WEEK 3

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Questions

This test exercise is of an applied nature and uses data that are available in the data file TestExer3. We consider the so-called Taylor rule for setting the (nominal) interest rate. This model describes the level of the nominal interest rate that the central bank sets as a function of equilibrium real interest rate and inflation, and considers the current level of inflation and production. Taylor (1993) considers the model:

$$i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5g_t$$
it=r∗+πt+0.5(πt−π∗)+0.5gt

with i_t it the Federal funds target interest rate at time t, r^* r∗ the equilibrium real federal funds rate, π_t πt a measure of inflation, π^* π∗ the target inflation rate and g_t gt the output gap (how much actual output deviates from potential output). We simplify the Taylor rule in two manners. First, we avoid determining r^* r∗ and π^* π∗ and simply add an intercept to the model to capture these two variables (and any other deviations in the means). Second, we consider production y_y yy rather than the output gap. In this form the Taylor rule is

$$i_t = \beta_1 + \beta_2\pi_t + \beta_3 y_t + \epsilon_t \qquad (1)$$
it=β1+β2πt+β3yt+ϵt(1)

Monthly data are available for the USA over the period 1960 through 2014 for the following variables:

- **INTRATE**: Federal funds interest rate
- **INFL**: Inflation
- **PROD**: Production
- **UNEMPL**: Unemployment
- **COMMPRI**: Commodity prices
- **PCE**: Personal consumption expenditure
- **PERSINC**: Personal income
- **HOUST**: Housing starts

Exercise initialization

Loading data…

```
## 'data.frame':    660 obs. of  11 variables:
##  $ OBS    : Factor w/ 660 levels "1960:1","1960:10",..: 1 5 6 7 8 9 10 11 12 2 ...
##  $ INTRATE: num  3.99 3.97 3.84 3.92 3.85 3.32 3.23 2.98 2.6 2.47 ...
##  $ INFL   : num  1.24 1.41 1.52 1.93 1.83 ...
##  $ PROD   : num  10.037 6.962 4.497 1.506 -0.114 ...
##  $ UNEMPL : num  3.42 3.47 2.72 2.8 1.73 ...
##  $ COMMPRI: num  7.95 -8.56 -16.84 -5.03 -12.44 ...
##  $ PCE    : num  5.71 5.06 5.56 7.77 4.39 ...
##  $ PERSINC: num  1.684 1.331 0.892 0.676 0.337 ...
##  $ HOUST  : num  -11.89 -9.84 -31.54 -18.93 -15.15 ...
##  $ Year   : int  1960 1960 1960 1960 1960 1960 1960 1960 1960 1960 ...
##  $ Month  : int  1 2 3 4 5 6 7 8 9 10 ...
```

```
##       OBS         INTRATE           INFL             PROD        
##  1960:1 :  1   Min.   : 0.070   Min.   :-1.959   Min.   :-15.0610  
##  1960:10:  1   1st Qu.: 3.000   1st Qu.: 1.954   1st Qu.:  0.7964  
##  1960:11:  1   Median : 5.220   Median : 3.173   Median :  3.3541  
##  1960:12:  1   Mean   : 5.348   Mean   : 3.920   Mean   :  2.9246  
##  1960:2 :  1   3rd Qu.: 7.122   3rd Qu.: 4.729   3rd Qu.:  5.9683  
##  1960:3 :  1   Max.   :19.100   Max.   :14.592   Max.   : 13.3821  
##  (Other):654                                                       
##      UNEMPL           COMMPRI             PCE            PERSINC       
##  Min.   :-4.9497   Min.   :-73.529   Min.   :-3.368   Min.   :-4.9073  
##  1st Qu.: 0.6991   1st Qu.:-16.926   1st Qu.: 5.031   1st Qu.: 0.9854  
##  Median : 2.0054   Median :  1.609   Median : 6.518   Median : 2.1287  
##  Mean   : 1.7747   Mean   :  4.694   Mean   : 6.853   Mean   : 2.1392  
##  3rd Qu.: 3.0386   3rd Qu.: 20.859   3rd Qu.: 8.876   3rd Qu.: 3.2992  
##  Max.   : 5.6352   Max.   :241.667   Max.   :13.574   Max.   : 7.3561  
##                                                                        
##      HOUST              Year          Month       
##  Min.   :-54.797   Min.   :1960   Min.   : 1.00  
##  1st Qu.:-11.180   1st Qu.:1973   1st Qu.: 3.75
```

```
##  Median :  1.472   Median :1987   Median : 6.50
##  Mean   :  1.809   Mean   :1987   Mean   : 6.50
##  3rd Qu.: 13.327   3rd Qu.:2001   3rd Qu.: 9.25
##  Max.   : 96.189   Max.   :2014   Max.   :12.00
##
```

(a) General-to-specific model

(a) Use general-to-specific to come to a model. Start by regressing the federal funds rate on the other 7 variables and eliminate 1 variable at a time.

General-to-specific regression runs results.

Variable name	regression round #1	regression round #2	regression round #3
(Constant)	**-0.221** se= 0.245 t= -0.903 p= 0.367	**-0.291** se= 0.236 t= -1.232 p= 0.218	**-0.240** se= 0.230 t= -1.042 p= 0.298
INFL	**0.696** se= 0.062 t= 11.185 p= 0.000	**0.693** se= 0.062 t= 11.150 p= 0.000	**0.718** se= 0.057 t= 12.555 p= 0.000
PROD	**-0.058** se= 0.040 t= -1.447 p= 0.148	**-0.025** se= 0.026 t= -0.989 p= 0.323	
UNEMPL	**0.102** se= 0.097 t= 1.059 p= 0.290		
COMMPRI	**-0.006** se= 0.003 t= -1.857 p= 0.064	**-0.007** se= 0.002 t= -2.308 p= 0.021	**-0.008** se= 0.003 t= -2.841 p= 0.005
PCE	**0.344** se= 0.069 t= 4.958 p= 0.000	**0.369** se= 0.066 t= 5.618 p= 0.000	**0.341** se= 0.059 t= 5.756 p= 0.000
PERSINC	**0.247** se= 0.061 t= 4.077 p= 0.000	**0.252** se= 0.060 t= 4.162 p= 0.000	**0.240** se= 0.059 t= 4.048 p= 0.000

Variable name	regression round #1	regression round #2	regression round #3
HOUST	**-0.019** se= 0.005 t= -4.155 p= 0.000	**-0.021** se= 0.004 t= -4.760 p= 0.000	**-0.021** se= 0.004 t= -4.678 p= 0.000
……	……	……	……
R^2	0.6385	0.6379	0.637
AIC	.	.	1.581
BIC	.	.	1.615

> *[..] you start with the most general model, including as many variables as are at hand. Then, check whether one or more variables can be removed from the model. This can be based on individual t-tests, or a joint F-test in case of multiple variables. In case you remove one variable at a time, the variable with the lowest absolute t-value is removed from the model. The model is estimated again without that variable, and the procedure is repeated. The procedure continues until all remaining variables are significant.*

Variables elimination after regression, one at a time, produced the following results:

- After regression round #1: UNEMPL UNEMPL variable was chosen to be removed,
- After regression round #2: PROD PROD variable was chosen to be removed,
- After regression round #3: all remaining variables were found to be significant; variables removal stops here.

(*) The results of all regressions performed during this step, are shown in Appendix A.

Calculating model AIC and BIC:

```
model <- lm(INTRATE ~ INFL + COMMPRI + PCE + PERSINC + HOUST, data = dat)
s <- sqrt(deviance(model)/df.residual(model))
k <- length(model$coefficients) - 1
n <- nrow(dat)
AIC <- log(s^2) + 2 * k / n
BIC <- log(s^2) + k * log(n) / n
print(round(c(AIC, BIC), 4))
```

```
## [1] 1.581 1.615
```

Conclusion:

> The general-to-specific process produced the following reduced model:
>
> $$\begin{aligned}\mathrm{INTRATE} = &-0.240\\ &+0.718\cdot\mathrm{INFL}\\ &-0.008\cdot\mathrm{COMMPRI}\\ &+0.341\cdot\mathrm{PCE}\\ &+0.240\cdot\mathrm{PERSINC}\\ &-0.021\cdot\mathrm{HOUST}\end{aligned}$$
>
> $$\mathrm{INTRATE}=-0.240+0.718\cdot\mathrm{INFL}-0.008\cdot\mathrm{COMMPRI}+0.341\cdot\mathrm{PCE}+0.240\cdot\mathrm{PERSINC}-0.021\cdot\mathrm{HOUST}$$
>
> Model characteristics: R^2 = 0.637, AIC = 1.581, BIC = 1.615.

(b) Specific-to-general model

(b) Use specific-to-general to come to a model. Start by regressing the federal funds rate on only a constant and add 1 variable at a time. Is the model the same as in (a)?

Specific-to-general regression runs results.

Variable name	regressions set round #1	regressions set round #2	regressions set round #3	regressions set round #4	regressions set round #5	regressions set round #6	regression round #7
(Constant)	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	**-0.240** se= 0.230 t= -1.042 p= 0.298
INFL	**0.946** se= 0.033 t= 28.93 p= 0.000	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	**0.718** se= 0.057 t= 12.555 p= 0.000
PROD	**-0.016** se= 0.030 t= -0.537 p= 0.592	**0.094** se= 0.020 t= 4.805 p= 0.000	**0.006** se= 0.022 t= 0.296 p= 0.767	**-0.037** se= 0.026 t= -1.506 p= 0.133	**-0.046** se= 0.024 t= -1.923 p= 0.055	**-0.025** se= 0.026 t= -0.989 p= 0.323	
UNEMPL	**0.452** se= 0.070 t= 6.447 p= 0.000	**0.336** se= 0.046 t= 7.235 p= 0.000	**0.142** se= 0.054 t= 2.638 p= 0.009	**0.072** se= 0.061 t= 1.184 p= 0.237	**-0.015** se= 0.063 t= -0.239 p= 0.811	**-0.004** se= 0.063 t= -0.072 p= 0.943	
COMMPRI	**-0.012** se= 0.004 t= -2.75 p= 0.006	**-0.005** se= 0.003 t= -1.654 p= 0.099	**-0.006** se= 0.003 t= -2.257 p= 0.024	**-0.008** se= 0.003 t= -3.173 p= 0.002	**-0.008** se= 0.003 t= -2.841 p= 0.005	*(different value per, each other variable)*	**-0.008** se= 0.003 t= -2.841 p= 0.005
PCE	**0.829** se= 0.038 t= 21.832 p= 0.000	**0.356** se= 0.041 t= 8.590 p= 0.000	**0.181** se= 0.053 t= 3.412 p= 0.001	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	**0.341** se= 0.059 t= 5.756 p= 0.000
PERSINC	**0.104** se= 0.072 t= 1.451 p= 0.147	**0.436** se= 0.046 t= 9.478 p= 0.000	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	*(different value per, each other variable)*	**0.240** se= 0.059 t= 4.048 p= 0.000
HOUST	**-0.031** se= 0.006 t= -5.106 p= 0.000	**-0.004** se= 0.004 t= -0.911 p= 0.362	**-0.011** se= 0.004 t= -2.733 p= 0.006	**-0.022** se= 0.004 t= -4.893 p= 0.000	*(different value per, each other variable)*	*(different value per, each other variable)*	**-0.0210** se= 0.004 t= -4.678 p= 0.000
……	……	……	……	……	……	……	……
R^2	.	.	.	.	.	.	0.637
AIC	.	.	.	.	.	.	1.581
BIC	.	.	.	.	.	.	1.615

> *The specific to general approach follows the same logic [as the general to specific approach], but starts with a very small model, sometimes even only consisting of the constant term. Variables get added one at a time, choosing the one that has the largest absolute t-statistic. This procedure is repeated until no significant variables can be added anymore.*

Variables inclusion (one at a time) after regressions (all possible combinations), produced the following results:

- After regressions set round #1 (with each candidate variable, individually): $INFL$ INFL variable was chosen to be included,
- After regressions set round #2 (with $INFL$ INFL and each other candidate variable combination): $PERSINC$ PERSINC variable was chosen to be included as well,
- After regressions set round #3 (with $INFL$ INFL, $PERSINC$ PERSINC and each other candidate variable combination): PCE PCE variable was chosen to be included as well,
- After regressions set round #4 (with $INFL$ INFL, $PERSINC$ PERSINC, PCE PCE and each other candidate variable combination): $HOUST$ HOUST variable was chosen to be included as well,
- After regressions set round #5 (with $INFL$ INFL, $PERSINC$ PERSINC, PCE PCE, $HOUST$ HOUST and each other candidate variable combination): $COMMPRI$ COMMPRI variable was chosen to be included as well,
- After regressions set round #6 (with $INFL$ INFL, $PERSINC$ PERSINC, PCE PCE, $HOUST$ HOUST, $COMMPRI$ COMMPRI and each other candidate variable combination): all remaining variables ($PROD$ PROD and $UNEMPL$ UNEMPL) were found to be insignificant; variables inclusion stops here.
- A final single regression round #7 with all selected variables ($INFL$ INFL, $PERSINC$ PERSINC, PCE PCE, $HOUST$ HOUST, $COMMPRI$ COMMPRI) was run in order to determine the concluded reduced model parameters.

(*) The results of all regressions performed during this step, are shown in Appendix B.

Calculating model AIC and BIC:

```
model <- lm(INTRATE ~ INFL + PERSINC + PCE + HOUST + COMMPRI, data = dat)
s <- sqrt(deviance(model)/df.residual(model))
k <- length(model$coefficients) - 1
n <- nrow(dat)
AIC <- log(s^2) + 2 * k / n
BIC <- log(s^2) + k * log(n) / n
print(round(c(AIC, BIC), 4))
```

```
## [1] 1.581 1.615
```

---

*Conclusion:**

> The specific-to-general process produced the following reduced model:
>
> $$\begin{aligned} INTRATE = & -0.240 \\ & +0.718 \cdot INFL \\ & -0.008 \cdot COMMPRI \\ & +0.341 \cdot PCE \\ & +0.240 \cdot PERSINC \\ & -0.021 \cdot HOUST \end{aligned}$$
>
> $$INTRATE = -0.240 + 0.718 \cdot INFL - 0.008 \cdot COMMPRI + 0.341 \cdot PCE + 0.240 \cdot PERSINC - 0.021 \cdot HOUST$$
>
> Model characteristics: R^2 = 0.637, AIC = 1.581, BIC = 1.615.
>
> This is the same reduced model produced with the general-to-specific process, in (a).

(c) Models comparison

(c) Compare your model from (a) and the Taylor rule of equation (1). Consider R^2R2, AIC AIC and BIC BIC. Which of the models do you prefer?

(*) The results of Taylor rule regression performed during this step, are shown in Appendix C.

Reduced model (a) vs. Taylor rule model.

Variable name	Reduced model (a)	Talor rule model

Variable name	Reduced model (a)	Talor rule model
(Constant)	**-0.240** se= 0.230 t= -1.042 p= 0.298	**1.249** se= 0.176 t= 7.088 p= 0.000
INFL	**0.718** se= 0.057 t= 12.555 p= 0.000	**0.975** se= 0.033 t= 29.785 p= 0.000
PROD		**0.095** se= 0.020 t= 4.805 p= 0.000
UNEMPL		
COMMPRI	**-0.008** se= 0.003 t= -2.841 p= 0.005	
PCE	**0.341** se= 0.059 t= 5.756 p= 0.000	
PERSINC	**0.240** se= 0.059 t= 4.048 p= 0.000	
HOUST	**-0.021** se= 0.004 t= -4.678 p= 0.000	
……	……	……
R^2	0.637	0.575
AIC	1.581	1.727
BIC	1.615	1.740

> *When comparing models, a lower value of the information criteria is preferred, as we aim for a low standard error of the regression.*

Conclusion:

> Based on the lower AIC and BIC of the reduced model (a), it is considered better than the Taylor rule model.
>
> The reduced model (a) has also a greater R^2 value than the Taylor rule model, which confirms the conclusion.

(d) Models testing

(d) Test the Taylor rule of equation (1) using the RESET test, Chow break and forecast test (with in both tests as break date January 1980) and a Jarque-Bera test. What do you conclude?

(*) The results of each Taylor rule regression test performed during this step, are shown in Appendix D.

Taylor rule model regression tests.

Test name	Test statistic	p-value	F distribution degr. of freedom	Test result
RESET	F= **2,537**	0.112	F(1/656)	H_0H0: **Not rejected**
Chow-break	F= **28,735**	0.000	F(3/654)	H_0H0: **Rejected**
Chow-forecast	F= **5,511**	0.000	F(420/237)	H_0H0: **Rejected**
Jarque-Bera	JB= **12,444**	0.002	X^2(2)	H_0H0: **Rejected**

(*) For the Chow tests, year 1980 is used as break-point, because it has been noted (lecture 3.1) that the book-to-market seems to behave somewhat differently after this year.

Conclusion:

> The RESET test did not rejected the null hypothesis of correct model specification, however the Chow tests and the Jarque-Bera test rejected the null hypothesis of stability and normality of the residuals.
>
> Conclusively, the Taylor rule model does NOT seem to fit the data very well.

Appendix A

General-to-specific approach regressions run

Results of regression round #1 (with all variables):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PROD + UNEMPL + COMMPRI + PCE +
##     PERSINC + HOUST, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.4066 -1.4340 -0.1175  1.3555  7.7386
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.221161   0.244995  -0.903   0.3670
## INFL         0.696059   0.062229  11.185  < 2e-16 ***
## PROD        -0.057743   0.039900  -1.447   0.1483
## UNEMPL       0.102481   0.096757   1.059   0.2899
## COMMPRI     -0.005521   0.002974  -1.857   0.0638 .
## PCE          0.344380   0.069455   4.958 9.08e-07 ***
## PERSINC      0.246999   0.060590   4.077 5.13e-05 ***
## HOUST       -0.019411   0.004672  -4.155 3.68e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.188 on 652 degrees of freedom
## Multiple R-squared:  0.6385, Adjusted R-squared:  0.6346
## F-statistic: 164.5 on 7 and 652 DF,  p-value: < 2.2e-16
```

Results of regression round #2 (with UNEMPL UNEMPL variable removed):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PROD + COMMPRI + PCE + PERSINC +
##     HOUST, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.5322 -1.4982 -0.1005  1.3882  7.6954
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.290851   0.236016  -1.232   0.2183
## INFL         0.693309   0.062180  11.150  < 2e-16 ***
## PROD        -0.025460   0.025752  -0.989   0.3232
## COMMPRI     -0.006514   0.002822  -2.308   0.0213 *
## PCE          0.368561   0.065602   5.618 2.86e-08 ***
## PERSINC      0.251581   0.060441   4.162 3.57e-05 ***
## HOUST       -0.021023   0.004417  -4.760 2.39e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.188 on 653 degrees of freedom
## Multiple R-squared:  0.6379, Adjusted R-squared:  0.6346
## F-statistic: 191.7 on 6 and 653 DF,  p-value: < 2.2e-16
```

Results of regression round #3 (with UNEMPL UNEMPL and PROD PROD variables removed):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + COMMPRI + PCE + PERSINC + HOUST,
##     data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.1631 -1.5244 -0.1125  1.3715  7.6725
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.240119   0.230366  -1.042  0.29764
## INFL         0.717527   0.057152  12.555  < 2e-16 ***
## COMMPRI     -0.007501   0.002640  -2.841  0.00464 **
## PCE          0.340525   0.059156   5.756 1.32e-08 ***
## PERSINC      0.240242   0.059342   4.048 5.77e-05 ***
## HOUST       -0.020530   0.004389  -4.678 3.52e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.188 on 654 degrees of freedom
## Multiple R-squared:  0.6374, Adjusted R-squared:  0.6346
## F-statistic: 229.9 on 5 and 654 DF,  p-value: < 2.2e-16
```

Appendix B

Specific-to-general approach regression sets run

Results of regressions set round #1 (with each candidate variable, individually):

```
##
## Call:
## lm(formula = INTRATE ~ INFL, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -5.9947 -1.5592  0.0603  1.4990  8.2910
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.64209    0.15863   10.35   <2e-16 ***
## INFL         0.94534    0.03268   28.93   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.403 on 658 degrees of freedom
## Multiple R-squared:  0.5598, Adjusted R-squared:  0.5591
## F-statistic: 836.6 on 1 and 658 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ PROD, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.4733 -2.3293 -0.1199  1.8050 13.7859
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.39419    0.16551  32.592   <2e-16 ***
## PROD        -0.01592    0.02966  -0.537    0.592
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.621 on 658 degrees of freedom
## Multiple R-squared:  0.0004375,  Adjusted R-squared:  -0.001082
## F-statistic: 0.288 on 1 and 658 DF,  p-value: 0.5917
```

```
##
## Call:
## lm(formula = INTRATE ~ UNEMPL, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.4502 -2.3216 -0.4573  1.9157 14.4183
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.54462    0.18496  24.571  < 2e-16 ***
## UNEMPL       0.45247    0.07018   6.447 2.21e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.513 on 658 degrees of freedom
## Multiple R-squared:  0.05942,    Adjusted R-squared:  0.05799
## F-statistic: 41.57 on 1 and 658 DF,  p-value: 2.206e-10
```

```
##
## Call:
## lm(formula = INTRATE ~ COMMPRI, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.0892 -2.4343 -0.2646  1.9122 13.8328
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.401743   0.141559   38.16  < 2e-16 ***
## COMMPRI     -0.011526   0.004191   -2.75  0.00613 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.601 on 658 degrees of freedom
## Multiple R-squared:  0.01136,    Adjusted R-squared:  0.009859
## F-statistic: 7.562 on 1 and 658 DF,  p-value: 0.006125
```

```
##
## Call:
## lm(formula = INTRATE ~ PCE, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.0034 -2.2094 -0.1965  1.6315 10.9790
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.33613    0.28161  -1.194    0.233
## PCE          0.82938    0.03799  21.832   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.758 on 658 degrees of freedom
## Multiple R-squared:  0.4201, Adjusted R-squared:  0.4192
## F-statistic: 476.6 on 1 and 658 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ PERSINC, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.6152 -2.2902 -0.2105  1.7326 13.9662
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.12454    0.20844  24.586   <2e-16 ***
## PERSINC      0.10429    0.07186   1.451    0.147
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.616 on 658 degrees of freedom
## Multiple R-squared:  0.003191,   Adjusted R-squared:  0.001676
## F-statistic: 2.106 on 1 and 658 DF,  p-value: 0.1472
```

```
##
## Call:
## lm(formula = INTRATE ~ HOUST, data = dat)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -6.950 -2.223 -0.156  1.833 14.152
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.403640   0.138710  38.956  < 2e-16 ***
## HOUST       -0.030950   0.006062  -5.106 4.32e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.552 on 658 degrees of freedom
## Multiple R-squared:  0.03811,    Adjusted R-squared:  0.03665
## F-statistic: 26.07 on 1 and 658 DF,  p-value: 4.317e-07
```

Results of regressions set round #2 (with INFL INFL and each other candidate variable combination):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PROD, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.1592 -1.6762  0.0141  1.3730  7.9203
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.24890    0.17619   7.088 3.51e-12 ***
```

```
## INFL         0.97498    0.03273  29.785  < 2e-16 ***
## PROD         0.09472    0.01971   4.805 1.92e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.364 on 657 degrees of freedom
## Multiple R-squared:  0.5747, Adjusted R-squared:  0.5734
## F-statistic: 443.9 on 2 and 657 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + UNEMPL, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.1135 -1.7040 -0.0674  1.2620  8.4818
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.12297    0.16879   6.653 6.05e-11 ***
## INFL         0.92573    0.03159  29.300  < 2e-16 ***
## UNEMPL       0.33581    0.04642   7.235 1.30e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.315 on 657 degrees of freedom
## Multiple R-squared:  0.5922, Adjusted R-squared:  0.591
## F-statistic: 477.1 on 2 and 657 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + COMMPRI, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.2351 -1.5814  0.0128  1.4972  8.3501
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.682029   0.160251  10.496   <2e-16 ***
## INFL         0.940702   0.032760  28.715   <2e-16 ***
## COMMPRI     -0.004637   0.002803  -1.654   0.0986 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.4 on 657 degrees of freedom
## Multiple R-squared:  0.5616, Adjusted R-squared:  0.5602
## F-statistic: 420.8 on 2 and 657 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PCE, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.8640 -1.7141 -0.0637  1.5733  7.8959
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.10125    0.23417   0.432    0.666
## INFL         0.71575    0.04094  17.483   <2e-16 ***
## PCE          0.35616    0.04146   8.590   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.28 on 657 degrees of freedom
## Multiple R-squared:  0.6042, Adjusted R-squared:  0.603
## F-statistic: 501.5 on 2 and 657 DF,  p-value: < 2.2e-16
```

```
##
## Call:
```

```
## lm(formula = INTRATE ~ INFL + PERSINC, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.4839 -1.4786 -0.1279  1.4757  7.8344
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.44720    0.19510   2.292   0.0222 *
## INFL         1.01224    0.03148  32.156   <2e-16 ***
## PERSINC      0.43597    0.04600   9.478   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.256 on 657 degrees of freedom
## Multiple R-squared:  0.6127, Adjusted R-squared:  0.6115
## F-statistic: 519.7 on 2 and 657 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + HOUST, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.1362 -1.5837  0.1037  1.4405  8.2763
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.676666   0.163125  10.278   <2e-16 ***
## INFL         0.938290   0.033590  27.934   <2e-16 ***
## HOUST       -0.003841   0.004215  -0.911    0.362
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.404 on 657 degrees of freedom
## Multiple R-squared:  0.5603, Adjusted R-squared:  0.559
## F-statistic: 418.6 on 2 and 657 DF,  p-value: < 2.2e-16
```

Results of regressions set round #3 (with INFL INFL, $\mathrm{PERSINC}$ PERSINC and each other candidate variable combination):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PROD, data = dat)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -7.354 -1.492 -0.136  1.450  7.817
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.442226   0.195958   2.257   0.0244 *
## INFL        1.013042   0.031616  32.042  < 2e-16 ***
## PERSINC     0.428021   0.053304   8.030 4.53e-15 ***
## PROD        0.006446   0.021800   0.296   0.7675
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.257 on 656 degrees of freedom
## Multiple R-squared:  0.6128, Adjusted R-squared:  0.611
## F-statistic:   346 on 3 and 656 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + UNEMPL, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.4139 -1.4914 -0.1884  1.3693  7.9992
##
```

```
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.44625    0.19422   2.298  0.02190 *
## INFL         0.99164    0.03230  30.705  < 2e-16 ***
## PERSINC      0.35595    0.05493   6.480  1.8e-10 ***
## UNEMPL       0.14249    0.05402   2.638  0.00854 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.246 on 656 degrees of freedom
## Multiple R-squared:  0.6168, Adjusted R-squared:  0.615
## F-statistic: 351.9 on 3 and 656 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + COMMPRI, data = dat)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -7.810 -1.438 -0.141  1.448  7.904
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.483740   0.195167   2.479   0.0134 *
## INFL         1.007126   0.031464  32.009   <2e-16 ***
## PERSINC      0.441293   0.045916   9.611   <2e-16 ***
## COMMPRI     -0.005935   0.002630  -2.257   0.0244 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.249 on 656 degrees of freedom
## Multiple R-squared:  0.6157, Adjusted R-squared:  0.6139
## F-statistic: 350.3 on 3 and 656 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.8267 -1.5734 -0.1168  1.4852  7.6214
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.02122    0.23031   0.092 0.926622
## INFL         0.87542    0.05083  17.224  < 2e-16 ***
## PERSINC      0.30541    0.05955   5.129 3.85e-07 ***
## PCE          0.18118    0.05310   3.412 0.000684 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.238 on 656 degrees of freedom
## Multiple R-squared:  0.6195, Adjusted R-squared:  0.6177
## F-statistic:   356 on 3 and 656 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + HOUST, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.7516 -1.4280 -0.1377  1.3543  7.7685
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.482973   0.194586   2.482  0.01331 *
## INFL         0.995683   0.031906  31.207  < 2e-16 ***
## PERSINC      0.458846   0.046532   9.861  < 2e-16 ***
## HOUST       -0.010938   0.004001  -2.733  0.00644 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 2.245 on 656 degrees of freedom
## Multiple R-squared:  0.6171, Adjusted R-squared:  0.6153
## F-statistic: 352.4 on 3 and 656 DF,  p-value: < 2.2e-16
```

Results of regressions set round #4 (with $INFL$ INFL, $PERSINC$ PERSINC, PCE PCE and each other candidate variable combination):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + PROD, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.4144 -1.5287 -0.1259  1.5313  7.6676
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.05171    0.23513  -0.220 0.826001
## INFL         0.83827    0.05645  14.849  < 2e-16 ***
## PERSINC      0.31987    0.06026   5.308 1.52e-07 ***
## PCE          0.22432    0.06029   3.720 0.000216 ***
## PROD        -0.03694    0.02454  -1.506 0.132675
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.236 on 655 degrees of freedom
## Multiple R-squared:  0.6208, Adjusted R-squared:  0.6185
## F-statistic: 268.1 on 4 and 655 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + UNEMPL, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.4059 -1.5649 -0.1561  1.5020  7.7442
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.09932    0.23950   0.415   0.6785
## INFL         0.89023    0.05232  17.013  < 2e-16 ***
## PERSINC      0.28896    0.06113   4.727 2.79e-06 ***
## PCE          0.14775    0.06012   2.458   0.0142 *
## UNEMPL       0.07218    0.06094   1.184   0.2367
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.237 on 655 degrees of freedom
## Multiple R-squared:  0.6203, Adjusted R-squared:  0.618
## F-statistic: 267.5 on 4 and 655 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + COMMPRI, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.1468 -1.4614 -0.1224  1.5219  7.6744
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.021050   0.229123  -0.092  0.92683
## INFL         0.837752   0.051854  16.156  < 2e-16 ***
## PERSINC      0.284055   0.059525   4.772 2.25e-06 ***
## PCE          0.221367   0.054235   4.082 5.02e-05 ***
## COMMPRI     -0.008483   0.002673  -3.173  0.00158 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.222 on 655 degrees of freedom
```

```
## Multiple R-squared:  0.6252, Adjusted R-squared:  0.6229
## F-statistic: 273.2 on 4 and 655 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + HOUST, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.8827 -1.5365 -0.1099  1.3049  7.7022
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.213571   0.231416  -0.923    0.356
## INFL         0.744809   0.056643  13.149  < 2e-16 ***
## PERSINC      0.256885   0.059370   4.327 1.75e-05 ***
## PCE          0.310975   0.058548   5.311 1.49e-07 ***
## HOUST       -0.021522   0.004398  -4.893 1.25e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.2 on 655 degrees of freedom
## Multiple R-squared:  0.6329, Adjusted R-squared:  0.6306
## F-statistic: 282.3 on 4 and 655 DF,  p-value: < 2.2e-16
```

Results of regressions set round #5 (with $INFL$ INFL, $PERSINC$ PERSINC, PCE PCE, $HOUST$ HOUST and each other candidate variable combination):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + HOUST + PROD, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.6237 -1.4669 -0.1326  1.3547  7.7370
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.312558   0.236607  -1.321   0.1870
## INFL         0.694049   0.062385  11.125  < 2e-16 ***
## PERSINC      0.273587   0.059881   4.569 5.86e-06 ***
## PCE          0.369249   0.065818   5.610 2.99e-08 ***
## HOUST       -0.022185   0.004403  -5.039 6.07e-07 ***
## PROD        -0.046477   0.024167  -1.923   0.0549 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.195 on 654 degrees of freedom
## Multiple R-squared:  0.6349, Adjusted R-squared:  0.6322
## F-statistic: 227.5 on 5 and 654 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + HOUST + UNEMPL,
##     data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.9710 -1.5410 -0.1044  1.3203  7.7000
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.233338   0.245864  -0.949    0.343
## INFL         0.739770   0.060466  12.235  < 2e-16 ***
## PERSINC      0.259579   0.060468   4.293 2.03e-05 ***
## PCE          0.319874   0.069389   4.610 4.85e-06 ***
## HOUST       -0.021845   0.004603  -4.745 2.56e-06 ***
## UNEMPL      -0.015013   0.062716  -0.239    0.811
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 2.201 on 654 degrees of freedom
## Multiple R-squared:  0.6329, Adjusted R-squared:  0.6301
## F-statistic: 225.5 on 5 and 654 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + HOUST + COMMPRI,
##     data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.1631 -1.5244 -0.1125  1.3715  7.6725
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.240119   0.230366  -1.042  0.29764
## INFL         0.717527   0.057152  12.555  < 2e-16 ***
## PERSINC      0.240242   0.059342   4.048 5.77e-05 ***
## PCE          0.340525   0.059156   5.756 1.32e-08 ***
## HOUST       -0.020530   0.004389  -4.678 3.52e-06 ***
## COMMPRI     -0.007501   0.002640  -2.841  0.00464 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.188 on 654 degrees of freedom
## Multiple R-squared:  0.6374, Adjusted R-squared:  0.6346
## F-statistic: 229.9 on 5 and 654 DF,  p-value: < 2.2e-16
```

Results of regressions set round #6 (with INFL INFL, $\mathrm{PERSINC}$ PERSINC, PCE PCE, HOUST HOUST, $\mathrm{COMMPRI}$ COMMPRI and each other candidate variable combination):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + HOUST + COMMPRI +
##     PROD, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.5322 -1.4982 -0.1005  1.3882  7.6954
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.290851   0.236016  -1.232   0.2183
## INFL         0.693309   0.062180  11.150  < 2e-16 ***
## PERSINC      0.251581   0.060441   4.162 3.57e-05 ***
## PCE          0.368561   0.065602   5.618 2.86e-08 ***
## HOUST       -0.021023   0.004417  -4.760 2.39e-06 ***
## COMMPRI     -0.006514   0.002822  -2.308   0.0213 *
## PROD        -0.025460   0.025752  -0.989   0.3232
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.188 on 653 degrees of freedom
## Multiple R-squared:  0.6379, Adjusted R-squared:  0.6346
## F-statistic: 191.7 on 6 and 653 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + HOUST + COMMPRI +
##     UNEMPL, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.1891 -1.5245 -0.1037  1.3731  7.6719
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.245982   0.244598  -1.006   0.3150
## INFL         0.716063   0.060725  11.792  < 2e-16 ***
```

```
## PERSINC      0.241071   0.060502   3.985 7.52e-05 ***
## PCE          0.343138   0.069508   4.937 1.01e-06 ***
## HOUST       -0.020628   0.004599  -4.485 8.61e-06 ***
## COMMPRI     -0.007489   0.002647  -2.830   0.0048 **
## UNEMPL      -0.004483   0.062494  -0.072   0.9428
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.19 on 653 degrees of freedom
## Multiple R-squared:  0.6374, Adjusted R-squared:  0.634
## F-statistic: 191.3 on 6 and 653 DF,  p-value: < 2.2e-16
```

Results of regressions set round #7 (with $INFL$ INFL, $PERSINC$ PERSINC, PCE PCE, $HOUST$ HOUST, $COMMPRI$ COMMPRI included variables):

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PERSINC + PCE + HOUST + COMMPRI,
##     data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.1631 -1.5244 -0.1125  1.3715  7.6725
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.240119   0.230366  -1.042  0.29764
## INFL         0.717527   0.057152  12.555  < 2e-16 ***
## PERSINC      0.240242   0.059342   4.048 5.77e-05 ***
## PCE          0.340525   0.059156   5.756 1.32e-08 ***
## HOUST       -0.020530   0.004389  -4.678 3.52e-06 ***
## COMMPRI     -0.007501   0.002640  -2.841  0.00464 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.188 on 654 degrees of freedom
## Multiple R-squared:  0.6374, Adjusted R-squared:  0.6346
## F-statistic: 229.9 on 5 and 654 DF,  p-value: < 2.2e-16
```

Appendix C

Taylor rule regression run

```
model <- lm(INTRATE ~ INFL + PROD, data = dat)
summary(model)
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PROD, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.1592 -1.6762  0.0141  1.3730  7.9203
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.24890    0.17619   7.088 3.51e-12 ***
## INFL         0.97498    0.03273  29.785  < 2e-16 ***
## PROD         0.09472    0.01971   4.805 1.92e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.364 on 657 degrees of freedom
## Multiple R-squared:  0.5747, Adjusted R-squared:  0.5734
## F-statistic: 443.9 on 2 and 657 DF,  p-value: < 2.2e-16
```

Calculating Taylor rule AIC and BIC:

```
s <- sqrt(deviance(model)/df.residual(model))
k <- length(model$coefficients) - 1
n <- nrow(dat)
AIC <- log(s^2) + 2 * k / n
BIC <- log(s^2) + k * log(n) / n
print(round(c(AIC, BIC), 4))
```

```
## [1] 1.7267 1.7403
```

Appendix D

Taylor rule regression tests run

```
model <- lm(INTRATE ~ INFL + PROD, data = dat)
summary(model)
```

```
##
## Call:
## lm(formula = INTRATE ~ INFL + PROD, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.1592 -1.6762  0.0141  1.3730  7.9203
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.24890    0.17619   7.088 3.51e-12 ***
## INFL         0.97498    0.03273  29.785  < 2e-16 ***
## PROD         0.09472    0.01971   4.805 1.92e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.364 on 657 degrees of freedom
## Multiple R-squared:  0.5747, Adjusted R-squared:  0.5734
## F-statistic: 443.9 on 2 and 657 DF,  p-value: < 2.2e-16
```

```
# RESET testing
library(lmtest)
resettest(model, power = 2, type = "fitted", data = dat)
```

```
##
##  RESET test
##
## data:  model
## RESET = 2.5371, df1 = 1, df2 = 656, p-value = 0.1117
```

```
# Chow break testing
library(gap)
grp <- dat[dat$Year < 1980, ]
x1 <- grp[, c("INFL", "PROD")]; y1 <- data.frame( INTRATE = grp["INTRATE"] )
grp <- dat[dat$Year >= 1980, ]
x2 <- grp[, c("INFL", "PROD")]; y2 <- data.frame( INTRATE = grp["INTRATE"] )
#chow.test
chow.test(y1, x1, y2, x2)
```

```
##      F value        d.f.1        d.f.2      P value
## 2.873501e+01 3.000000e+00 6.540000e+02 1.836802e-17
```

– End of document –