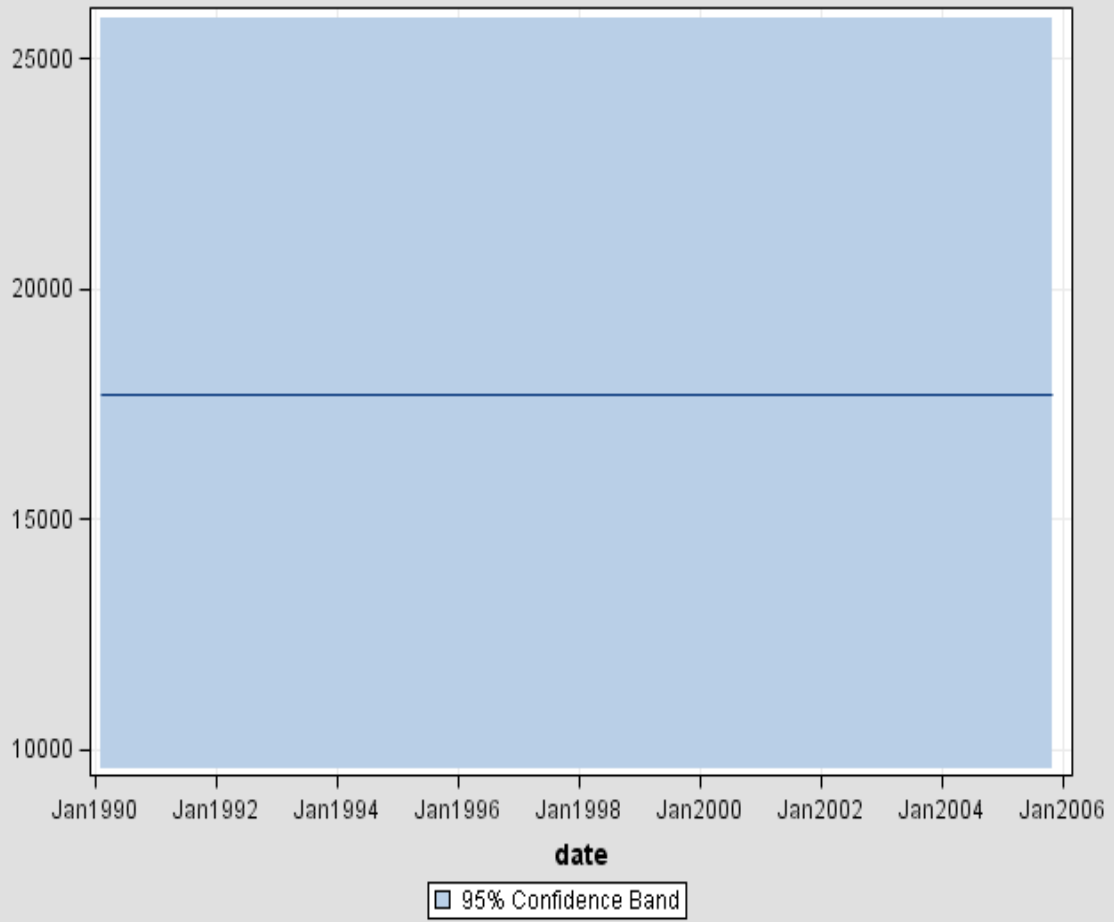


Smoothed Seasonal Component

Season Length = 12



Smoothed Slope Component



c) In this part we are going to report the forecasts for Plano's sales tax revenue for December of 2005 and for January, 2006 – December 2006. Report your forecasts in the second table that follows. You should also be including the 95% confidence intervals for the point forecasts that you make.

BSM Forecasts for Plano Sales Tax Revenue			
Months	Monthly Forecast	95% Confidence Interval	
Dec.'05	3640115.2	3198604.3	4081626.2
Jan.'06	4006020.4	3560120	4451920.8
Feb.	6502722	6043544.2	6961899.9
Mar.	3956151	3483385.5	4428916.6
Apr.	3613691.8	3127474.2	4099909.4
May	5529597.8	5030195.4	6029000.2
June	4218686.5	3706437.9	4730935.1
July	3965676.4	3441009.1	4490343.7
Aug.	5592811.1	5056327.2	6129294.9
Sep.	4117461.6	3570171.9	4664751.2
Oct.	4144923.1	3588970.3	4700875.8
Nov.	5642665.1	5083612.7	6201717.4
Dec.	3852755.2	3229257.5	4476252.9

d) Given the forecasts you have made in part b) above, I want you to fill in the following blanks:

Total Tax Revenue for Plano in 2005 (including the December 2005 forecast) =

\$52,578,239.20

Total Forecasted Tax Revenue for Plano in 2006 = \$55,143,162.00

The percentage increase in Tax Revenue that is forecasted for 2006 as compared

to 2005 = 4.87830 %.