WORKSHOP

Suppose you have the results of a small-scale marketing survey on the demand for a new residential service that integrates multimedia and voice-based telecommunications. Test-marketing of the service to 224 randomly chosen households gives information only on monthly household expenditure (NSEXP) on the service (billed on a flat rate--per-minute basis) and on monthly household income (HHINC).

Your goal is to forecast monthly revenues if this service is introduced. Since it is a new service, there are no historical data that can be used to extrapolate; however, there are good income forecasts for the potential service area that can be used to forecast revenues if the relationship between household expenditures and income is stable and precisely estimated.

The file SERVICE.DAT has the 224 observations on NSEXP (new service expenditures) and HHINC (household income).

1. Use TSP interactively to load these data in with the commands:

```
options crt;
smpl 1,224;
out service;
load (file="SERVICE.DAT") nsexp, hhinc;
out;
```

2. Use the TSP command

```
genr y = log(nsexp);
genr x = log(hhinc);
graph y, x ;
```

   to examine the scatter plot of y (log NSEXP) on x (log HHINC). Is there visual evidence of heteroskedasticity?

3. An important question is whether customers will spend a fixed proportion of their income on the good. Assuming a simple linear model for y and x ,

$$y = \alpha + \beta x + \varepsilon \quad , \quad E(\varepsilon) = 0 \quad ,$$

   If customers spend a fixed share of their income on the good, then $\beta = 1$ (such that a 10% change in income, HHINC, results in a 10% change in expenditures, NSEXP).

Assuming homoskedastic errors, use TSP to construct y and x and regress y on a constant, c, and x using the OLSQ command. Then do a t-test of the hypothesis that $\beta = 1$. Note: This is not the same as testing $\beta = 0$. To test $\beta = 1$, the test statistic is

$$\frac{\hat{\beta} - 1}{\text{S.E. of } \beta}$$

4. Supposing that a random coefficients model might apply, generate the squared residuals and regressors:

```
olsq y, c, x;
genr e2 = (@res)*(@res);
genr x2 = x*x;
```

then regress e2 on c, x, and x2 and use an F-test to check whether the variance of y is related to x and x^2.

5. Following this squared residual regression, retrieve the fitted values (which estimate σ_i^2):

```
genr s2hat = @fit;
```

then use these to do feasible WLS, with

```
genr ystar = y/(sqrt(s2hat));
genr z = 1/(sqrt(s2hat));
genr xstar = x/(sqrt(s2hat));
olsq ystar, z, xstar;
```

Do your conclusions about whether $\beta = 1$ change if you use this WLS estimator instead of OLS?

6. Now we can let TSP do some of the work for us. The command

```
genr w=1/s2hat;
olsq(wtype=het,weight=w) y c x;
```

should produce the same estimates and standard errors as part (5) above.

7. Finally, to get the LS estimates with correct (Eicker-White) standard errors, use

```
olsq(robustse) y c x;
```

In fact, this can be combined with the command for WLS, which ensures correct standard errors even if the quadratic model for heteroskedasticity is misspecified:

```
olsq(robustse, wtype=het, weight=w) y c x;
```

Do your conclusions about whether $\beta = 1$ or $\beta < 1$ change for either of these alternative estimation approaches?