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Homework 4

Q1

1). Dummy variable regression methods are key in modeling seasonality in regression models. To seasonally adjust a series, binary regressors can be implemented into the model to adjust for seasonal vairiables. These binary regressors are sometimes called a "dummy" variable. Instead of including a full set of these binary regressors, we can include any seasonal dummies (s-1) and an intercept. The constant term is the intercept for the omitted season. With this, the coefficients on the seasonal dummies give the seasonal increase/decrease relative to the omitted season. This allows for the model to seasonally adjust a series without dropping the seasonal factors - rather it includes them in the model and tries to account for the effect the seasonal vars have on the model.

2). The U.S. Census Bureau uses the X-13ARIMA-SEATS software to account for seasonal adjustments. This software is specifically developed & maintained by the bureau. With this, the bureau adjusts series for outliers using regression effects before seasonal adjustment. These outlier effects are an important part of the economic story the series tells, however, and so they are returned to the seasonally adjusted series after the final estimation of the seasonal factors. They use the models to also provide forecasts of series values for the estimation during the filtering, through the bureaus various methods.

More on back!

Q2

1). $D_1 = (2, 0, 0, \ldots)$: $\hat{y}_1 = \hat{y}_1/2$

- In this case, the change in the first dummy variable to '2' represents an increase in seasonal changes in that time during the quarter. This intercept would increase, as we are regressing on the intercept.

2). $D_1 = (-10, 0, 0, \ldots)$: $\hat{y}_1 = -\hat{y}_1/10$

- Following similar logic, the change in this first dummy variable to '-10' represents a decrease in seasonal changes in the quarter during that time. This intercept would decrease, as we are regressing on the intercept.

3). $D_1 = (1, 1, 0, \ldots)$: $\hat{y}_2 = \hat{y}_2 - \hat{y}_1$

- The change in the first two dummy vars to '1' represents a stable increase followed by a plateaued decrease in seasonal changes during the quarter in that specific time frame. This intercept would increase, than decrease, as a result of not being able to seasonally adjust and include those seasonal changes.

Q3

1). In this model, I would use 4 total dummies for each quarter.

2). In this model, I would use 4 dummies for months of trimester.

3). In this model, I would use 2 dummies, one for Nov. - Dec.; other.

More on back!

Q4.

1). The units of β_0, δ_s, and δ_w are in dollars.

2). δ_w to estimate average income firm receives per wedding.

3). I would modify the model by including a time-trend to account for the effects of inflation increases.

Q5.

1). log-linear trend model: adj. $R^2 = 0.8428$
seasonal model: adj. $R^2 = 0.997$
log-linear + seasonal model: adj. $R^2 = 0.9998$
log-quadratic + seasonal model: adj. $R^2 = 1$
- The higher the adj-R^2, the better the model fits the data. In this case, the log-quadratic + seasonal model best fits the data with it's adj-R^2 value of 1.

2). log-quadratic + seasonal model diagnostic statistics:
AIC = -1,099.345 ; BIC = -1,042.088 ; DW-Test = 0.58138
These values for AIC & BIC are relatively small, which means the data fits the model well. The DW Test also shows a positive autocorrelation, with its value of 0.58138. It exhibits a positive autocorrelation since the forecast trends in the same direction as the data. It matches the data very closely.

3). log-linear + seasonal model: AIC = -509.9491 ; BIC = -456.5096
log-quadratic + seasonal model: AIC = -1099.345 ; BIC = -1042.088
- By looking at the best model based on the AIC and BIC selection criterions, it is clear that the log-quadratic + seasonal model is the best fit for the data provided. All other models seem to agree w/ this, as they have smaller R^2 & larger AIC/BIC scores compared to the log-quad + seasonal model.

4). *See R-code for all forecasted values for 2015.01 - 2015.12*

2015.01 $\approx$ (7.588193, 7.681074)

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2015.12 $\approx$ (8.067043, 8.159864)