QA

The general to specific model selection method is used, where one explanatory variable is removed at a time until we come to a model specification that can be used. **Table 1** shows the results of this method.

Table 1 – Results of the general to specific model selection method

Dependant variable: INTRATE; Sample size = 660			
	Coefficient (p-value) by specification		
	(A)	(B)	(C)
Constant	-0.221 (0.367)	-0.291 (0.218)	-0.240 (0.298)
INFL	0.696 (0)	0.693 (0)	0.718 (0)
PROD	-0.058 (0.148)	-0.025 (0.323)	
UNEMPL	0.102 (0.29)		
COMMPRI	-0.006 (0.064)	-0.007 (0.021)	-0.008 (0.005)
PCE	0.344 (0)	0.369 (0)	0.341 (0)
PERSINC	0.247 (0)	0.252 (0)	0.240 (0)
HOUST	-0.019 (0)	-0.021 (0)	-0.021 (0)
R-squared	0.639	0.638	0.637

Regression A

The results of regression (A) show that some variables are insignificant at the 95% level. Although the constant is insignificant, it is kept in the general-to-specific method since the economic theory used states that the constant term is used to simplify the Taylor rule. Unemployment has a p-value of 0.29, greater than the significance level of 0.05. Therefore, **unemployment** is not statistically significant and is the first variable to be removed in the general to specific method.

Regression B

The results of regression (B) shows that **Production** is the only explanatory variable that is statistically insignificant at the 95% level other than the constant. This can mean one of two things:

1) either that the regression does not follow theory and production is not useful to explain changes in the interest rate under the Taylor rule;
2) or that the variable used for production is not a good proxy for the output gap.

Production is the next variable to be removed in the general to specific method.

Regression C

In regression C, all explanatory variables are statistically significant at the 95% level. The constant is statistically insignificant but is kept due to its relevance to economic theory.

The final regression is a multiple linear regression with INTER as the dependant variable, a constant term, and INFL, COMMPRI, PCE, PERSINC, and HOUST as the independent variables.

QB

The specific to general model selection method is used, where the regression is first run against a constant and one explanatory variable is added at a time. **Table 2** shows the results of this method.

Table 2 – Results of the specific to general model selection method

Dependant variable: INTRATE; Sample size = 660

	Coefficient (p-value) by specification							
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Constant	5.348 (0)	1.642 (0)	1.249 (0)	1.204 (0)	1.194 (0)	0.187 (0.435)	0.790 (0.79)	-0.240 (0.298)
INFL		0.945 (0)	0.975 (0)	0.891 (0)	0.901 (0)	0.730 (0)	0.000 (0)	0.718 (0)
PROD			0.095 (0)	-0.080 (0.026)	-0.041 (0.309)			
UNEMPL				0.498 (0)	0.435 (0)	0.139 (0.02)	0.079 (0.194)	
COMMPRI					-0.006 (0.05)	-0.010 (0)	-0.009 (0.001)	-0.008 (0.005)
PCE						0.306 (0)	0.185 (0.002)	0.341 (0)
PERSINC							0.266 (0)	0.240 (0)
HOUST								-0.021 (0)
R-squared	0.0002	0.75	0.57	0.595	0.598	0.62	0.63	0.64

Regressions A-D

In regressions A to D, one explanatory variable was added in each regression, starting with the constant in Regression A. All variables are statistically significant

Regression E

When adding COMMPRI to the specific to general model, PROD becomes insignificant at the 95% level. PROD is dropped going forward.

Regression F

By adding PCE, the constant term becomes insignificant. This is kept going forward due to its relevant in theory.

Regression G

When adding PERSINC to the specific to general model, UNEMP becomes insignificant at the 95% level. UNEMPL is dropped going forward.

Regression H

The final regression is a multiple linear regression with INTER as the dependant variable, a constant term, and INFL, COMMPRI, PCE, PERSINC, and HOUST as the independent variables. **Therefore, the results of the specific to general approach are the same as the general to specific approach.**

QC

Table 3 – Comparing the model selected by the general to specific method to the Taylor rule model

Dependant variable: INTRATE; Sample size = 660		
	Coefficient (p-value) by specification	
	Q(A)	Taylor Rule model
Constant	-0.240 (0.298)	1.249 (0)
INFL	0.718 (0)	0.975 (0)
PROD		0.095 (0)
UNEMPL		
COMMPRI	-0.008 (0.005)	
PCE	0.341 (0)	
PERSINC	0.240 (0)	
HOUST	-0.021 (0)	
R-squared	0.637	0.575
AIC	1.584	1.730
BIC	1.625	1.750

Table 3 compares the model selected by the general to specific method to the Taylor rule model (Q(A)) to the Taylor rule model.

The Q(A) model has a higher R-squared and a lower AIC and BIC statistic, implying that it has a better fit.

QD

The Taylor model is:

$$i_t = \beta_1 + \beta_2 \pi_t + \beta_3 y_t + \varepsilon_t .$$

RESET Test

The regression specification error test (RESET) is used to detect general function form misspecification. Although we can test for this by adding quadratics of the explanatory variables, this consumes may degrees of freedom.

The RESET test adds **polynomials** in the OLS **fitted values** to include in an extended regression. The squared and cubed terms of the fitted values have proven useful in most applications:

$$i_t = \beta_1 + \beta_2\pi_t + \beta_3 y_t + \beta_4\, fitted\ i_t^2 + \varepsilon_t.$$

We only use the equation above to test whether the original Taylor rule equation has missed important non-linearities since the variable “fitted i" is a nonlinear function of the other explanatory variables. The null hypotheses is that the Taylor rule regression is correctly specified. A significant F-statistic would suggest some sort of functional form problem.

The F-statistic for the RESET Test has the following results:

F statistic	**2.53712**
DF numerator (g)	1
DF denominator (n-k-g)	655
This F-statistic has P-value of	**0.11**

This means that the null hypothesis is not rejected. We do not reject that the model is a linear regression model and the test shows that there are no functional form problems.

Chow break test

A series of data can often contain a structural break, due to a change in policy or sudden shock to the economy. The Chow break test uses an F-test to determine whether a single regression is more efficient than two separate regressions involving splitting the data into two sub-samples. The equation uses the residual sum of squares of the complete regression (RSS) and of two regressions using a sub-sample split at the point of a suspected structural break (RSS1 and RSS2):

$$\text{Chow} = \frac{(RSS - RSS_1 - RSS_2)/k}{(RSS_1 + RSS_2)/(n_1 + n_2 - 2k)} \sim F_{k, n_1+n_2-2k}$$

The Chow test basically tests whether the single regression line or the two separate regression lines fit the data best. The result of the Chow break test for the Taylor rule model where the structural break is taken in January of 1980 is:

F statistic	**28.73501**
DF numerator (k)	3
DF denominator (n-2k)	654.00
This F-statistic has P-value of	**< .00001**

Since the P-value is very small the Chow break test is significant and the null hypothesis that there are no structural breaks is rejected.

Chow Forecast test

The Chow forecast test is another test to check for structural breaks in the sample.

$$F = \frac{\hat{e}'\hat{e} - \hat{e}_1'\hat{e}_1/N_2}{\hat{e}_1'\hat{e}_1/N_1 - k} \sim F(N_2, N_1 - k)$$

The result of the Chow forecast test for the Taylor rule model where the structural break is taken in January of 1980 is:

F-statistic	**5.510518**
DF numerator (n2)	420
DF denominator (n1-k)	237
P-value	**< .00001**

Since the P-value is very small the Chow break test is significant and the null hypothesis that there are no structural breaks is rejected.

Jarque-Bera test

The Jarque-Bera test is a goodness-of-fit test that determines whether or not sample data have skewness and kurtosis that matches a normal distribution. The test statistic of the Jarque-Bera test is always a positive number and if it's far from zero, it indicates that the sample data do not have a normal distribution.

The JB test follows a Chi-Square distribution with 2 degrees of freedom:

	INTRATE	INFL	PROD
Observations	660.00	660.00	660.00
sample skewness	0.90	1.53	-0.96
sample kurtosis	1.41	2.34	1.61
JB test	143.9	410.0	173.4
Chi-squared distribution p-value	**0.00000**	**0.00000**	**0.00000**

Since the P-value is less than 0.05, the null hypothesis is rejected. The dataset is therefore not normally distributed.

Conclusions

When applying the RESET and Chow tests, it can be concluded that a linear regression is a good fit for this mode. However, when splitting the data into two sub-samples (1927-1980 and 1980-2014), the Chow tests shows that the data has a structural break and that splitting it into two sub-samples might be more informative. Moreover, the JB test shows that the dataset used is not normally distributed.