Economics 310
Fall 2004
University of Wisconsin-Madison

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Social Sciences 7418

Prediction and Multiple Regression

1. Simple Regression, Residuals, and Confidence/Prediction Intervals

Dependent Variable: USIGB_
Method: Least Squares
Date: 12/02/03 Time: 14:52
Sample: 1961:1 2003:1
Included observations: 169

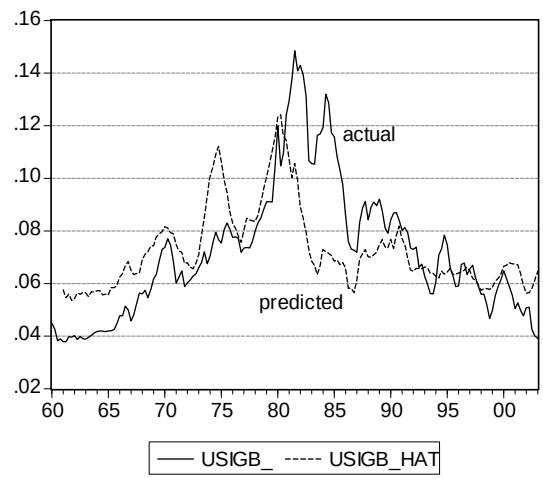
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.049855	0.002720	18.33019	0.0000
USINFL1Y	0.514719	0.050905	10.11129	0.0000

R-squared	0.379732	Mean dependent var	0.072622
Adjusted R-squared	0.376017	S.D. dependent var	0.025109
S.E. of regression	0.019834	Akaike info criterion	-4.991068
Sum squared resid	0.065696	Schwarz criterion	-4.954027
Log likelihood	423.7452	F-statistic	102.2383
Durbin-Watson stat	0.070167	Prob(F-statistic)	0.000000

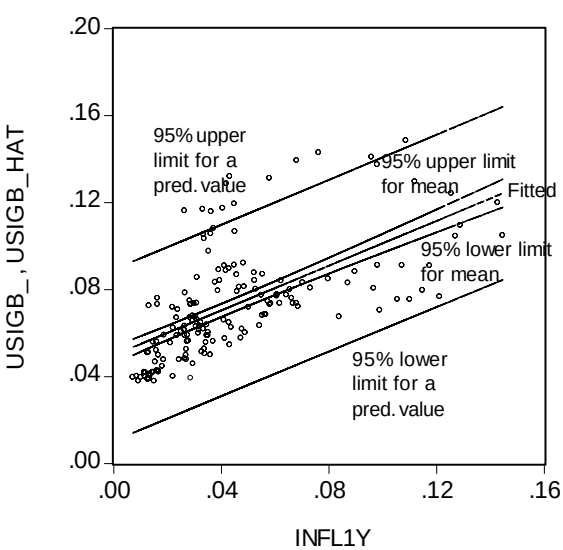
The graph below left is of the actual series (y) and the predicted ($\hat{y}$), where the OLS regression is:

$$\hat{y} = 0.049855 + 0.514719 \times x$$

Below right are some actual and fitted values, and resulting "residuals" (what the textbook calls "errors"), for observations i=2001q1 to 2003q1. These columns correspond to the variables x_i, y_i $\hat{y}_i$, and $y_i - \hat{y}_i$



obs	USINFL1Y	USIGB_	USIGB_HAT	USIGB_-USIGB_HAT
2001:1	0.033895	0.050500	0.067302	-0.016802
2001:2	0.033718	0.052700	0.067210	-0.014510
2001:3	0.026937	0.049800	0.063720	-0.013920
2001:4	0.018562	0.047700	0.059410	-0.011710
2002:1	0.012576	0.050800	0.056328	-0.005528
2002:2	0.012961	0.051000	0.056527	-0.005527
2002:3	0.015944	0.042600	0.058062	-0.015462
2002:4	0.022006	0.040100	0.061182	-0.021082
2003:1	0.028608	0.039200	0.064580	-0.025380



This graph presents the Fitted values, Confidence Interval (narrow band) for mean of y at $x = x_p$, and the Prediction Interval (broader band) for individual value of y at $x=x_p$.

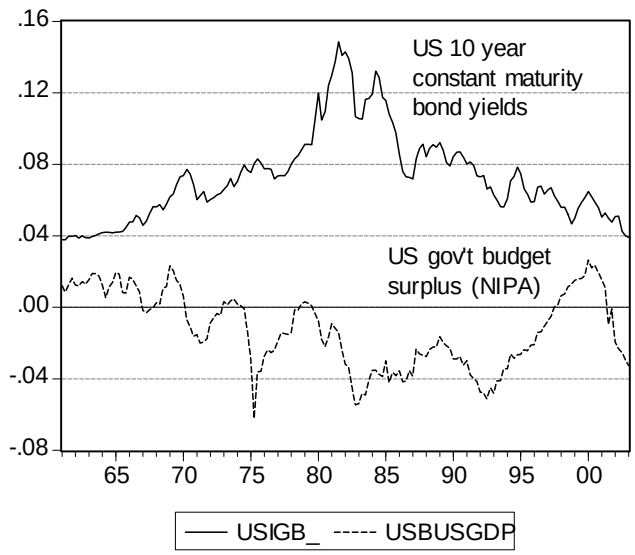
2. Multiple Regression

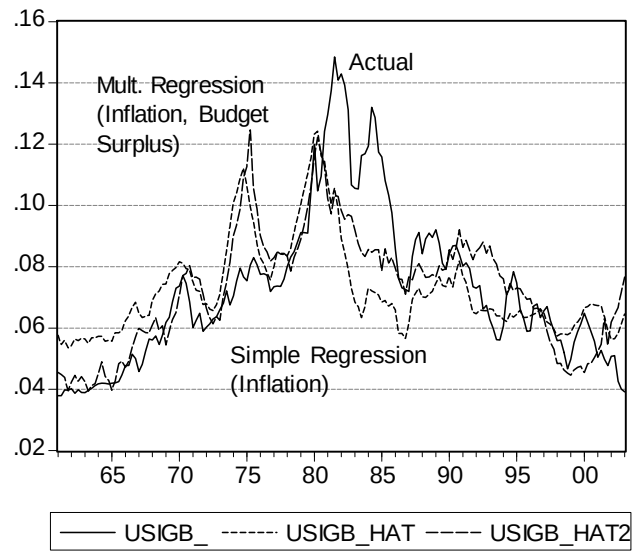
Consider augmenting the regression with an additional independent variable. Economic theory suggests that interest rates depend upon government borrowing. One can exam whether the prediction of this theory is borne out by the data.

Dependent Variable: USIGB_
Method: Least Squares
Date: 12/02/03 Time: 21:26
Sample(adjusted): 1961:1 2003:1
Included observations: 169 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.045264	0.002250	20.11792	0.0000
USINFL1Y	0.463224	0.041480	11.16733	0.0000
USBUSGDP	-0.556245	0.058666	-9.481509	0.0000

R-squared	0.597636	Mean dependent var	0.072622
Adjusted R-squared	0.592788	S.D. dependent var	0.025109
S.E. of regression	0.016023	Akaike info criterion	-5.412028
Sum squared resid	0.042617	Schwarz criterion	-5.356468
Log likelihood	460.3164	F-statistic	123.2808
Durbin-Watson stat	0.164138	Prob(F-statistic)	0.000000





The figure on the left is the 10 year government T-bill rate, and the US government budget surplus expressed as a ratio to GDP (National Income and Product Accounts definition). The figure on the right shows the actual interest rate, the prediction from the simple regression and the prediction from the multiple regression. Below are columns for the actual series, the residuals from the simple and multiple regression.

obs	USIGB_	USIGB_-USIGB_HAT	USIGB_-USIGB_HAT2
2001:1	0.050500	-0.016802	-0.001740
2001:2	0.052700	-0.014510	-0.001978
2001:3	0.049800	-0.013920	-0.013334
2001:4	0.047700	-0.011710	-0.006650
2002:1	0.050800	-0.005528	-0.011163
2002:2	0.051000	-0.005527	-0.013170
2002:3	0.042600	-0.015462	-0.024090
2002:4	0.040100	-0.021082	-0.031590
2003:1	0.039200	-0.025380	-0.037421