Economic Forecasting
Exercise Sheet 8 Solutions

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1. (a) The estimates for the first consumption equation are:

```
Dependent Variable: CONSUMPTION
Method: Least Squares
Date: 04/28/13   Time: 11:59
Sample (adjusted): 1921 1941
Included observations: 21 after adjustments
===============================================================
Variable                  Coefficient Std.Error t-Statistic Prob.
===============================================================
C                             16.23660  1.302698 12.46382 0.0000
PROFITS                       0.192934  0.091210 2.115273 0.0495
PROFITS(-1)                   0.089885  0.090648 0.991582 0.3353
PRIV_WAGE_BILL+GOV_WAGE_BILL 0.796219  0.039944 19.93342 0.0000
===============================================================
R-squared            0.981008     Mean dependent var    53.99524
Adjusted R-squared   0.977657     S.D. dependent var    6.860866
S.E. of regression   1.025540     Akaike info criterion 3.057959
Sum squared resid    17.87945     Schwarz criterion     3.256916
Log likelihood      -28.10857     Hannan-Quinn criter.  3.101138
F-statistic          292.7076     Durbin-Watson stat    1.367474
Prob(F-statistic)    0.000000
===============================================================
```

This is the same equation as in Klein's Model 1 although here it is estimated by *OLS* which is not really an appropriate estimator for an equation from a simultaneous system (in Klein's Model 1 the equation was estimated by *3SLS*).

Note that the lagged profits term is not significant and the current profits term is only barely significant. Nevertheless, the equation fit is quite good with $R^2 = 0.981$.

The estimates for the second consumption equation are:

```
Dependent Variable: CONSUMPTION
Method: Least Squares
Date: 04/28/13   Time: 12:01
Sample (adjusted): 1921 1941
Included observations: 21 after adjustments
===============================================================
Variable            Coefficient   Std.Error   t-Statistic  Prob.
===============================================================
C                     4.986164    1.612156    3.092855    0.0066
PRODUCTION            0.503795    0.032920    15.30364    0.0000
CONSUMPTION(-1)       0.807608    0.091415    8.834527    0.0000
PRODUCTION(-1)       -0.408800    0.072374   -5.648421    0.0000
===============================================================
R-squared              0.988408   Mean dependent var    53.99524
Adjusted R-squared     0.986362   S.D. dependent var    6.860866
S.E. of regression     0.801216   Akaike info criterion 2.564271
Sum squared resid      10.91310   Schwarz criterion     2.763227
Log likelihood        -22.92484   Hannan-Quinn criter.  2.607449
F-statistic            483.1742   Durbin-Watson stat    2.045354
Prob(F-statistic)      0.000000
===============================================================
```

This is a dynamic equation in which consumption is explained by its own past value as well as current and lagged output. The long run marginal propensity to consume out of output implied by this equation is

$$\frac{0.503795 - 0.408800}{1 - 0.807608} = 0.4937575$$

which might appear to be rather low.

The Mincer and Zarnowitz regressions for the two alternative consumption equations are:

```
Dependent Variable: CONSUMPTION
Method: Least Squares
Date: 04/28/13   Time: 13:27
Sample (adjusted): 1921 1941
Included observations: 21 after adjustments
===============================================================
Variable           Coefficient   Std.Error   t-Statistic  Prob.
===============================================================
C                    8.62E-13    1.736507    4.96E-13    1.0000
MOD1F                1.000000    0.031921    31.32780    0.0000
===============================================================
```

and

```
Dependent Variable: CONSUMPTION
Method: Least Squares
Date: 04/28/13   Time: 13:28
Sample (adjusted): 1921 1941
Included observations: 21 after adjustments
===============================================================
Variable           Coefficient   Std.Error   t-Statistic  Prob.
===============================================================
C                    1.24E-14    1.351656    9.18E-15    1.0000
MOD2F                1.000000    0.024845    40.24990    0.0000
===============================================================
```

respectively. In both cases, the null hypotheses for an optimal forecast that the intercept is zero and the coefficient on the one-step ahead forecast values in one seem to be strongly supported. Formal *Wald* test results are:

```
Wald Test:
Equation: Untitled
===============================================================
Test Statistic           Value          df       Probability
===============================================================
F-statistic            1.23E-25      (2, 19)        1.0000
Chi-square             2.47E-25         2           1.0000
===============================================================
```

and

```
Wald Test:
Equation: Untitled
===============================================================
Test Statistic            Value          df       Probability
===============================================================
F-statistic             7.61E-28     (2, 19)         1.0000
Chi-square              1.52E-27        2            1.0000
===============================================================
```

The test results are reported in both *F-statistic* form as $F_{2,19}$ and in *chi-squared* form as χ^2_2. Both forms strongly fail to reject the null hypothesis that the *Mincer-Zarnowitz* restrictions for an optimal forecast are satisfied by both equations.

(b) The results for the encompassing regression are:

```
Dependent Variable: CONSUMPTION
Method: Least Squares
Date: 04/28/13   Time: 14:16
Sample (adjusted): 1921 1941
Included observations: 21 after adjustments
===============================================================
Variable           Coefficient   Std.Error   t-Statistic  Prob.
===============================================================
C                  -0.030816     1.391320    -0.022148   0.9826
MOD1F               0.070496     0.274124     0.257170   0.8000
MOD2F               0.930074     0.273096     3.405674   0.0032
===============================================================
R-squared             0.988450  Mean dependent var     53.99524
Adjusted R-squared    0.987167  S.D. dependent var     6.860866
S.E. of regression    0.777215  Akaike info criterion  2.465365
Sum squared resid     10.87315  Schwarz criterion      2.614583
Log likelihood       -22.88633  Hannan-Quinn criter.   2.497749
F-statistic           770.2469  Durbin-Watson stat     2.015745
Prob(F-statistic)     0.000000
===============================================================
```

It is pretty clear from this regression result that the coefficient on the first model forecast is close to zero and the coefficient on the second forecast is close to one. Also, the intercept is close to zero. This suggests that we should test the hypothesis that the second model encompasses the first. The formal *Wald* test result of this hypothesis is:

```
Wald Test:
Equation: Untitled
===============================================================
Test Statistic            Value          df       Probability
===============================================================
F-statistic             0.022045      (3, 18)        0.9954
Chi-square              0.066136         3           0.9956
===============================================================
```

Both in *F-statistic* form as $F_{3,18}$ and in *chi-squared* form as χ^2_3, this test strongly supports the null hypothesis that the second forecast encompasses the first.

(c) The results of the forecast combination regression are:

```
Dependent Variable: CONSUMPTION
Method: Least Squares
Date: 04/28/13   Time: 15:21
Sample (adjusted): 1921 1941
Included observations: 21 after adjustments
CONSUMPTION=C(1)+C(2)*MOD1F+(1-C(2))*MOD2F
===============================================================
Variable           Coefficient   Std.Error   t-Statistic  Prob.
===============================================================
C(1)               -1.43E-15      0.165081    -8.67E-15  1.0000
C(2)                0.069966      0.265810     0.263217  0.7952
===============================================================
R-squared           0.988450     Mean dependent var    53.99524
Adjusted R-squared  0.987842     S.D. dependent var    6.860866
S.E. of regression  0.756496     Akaike info criterion 2.370155
Sum squared resid   10.87345     Schwarz criterion     2.469633
Log likelihood     -22.88662     Hannan-Quinn criter.  2.391744
F-statistic         1626.031     Durbin-Watson stat    2.013684
Prob(F-statistic)   0.000000
===============================================================
```

As expected from the previous encompassing result, the estimated weight on the first model, α_1, at 0.07, is insignificantly different from zero. This demonstrates that when one forecast encompasses another, there is nothing to be gained from combining their forecasts together.