UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

KEMMY BUSINESS SCHOOL

Department of Economics

End of Term Assessment

ACADEMIC YEAR:	**Autumn, 2007/08**
MODULE CODE:	**EC4307**
DURATION OF EXAMINATION:	**2.5 hours**
MODULE TITLE:	**ECONOMETRICS**
PERCENTAGE OF TOTAL MARKS:	**60%** (Remaining 40% awarded for two course work assignments)
LECTURER:	**Declan Dineen**
EXTERNAL EXAMINER:	**Professor Eamon O'Shea**

INSTRUCTIONS TO CANDIDATES:

- Answer 3 (THREE) questions only out of the (SIX) questions on this exam paper.
- Answer ***at least*** ONE question from SECTION A and ***at least*** ONE question from SECTION B.
- Put your answers to Section A and Section B in SEPARATE ANSWER BOOKS.
- All answers should be concise and relevant.
- All questions carry equal marks. Marks awarded for individual parts of each question are indicated on the paper.
- All rough work to be handed up with the exam paper.
- Dictionaries and non-programmable calculators are permitted.

STUDENT NAME: ______________________________

ID NUMBER: ______________________________

COURSE OF STUDY: ______________________________

SECTION A

A1. Consider the following model used to estimate how a hamburger chain's weekly revenue tr depends on price p, and advertising expenditure a

$$tr_t = \beta_1 + \beta_2 p_t + \beta_3 a_t + \varepsilon_t$$

where price p is measured in Euro while total revenue tr and advertising expenditure a are measured in Euro (000s).

The least squares output from estimating this equation appears in TABLE 1.0 below.

TABLE 1.0

Dependent variable:		tr		
Number of observations:		52		
Variable	Coefficient	Std. Error	t-statistic	p-value
Intercept	104.7855	6.482719	16.16382	0.0000
Price	−6.641930	3.191193	?	0.0427
Advert	2.984299	0.166936	17.87689	0.0000
R-squared		?		
Adjusted R-squared		0.861660		
$\sum (Y_t - \bar{Y})^2$		13581.35		
Sum of squared residuals (RSS)		1805.168		

(a) Interpret the estimates $\hat{\beta}_2$ and $\hat{\beta}_3$. Are the signs on these coefficients what you would expect from a theory or logical point of view? **(10%)**

(b) Calculate the estimated error variance $\hat{\sigma}_\varepsilon^2$ and standard error. **(10%)**

(c) Calculate the R^2. **(10%)**

(d) Calculate the t-statistic for $\hat{\beta}_2$ and using the test of significance approach, without using the reported p-value, explain how you would test the null hypothesis that $\beta_2 = 0$. **(10%)**

(e) Interpret the p-value = 0.0427 given above, and say how this can be used to test for significance (i.e. to test the null hypothesis that $\beta_2 = 0$). **(10%)**

(f) Calculate a 95% confidence interval for the true population parameter β_3. What does the interval tell you (i.e. in what are you 95% confident)? **(15%)**

(g) Test the joint hypothesis that $\beta_2 = 0$ and $\beta_3 = 0$ (that is, $\beta_2 = \beta_3 = 0$) using the F-test at the 5 per cent level of significance. **(15%)**

(h) Decompose the total sum of squares (*TSS*) of the dependent variable in a regression into its two components: the explained sum of squares (*ESS*) and the residual sum of squares (*RSS*). You may use a diagram to illustrate. **(20%)**

A2. **(a)** Explain the difference between a model which is linear in the *variables* and one which is linear in the *parameters* (giving examples). **(15%)**

Given the two-variable regression model

$$Y_i = \beta_1 + \beta_2 X_i + \varepsilon_i$$

(b) Briefly, describe the classical linear regression model assumptions underlying the OLS estimation technique. Use well-labelled diagrams to support your answer where appropriate. **(20%)**

(c) Derive the least-squares normal equations for α and β and proceed to derive the estimator for β. **(40%)**

(d) Describe the Gauss-Markov theorem and prove that the estimator for β is linear and unbiased. **(25%)**

A3. **(a)** What is autocorrelation?

How would you distinguish between *"pure"* autocorrelation and specification error?

Discuss the consequences of *"pure"* autocorrelation for estimation and hypothesis testing using OLS estimates. **(35%)**

(b) Derive the Durbin-Watson test statistic and describe how it is used to test for autocorrelation.

What are the weaknesses of this test? **(35%)**

(c) In the presence of *"pure"* autocorrelation, describe the Cochrane-Orcutt method for estimating the autocorrelation coefficient ρ. **(30%)**

SECTION B

B1. Suppose we posit the following demand for money relation

$$M0_t = \beta_1 + \beta_2 GNP_t + \beta_3 i_t + \varepsilon_t$$

where $M0_t$ = demand for money (*nominal* cash balances)

i_t = an interest rate indicator (%)

GNP_t = Gross National Product

Based on quarterly data for 1972Q1-1989Q4, the following results were obtained:

Ordinary Least Squares Estimation

Dependent variable is M0
72 observations used for estimation from 1972Q1 to 1989Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
INPT	-27.9858	6.8392	-4.0920[.000]
GNP	.19020	.0032369	58.7617[.000]
I	-3.6733	.83807	-4.3831[.000]

R-Squared	.98135	R-Bar-Squared	.98081
S.E. of Regression	11.3900	F-stat. F(2, 69)	1815.7[.000]
Mean of Dependent Variable	239.4806	S.D. of Dependent Variable	82.2268
Residual Sum of Squares	8951.5	Equation Log-likelihood	-275.7885
Akaike Info. Criterion	-278.7885	Schwarz Bayesian Criterion	-282.2035
DW-statistic	.14432		

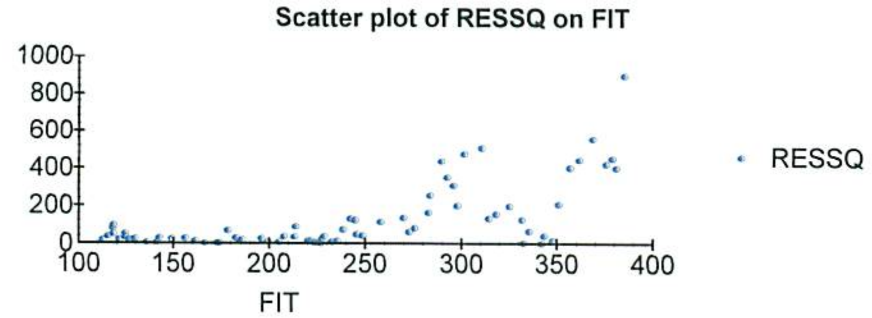
Diagnostic Tests

Test Statistics	F Version
A: Serial Correlation	F(4, 65) = 111.9423[.000]
B: Functional Form	F(1, 68) = 53.1390[.000]
C: Heteroscedasticity	F(1, 70) = 65.4813[.000]

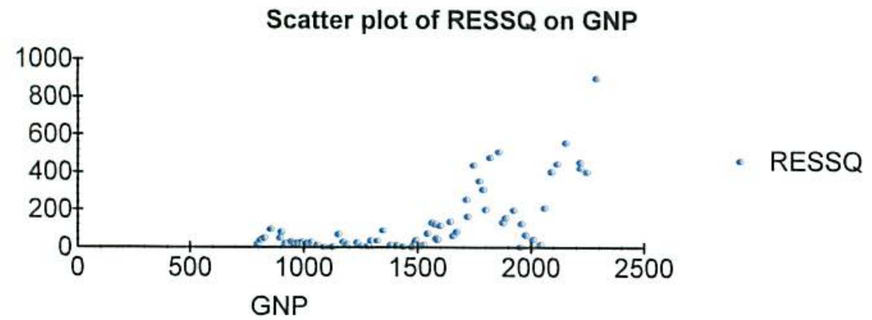
A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on the regression of squared residuals on squared fitted values

Plotting the estimated squared residuals from this regression on
(i). the fitted $M0_t$ values from the regression line and
(ii). the *GNP* explanatory variable
gives FIGURE 1.0

FIGURE 1.0:
(i).



(ii).



where
RESSQ denotes the residual squared $\hat{\varepsilon}_t^2$ and
FIT denotes $\hat{M}0_t$, the fitted values from the regression line.

(a) Explain what is meant by heteroscedasticity?

Discuss the consequences of heteroscedasticity for estimation and hypothesis testing using OLS estimators. **(30%)**

(b) Explain what the researcher hoped to achieve with the scatter plots in FIGURE 1.0? What does FIGURE 1.0 show? Based on the results given, formally, conduct a test for heteroscedasticity in this model (describe the steps involved in the test procedure). Does the outcome of this test support the evidence from FIGURE 1.0? **(30%)**

(c) Describe the GLS/ WLS method of correcting for heteroscedasticity when σ_i^2 is known. **(20%)**

(d) Consider the two-variable regression model

$$Y_i = \beta_1 + \beta_2 X_i + \varepsilon_i$$

Explain how the weighted or generalised least squares estimator works when:

$\sigma_i^2 = \sigma^2 X_i^2$

$\sigma_i^2 = \sigma^2 X_i$ **(20%)**

B2. Explain/ discuss the following:

(a) In intuitive terms, what is the difference between stationary and nonstationary time series processes?

What is a "stationary stochastic process?" **(20%)**

(b) The autocorrelation function (ACF). The general characteristics of the correlogram for stationary and nonstationary processes. **(15%)**

(c) The Dickey-Fuller (DF) and Augmented DF tests. **(25%)**

(d) The meaning of a series being "integrated of order 1," that is I(1). The concept of cointegration and ONE test of whether two time series are cointegrated. **(25%)**

(e) A regression between two nonstationary variables can produce spurious results. If the variables are nonstationary, and not cointegrated, is there any relationship that can be estimated (mention any problems with your approach here)? **(15%)**

B3. **(a)** What is meant by multicollinearity?

Discuss the consequences of multicollinearity for OLS estimation. **(25%)**

(b) Describe the auxiliary regression method which can be used to detect for the presence of multicollinearity. **(20%)**

(c) *"A high degree of multicollinearity may have an adverse effect on regression results, but this is by no means inevitable."*

Discuss this statement. **(20%)**

(d) Describe two possible remedial measures for the multicollinearity problem. **(10%)**

(e) Suppose we fit the model

$$M0_t = \beta_1 + \beta_2 GNP_t + \beta_3 i_t + \varepsilon_t$$

where $M0_t$ = demand for money (*nominal* cash balances)
i_t = an interest rate indicator (%)
GNP_t = Gross National Product

Partial *Microfit* output from estimating this relation based on quarterly data for 1972Q1-1989Q4 (72 observations) appears below

Diagnostic Tests

Test Statistics	F Version
A: Serial Correlation	F(4, 65) = 111.9423[.000]
B: Functional Form	F(1, 68) = 53.1390[.000]
C: Heteroscedasticity	F(1, 70) = 65.4813[.000]

A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on the regression of squared residuals on squared fitted values

Describe the steps involved in the RESET test procedure as used here. Does the RESET test suggest the model is misspecified? **(25%)**

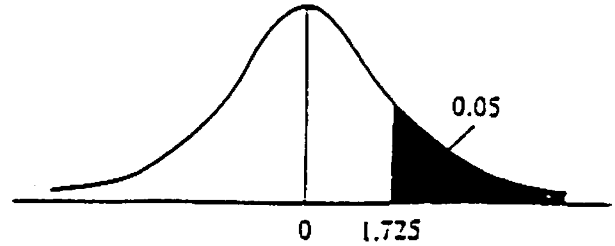
Percentage points of the t distribution

Example

$Pr(t > 2.086) = 0.025$

$Pr(t > 1.725) = 0.05$ for df = 20

$Pr(|t| > 1.725) = 0.10$



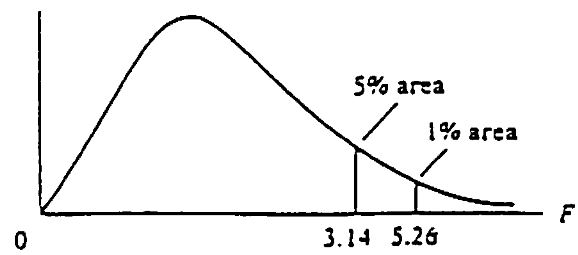
df \ Pr	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.05	0.01 0.02	0.005 0.010	0.001 0.002
1	1.000	3.078	6.314	12.706	31.821	63.657	318.31
2	0.816	1.886	2.920	4.303	6.965	9.925	22.327
3	0.765	1.638	2.353	3.182	4.541	5.841	10.214
4	0.741	1.533	2.132	2.776	3.747	4.604	7.173
5	0.727	1.476	2.015	2.571	3.365	4.032	5.893
6	0.718	1.440	1.943	2.447	3.143	3.707	5.208
7	0.711	1.415	1.895	2.365	2.998	3.499	4.785
8	0.706	1.397	1.860	2.306	2.896	3.355	4.501
9	0.703	1.383	1.833	2.262	2.821	3.250	4.297
10	0.700	1.372	1.812	2.228	2.764	3.169	4.144
11	0.697	1.363	1.796	2.201	2.718	3.106	4.025
12	0.695	1.356	1.782	2.179	2.681	3.055	3.930
13	0.694	1.350	1.771	2.160	2.650	3.012	3.852
14	0.692	1.345	1.761	2.145	2.624	2.977	3.787
15	0.691	1.341	1.753	2.131	2.602	2.947	3.733
16	0.690	1.337	1.746	2.120	2.583	2.921	3.686
17	0.689	1.333	1.740	2.110	2.567	2.898	3.646
18	0.688	1.330	1.734	2.101	2.552	2.878	3.610
19	0.688	1.328	1.729	2.093	2.539	2.861	3.579
20	0.687	1.325	1.725	2.086	2.528	2.845	3.552
21	0.686	1.323	1.721	2.080	2.518	2.831	3.527
22	0.686	1.321	1.717	2.074	2.508	2.819	3.505
23	0.685	1.319	1.714	2.069	2.500	2.807	3.485
24	0.685	1.318	1.711	2.064	2.492	2.797	3.467
25	0.684	1.316	1.708	2.060	2.485	2.787	3.450
26	0.684	1.315	1.706	2.056	2.479	2.779	3.435
27	0.684	1.314	1.703	2.052	2.473	2.771	3.421
28	0.683	1.313	1.701	2.048	2.467	2.763	3.408
29	0.683	1.311	1.699	2.045	2.462	2.756	3.396
30	0.683	1.310	1.697	2.042	2.457	2.750	3.385
40	0.681	1.303	1.684	2.021	2.423	2.704	3.307
60	0.679	1.296	1.671	2.000	2.390	2.660	3.232
120	0.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	0.674	1.282	1.645	1.960	2.326	2.576	3.090

Note: The smaller probability shown at the head of each column is the area in one tail; the larger probability is the area in both tails.

Upper percentage points of the F distribution

Example

$Pr(F > 1.59) = 0.25$
$Pr(F > 2.42) = 0.10$ for df $N_1 = 10$
$Pr(F > 3.14) = 0.05$ and $N_2 = 9$
$Pr(F > 5.26) = 0.01$



df for denominator N_2	df for numerator N_1												
	Pr	1	2	3	4	5	6	7	8	9	10	11	12
1	.25	5.83	7.50	8.20	8.58	8.82	8.98	9.10	9.19	9.26	9.32	9.36	9.41
	.10	39.9	49.5	53.6	55.8	57.2	58.2	58.9	59.4	59.9	60.2	60.5	60.7
	.05	161	200	216	225	230	234	237	239	241	242	243	244
2	.25	2.57	3.00	3.15	3.23	3.28	3.31	3.34	3.35	3.37	3.38	3.39	3.39
	.10	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39	9.40	9.41
	.05	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4
	.01	98.5	99.0	99.2	99.2	99.3	99.3	99.4	99.4	99.4	99.4	99.4	99.4
3	.25	2.02	2.28	2.36	2.39	2.41	2.42	2.43	2.44	2.44	2.44	2.45	2.45
	.10	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23	5.22	5.22
	.05	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.76	8.74
	.01	34.1	30.8	29.5	28.7	28.2	27.9	27.7	27.5	27.3	27.2	27.1	27.1
4	.25	1.81	2.00	2.05	2.06	2.07	2.08	2.08	2.08	2.08	2.08	2.08	2.08
	.10	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92	3.91	3.90
	.05	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.94	5.91
	.01	21.2	18.0	16.7	16.0	15.5	15.2	15.0	14.8	14.7	14.5	14.4	14.4
5	.25	1.69	1.85	1.88	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89
	.10	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32	3.30	3.28	3.27
	.05	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.71	4.68
	.01	16.3	13.3	12.1	11.4	11.0	10.7	10.5	10.3	10.2	10.1	9.96	9.89
6	.25	1.62	1.76	1.78	1.79	1.79	1.78	1.78	1.78	1.77	1.77	1.77	1.77
	.10	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94	2.92	2.90
	.05	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03	4.00
	.01	13.7	10.9	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.79	7.72
7	.25	1.57	1.70	1.72	1.72	1.71	1.71	1.70	1.70	1.69	1.69	1.69	1.68
	.10	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70	2.68	2.67
	.05	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.60	3.57
	.01	12.2	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.54	6.47
8	.25	1.54	1.66	1.67	1.66	1.66	1.65	1.64	1.64	1.63	1.63	1.63	1.62
	.10	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.54	2.52	2.50
	.05	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.31	3.28
	.01	11.3	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.73	5.67
9	.25	1.51	1.62	1.63	1.63	1.62	1.61	1.60	1.60	1.59	1.59	1.58	1.58
	.10	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42	2.40	2.38
	.05	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.10	3.07
	.01	10.6	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	5.18	5.11

Upper percentage points of the F distribution (*continued*)

df for denominator N_2	df for numerator N_1												
	Pr	1	2	3	4	5	6	7	8	9	10	11	12
	.25	1.49	1.60	1.60	1.59	1.59	1.58	1.57	1.56	1.56	1.55	1.55	1.54
10	.10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32	2.30	2.28
	.05	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.94	2.91
	.01	10.0	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.77	4.71
	.25	1.47	1.58	1.58	1.57	1.56	1.55	1.54	1.53	1.53	1.52	1.52	1.51
11	.10	3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27	2.25	2.23	2.21
	.05	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.82	2.79
	.01	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54	4.46	4.40
	.25	1.46	1.56	1.56	1.55	1.54	1.53	1.52	1.51	1.51	1.50	1.50	1.49
12	.10	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21	2.19	2.17	2.15
	.05	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.72	2.69
	.01	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39	4.30	4.22	4.16
	.25	1.45	1.55	1.55	1.53	1.52	1.51	1.50	1.49	1.49	1.48	1.47	1.47
13	.10	3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16	2.14	2.12	2.10
	.05	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.63	2.60
	.01	9.07	6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10	4.02	3.96
	.25	1.44	1.53	1.53	1.52	1.51	1.50	1.49	1.48	1.47	1.46	1.46	1.45
14	.10	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12	2.10	2.08	2.05
	.05	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.57	2.53
	.01	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94	3.86	3.80
	.25	1.43	1.52	1.52	1.51	1.49	1.48	1.47	1.46	1.46	1.45	1.44	1.44
15	.10	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09	2.06	2.04	2.02
	.05	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.51	2.48
	.01	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.73	3.67
	.25	1.42	1.51	1.51	1.50	1.48	1.47	1.46	1.45	1.44	1.44	1.44	1.43
16	.10	3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	2.06	2.03	2.01	1.99
	.05	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.46	2.42
	.01	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.62	3.55
	.25	1.42	1.51	1.50	1.49	1.47	1.46	1.45	1.44	1.43	1.43	1.42	1.41
17	.10	3.03	2.64	2.44	2.31	2.22	2.15	2.10	2.06	2.03	2.00	1.98	1.96
	.05	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.41	2.38
	.01	8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.52	3.46
	.25	1.41	1.50	1.49	1.48	1.46	1.45	1.44	1.43	1.42	1.42	1.41	1.40
18	.10	3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	2.00	1.98	1.96	1.93
	.05	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.37	2.34
	.01	8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.60	3.51	3.43	3.37
	.25	1.41	1.49	1.49	1.47	1.46	1.44	1.43	1.42	1.41	1.41	1.40	1.40
19	.10	2.99	2.61	2.40	2.27	2.18	2.11	2.06	2.02	1.98	1.96	1.94	1.91
	.05	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.34	2.31
	.01	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.36	3.30
	.25	1.40	1.49	1.48	1.46	1.45	1.44	1.43	1.42	1.41	1.40	1.39	1.39
20	.10	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94	1.92	1.89
	.05	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.31	2.28
	.01	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.29	3.23

Upper percentage points of the F distribution (*continued*)

df for denominator N_2	df for numerator N_1												
	Pr	1	2	3	4	5	6	7	8	9	10	11	12
	.25	1.40	1.48	1.47	1.45	1.44	1.42	1.41	1.40	1.39	1.39	1.38	1.37
22	.10	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90	1.88	1.86
	.05	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.26	2.23
	.01	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.18	3.12
	.25	1.39	1.47	1.46	1.44	1.43	1.41	1.40	1.39	1.38	1.38	1.37	1.36
24	.10	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.85	1.83
	.05	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.21	2.18
	.01	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.09	3.03
	.25	1.38	1.46	1.45	1.44	1.42	1.41	1.39	1.38	1.37	1.37	1.36	1.35
26	.10	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88	1.86	1.84	1.81
	.05	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15
	.01	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09	3.02	2.96
	.25	1.38	1.46	1.45	1.43	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34
28	.10	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87	1.84	1.81	1.79
	.05	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.15	2.12
	.01	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.96	2.90
	.25	1.38	1.45	1.44	1.42	1.41	1.39	1.38	1.37	1.36	1.35	1.35	1.34
30	.10	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.79	1.77
	.05	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.13	2.09
	.01	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.91	2.84
	.25	1.36	1.44	1.42	1.40	1.39	1.37	1.36	1.35	1.34	1.33	1.32	1.31
40	.10	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.73	1.71
	.05	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.04	2.00
	.01	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.73	2.66
	.25	1.35	1.42	1.41	1.38	1.37	1.35	1.33	1.32	1.31	1.30	1.29	1.29
60	.10	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.68	1.66
	.05	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92
	.01	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.56	2.50
	.25	1.34	1.40	1.39	1.37	1.35	1.33	1.31	1.30	1.29	1.28	1.27	1.26
120	.10	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65	1.62	1.60
	.05	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.87	1.83
	.01	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.40	2.34
	.25	1.33	1.39	1.38	1.36	1.34	1.32	1.31	1.29	1.28	1.27	1.26	1.25
200	.10	2.73	2.33	2.11	1.97	1.88	1.80	1.75	1.70	1.66	1.63	1.60	1.57
	.05	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98	1.93	1.88	1.84	1.80
	.01	6.76	4.71	3.88	3.41	3.11	2.89	2.73	2.60	2.50	2.41	2.34	2.27
	.25	1.32	1.39	1.37	1.35	1.33	1.31	1.29	1.28	1.27	1.25	1.24	1.24
∞	.10	2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63	1.60	1.57	1.55
	.05	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.79	1.75
	.01	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.25	2.18