Single Hypothesis – Multiple Parameters

$$H_0 : \beta_j = \beta_l$$

$$H_1 : \beta_j \neq \beta_l$$

$$t_{test} = \frac{\hat{\beta}_j - \hat{\beta}_l}{se(\hat{\beta}_j - \hat{\beta}_l)}$$

nbasal : $H_0 : \beta_1 = \beta_2$

$H_1 : \beta_1 \neq \beta_2$

stata: lincom points – rebounds

test points = rebounds

Multiple Hypotheses

$$H_0 : \beta_j = 0 \;,\; \beta_\ell = 0$$

H_1: at least β_j or $\beta_\ell \neq 0$

unrestricted model: H_0 not imposed

restricted " : H_0 imposed

(by omitting x_j and x_ℓ)

Test statistic based on comparing fit across the 2 models.

Follows F distribution.

SSR_r : SSR in restricted

$$F_{test} = \frac{(SSR_r - SSR_{ur})/q}{SSR_{ur}/(n-k-1)}$$

SSR in unrestricted

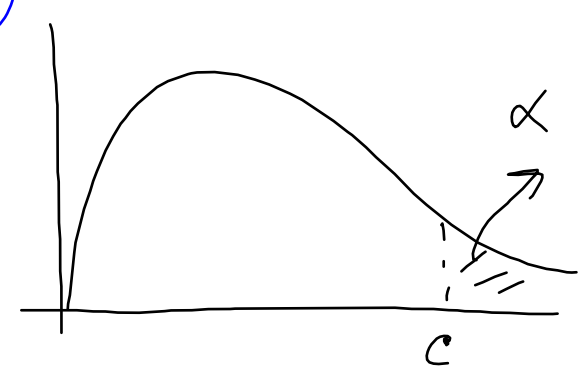
$$F_{test} \sim F_{q,\,n-k-1}$$

q : numerator df (# β's tested)

n−k−1 : denominator df

↓ sample size

→ # x's (unrestricted)



Reject H_0 if $F_{test} > c$

Critical values: Tables G.3a, G.3b, & G.3c

$q = 1$ $\quad F_{1,\,n-k-1} = t^2_{n-k-1}$

Also, $F_{test} = \dfrac{(R^2_{ur} - R^2_{r})/q}{(1 - R^2_{ur})/(n-k-1)}$

$R^2_{restricted}$

$R^2_{unrestricted}$

nbasal : $H_0 : \beta_1 = 0, \beta_2 = 0$

H_1 : not H_0

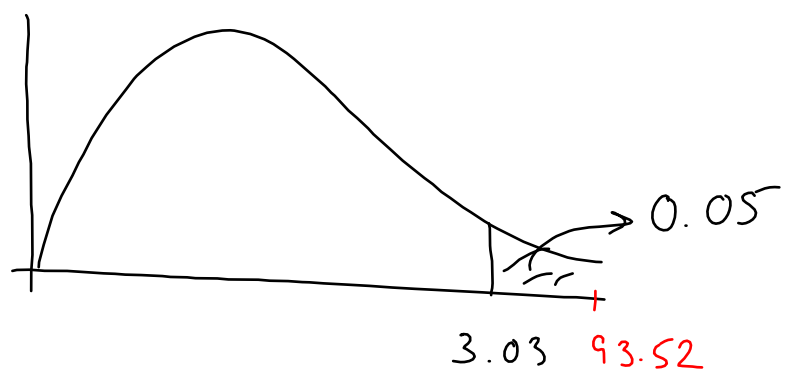
$F_{test} = 93.52$

3 (from table)

@ for $\alpha = 0.05$, $F_{2,265} = 3.03$ (stata)

```
. display invFtail(2, 265, 0.05)
3.0298547
```

Reject H_0.




```
. reg wage points rebounds assists
```

Source	SS	df	MS	Number of obs	=	269
				F(3, 265)	=	80.07
Model	127366839	3	42455612.8	Prob > F	=	0.0000
Residual	140512078	265	530234.258	R-squared	=	0.4755
				Adj R-squared	=	0.4695
Total	267878917	268	999548.197	Root MSE	=	728.17

wage	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
points	81.19369	11.56929	7.02	0.000	58.41426	103.9731
rebounds	92.23602	19.911	4.63	0.000	53.03213	131.4399
assists	24.34695	26.98747	0.90	0.368	-28.79021	77.4841
_cons	130.2154	96.50168	1.35	0.178	-59.79217	320.223

```
.
end of do-file

. do "C:\Users\royj\AppData\Local\Temp\STD2d54_000000.tmp"

. test points rebounds

 ( 1)  points = 0
 ( 2)  rebounds = 0

       F(  2,   265) =   93.52
            Prob > F =    0.0000
```

Special case: overall significance of regression

$H_0: \beta_1, \ldots, \beta_k = 0$

H_1: at least one of $\beta_1 \ldots \beta_k \neq 0$

R^2_{ur} : usual R^2

R^2_r : 0

$q = k$

$$F_{test} = \frac{R^2/k}{(1-R^2)/(n-k-1)}$$

mbasal: $H_0: \beta_1, \beta_2, \beta_3 = 0$

H_1: not H_0

$F_{test} = 80.07$

c for $\alpha = 0.05$ $F_{3,265} = 2.60$ (table)

$= 2.64$ (Stata)

. display invFtail(3, 265, 0.05)

2.6386664

Reject H_0.