BOSTON COLLEGE
Department of Economics
EC 228 02 Econometric Methods
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Problem Set 6
Due Thursday 19 November 2009
Total Points Possible: 120

Problem 10.6

(i) (5 pts) Given the formula for $\delta_j = \gamma_0 + \gamma_1 j + \gamma_2 j^2$, we substitute into the original equation to get
$y_t = \alpha_0 + \gamma_0 z_t + (\gamma_0 + \gamma_1 + \gamma_2)z_{t-1} + (\gamma_0 + 2\gamma_1 + 4\gamma_2)z_{t-2}+$
$(\gamma_0 + 3\gamma_1 + 9\gamma_2)z_{t-3} + (\gamma_0 + 4\gamma_1 + 16\gamma_2)z_{t-4}$
which we can rearrange in terms of the γ's as follows:
$y_t = \alpha_0 + \gamma_0(z_t + z_{t-1} + z_{t-2} + z_{t-3} + z_{t-4})+$
$\gamma_1(z_{t-1} + 2z_{t-2} + 3z_{t-3} + 4z_{t-4}) + \gamma_2(z_{t-1} + 4z_{t-2} + 9z_{t-3} + 16z_{t-4})$

(ii) (5 pts) Now we simply define 3 new variables x_0, x_1, x_2 as follows:
$x_0 = z_t + z_{t-1} + z_{t-2} + z_{t-3} + z_{t-4}$
$x_1 = z_{t-1} + 2z_{t-2} + 3z_{t-3} + 4z_{t-4}$
$x_2 = z_{t-1} + 4z_{t-2} + 9z_{t-3} + 16z_{t-4}$
Then we can substitute these into our equation from part (i) and run OLS on:
$y_t = \alpha_0 + \gamma_0 x_0 + \gamma_1 x_1 + \gamma_2 x_2$

(iii) (5 pts) To see how many restrictions we have imposed, notice that our original equation had six parameters: $\alpha_0, \delta_0, \delta_1, \delta_2, \delta_3, \delta_4$ while our new equation from part (ii) has 4 parameters: $\alpha_0, \gamma_0, \gamma_1, \gamma_2$. So we are imposing 6-4=2 restrictions. You could test the validity of these restrictions using an F test with 2 and n-6 degrees of freedom.

Problem 10.7

(i) (5 pts) Since pe_t is increasing, but $(pe_{t-1} - pe_t)$ and $(pe_{t-2} - pe_t)$ are fixed, then we know that both pe_{t-1} and pe_{t-2} must also be increasing at the same amount.

(ii) (5 pts) The long-run propensity is defined as the change in gfr when pe increases permanently. So we can examine this change by increasing pe_{t-2}, pe_{t-1}, pe_t by the same amount. Then we can see from the original equation, that gfr is predicted to increase by $\delta_0 + \delta_1 + \delta_2 = \theta_0$, which is our LRP.

Problem C10.1

(i) (15 pts) Define y1979 if year $>$ 1979; so it is a dummy with 0 for years 1948-1979 and 1 for 1980-2003. Then run regression from eq. 10.15. The coefficient on y1979 is 1.559 which is significant at the 1 percent level. This allows us to conclude that, ceteris paribus, after 1979 the interest rate on 3-month t-bills was 1.55 percent higher. So we can conclude that the regime change towards targeting the short-term interest rate increased this interest rate.

Problem C10.2

(i) (5 pts) While the time trend variable is significant at the 1 percent level, none of the other variables are significant, even at the 20 percent level.

(ii) (5 pts) Conducting a joint F test for all other variables besides the time trend yields an F statistic with 6 and 123 dfs and a resulting probability of .7767. Therefore, we fail to reject the joint significance of all other variables besides the time trend.

(iii) (5 pts) We add dummies for February through December then run the regression from part i again. Then we can conduct a joint F test on the month dummies to determine the presence of seasonality. We get an F-stat of .85 with a p-val of .5943. Therefore, we fail to reject the absence of seasonality. Adding the month dummies does change the sign of the point estimates on *lgas* and *lrtwex* from positive to negative; however, it doesn't change the lack of significance of any of the explanatory variables besides time. Some of the standard errors decrease in absolute value while others increase.

Problem C10.7

(i) (5 pts) The estimated equation is

$$\widehat{gc}_t = \underset{(.0019)}{.0081} + \underset{(.067)}{.571}\ gy_t$$

$$n = 36, R^2 = .679.$$

This equation implies that if income growth increases by one percentage point, consumption growth increases by .571 percentage points. The coefficient on gy_t is very statistically significant (t-statistic $\approx$ 8.5).

(ii) (5 pts) Adding gy_{t-1} to the equation gives

$$\widehat{gc}_t = \underset{(.0023)}{.0064} + \underset{(.070)}{.552}\ gy_t + \underset{(.069)}{.096}\ gy_{t-1}$$

$$n = 35, R^2 = .695.$$

The t-statistic on gy_{t-1} is only about 1.39, so it is not significant at the usual significance levels. (It is significant at the 20 % level against a two-sided alternative.) In addition, the coefficient is not especially large. At best there is weak evidence of adjustment lags in consumption.

(iii) (5 pts) If we add $r3_t$ to the model estimated in part (i) we obtain

$$\widehat{gc}_t = \underset{(.0020)}{.0082} + \underset{(.072)}{.578}\ gy_t - \underset{(.00063)}{.00021}\ r3_t$$

$$n = 36, R^2 = .680.$$

The t-statistic on $r3_t$ is very small. The estimated coefficient is also practically small: a one-point increase in $r3_t$ reduces consumption growth by about .021 percentage points.

Problem C10.9

(i) (5 pts) The sign of β_2 is fairly clear-cut: as interest rates rise, stock returns fall, so $\beta_2 < 0$. Higher interest rates imply that T-bill and bond investments are more attractive, and also signal a future slowdown in economic activity. The sign of β_1 is less clear. While economic growth can be a good thing for the stock market, it can also signal inflation, which tends to depress stock prices.

(ii) (5 pts) The estimated equation is

$$\widehat{rsp500}_t = \underset{(3.27)}{18.84} + \underset{(.129)}{.036}\ pcip_t - \underset{(.54)}{1.36}\ i3_t$$

$$n = 557, R^2 = .012.$$

A one percentage point increase in industrial production growth is predicted to increase the stock market return by .036 percentage points (a very small effect). On the other hand, a one percentage point increase in interest rates decreases the stock market return by an estimated 1.36 percentage points.

(iii) (5 pts) Only $i3$ is statistically significant with t-statistic $\approx$ -2.52.

(iv) (5 pts) The regression in part (i) has nothing directly to say about predicting stock returns because the explanatory variables are dated contemporaneously with $rsp500$. In other words, we do not know $i3_t$ before we know $rsp500_t$. What the regression in part (i) says is that a change in $i3$ is associated with a contemporaneous change in $rsp500$.

Problem C10.11

(i) (5 pts) Using **browse beltlaw spdlaw** we can see that the belt law was introduced in the 61st month of observation, or January 1986. We can see that the speed limit law was introduced in the 77th month of observation, or May 1987.

(ii) (5 pts) Using a linear time trend and the 11 monthly dummies for February to December, we get an estimate on the coefficient of the time trend as .0027 percent with a t-stat of 17.06, meaning that accidents are significantly increasing over time. The coefficient on t gives the average monthly increase in total accidents. So accidents are growing at $(12 * .275) = 3.3$ percent annually. I would say there is seasonality in total accidents as the coefficient estimates in the summer in general not significantly higher than January (with the exception of August), while the coefficients in October, November, and December are significantly higher than January at the 99 percent level. Running an F-test for joint significance of the monthly dummies, we can reject the absence of seasonality at the 1 percent level with an F-stat of 5.15.

(iii) (5 pts) Adding *wkends*, *unem*, *spdlaw*, and *beltlaw* to the regression in part ii, we get a coefficient of -.0212 on unemployment. The interpretation is that unemployment lowers total accidents by 2.12 percent. The sign and magnitude seem to make sense if you think that many accidents occur during commutes.

(iv) (5 pts) The coefficient on speed law is -.0538, meaning that introducing the speed limit increase to 65 mph actually reduced traffic accidents by 5.38 percent. The coefficient on beltlaw is .0954, meaning that mandating seat belts actually increased accidents by 9.54 percent. Neither of these coefficients are the sign that I would expect. However, it is plausible that raising the speed limit eased congestion on roads and therefore could reduce accidents. Moreover, it is also possible that by people compensated for feeling "safer" due to seatbelt laws by driving more recklessly.

(v) (5 pts) Using **summarize prcfat** you can see that the mean is .88 percent. Yes, it seems plausible that a little less than 1 percent of accidents resulted in at least one fatality.

(vi) (5 pts) Running the regression from part iii with $prcfat$ as the dependent variable, we get coefficients of .067 on *spdlaw* which is significant at the 1 percent level and -.029 on *beltlaw* which is not significant at the 20 percent level. The *spdlaw* result is intuitive since if people are allowed to drive faster, we expect more accidents to have fatalities. Since the *beltlaw* estimate is negative, we may think that seat belt laws reduced fatalities; however, it is not significantly different from zero.