Ch. 6. Business and Economic Forecasting

1. Introduction- the importance of forecasting

2. Survey Techniques
   a. Prominent surveys
      i. U.S. Department of Commerce
      ii. Securities and Exchange Commission
      iii. Survey Research Center at Univ. of Michigan
         1. Consumer Confidence Index
   b. Forecast reliability
      i. Root mean squared error

3. Taking Apart a Time Series
   a. Four components
      i. Trend (T)
      ii. Seasonal variation (S)
      iii. Cyclical variation (C)
iv. Irregular movements (I)

\[ Y = T \times S \times C \times I \]

4. How to Estimate a Linear Trend
   a. \[ Y = A + Bt \]

b. Ordinary Least Squares estimator for \( b \) is:

c. Ordinary Least Squares estimator for \( a \) is:

5. How to Estimate a Nonlinear Trend
   a. Quadratic form:
      i. \[ Y_t = A + B_1 t + B_2 t^2 \]

      ii. How do you input squared \( t \) in Excel regression package?
iii. Which is better fit, linear or quadratic?

1. Answer: if B_2 is statistically significant, then quadratic is the best fit.

2. Answer: if B_2 is not statistically significant, and B_1 is significant than the linear model is best.

b. Exponential trend:

i. \( Y_t = \alpha \beta^t \)

   1. alternative way of writing this is
   a. \( Y_t = \alpha (1 + r)^t = Y_0 (1 + r)^t \), where \( \beta = (1 + r) \), \( r = 1 - \beta \)

   b. This is compound growth

   c. This is nonlinear, but can be made linear using logarithms.

   d. \( \log Y_t = \log(\alpha) + \log(\beta^t) \)
   
     \[ = \log(\alpha) + t \log(\beta) \]
   
     \[ = A + Bt \), where \( A = \log(\alpha) \) and \( B = \log(\beta) \),
   
     so \( \beta = e^B \)

     and \( r = 1 - \beta \)

   This is a simple linear regression.
6. Seasonal Variations

   a. Dummy variables D = 0 or 1
      i. What is a dummy variable?

   e.g., U.S. Savings Bonds sales are higher in war times

   \[ E(B) = A + BY + CW \]

   Where \( B \) is bond sales, \( Y \) is income

   Where \( W = 0 \) for peacetime
   \[ W = 1 \] for wartime

   \[ E(B) = 1.29 + 0.68Y + 2.30W \]

How many bonds will be sold when I = 10 and W = 1 (war time)?

How many bonds will be sold when I = 10 and W = 0 (peace time)?

ii. Examples
   1. Gender?
      a. How many categories?
      b. How many dummies?

   2. Educational level?
      a. How many categories?
      b. How many dummies?

   3. Others?

4. Summary: need \( n-1 \) dummy variables for \( n \) categories, if you are including an intercept term already
iii. Seasonal dummies:

1. \( Y = A + B_1 t + B_2 Q_1 + B_3 Q_2 + B_4 Q_3 + e_t \)

Where \( Q_1 = 1 \) if time is in 1\(^{st}\) quarter
Where \( Q_2 = 1 \) if time is in 2\(^{nd}\) quarter
Where \( Q_3 = 1 \) if time is in 3\(^{rd}\) quarter

2. Interpreting dummy variables
iv. Excel example

Econ 4140/5140 Assignment
Managerial Economics

**Dummy Variables**

With Excel's regression feature, use quarterly dummy variables to estimate the regression equation using a linear time trend. Show your regression results. Forecast the sales for 2004I and 2004 II

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