Examination:	20028 – Financial Econometrics	**Summer Term 2010**
Examiner:	Prof. Dr. Dr. Bodo Vogt	**15.07.2010**
Aids permitted:	non-programmable pocket calculators; English dictionaries without any markings	

The examination is comprised of **six** problems. All of them are to be solved. You can reach a maximum of **86 points. Good luck!**

Problem 1: (12 points)

Please answer the following multiple choice questions. Each question has only **one** correct answer. For each correct answer you receive 2 points and for each incorrect answer you lose 1 point.

1. Which of the following is a classical assumption of the OLS model?
   a) The regression model is linear, is correctly specified and has a multiplicative error term;
   b) The error term has a constant variance;
   c) All explained variables are uncorrelated with the error term;

2. Which of the following statements is incorrect:
   a) An irrelevant variable causes the standard error to increase;
   b) An irrelevant variable causes a bias;
   c) An irrelevant variable causes a decrease in the t-scores;

3. Which of the following statements is true:
   a) Imperfect multicollinearity is caused by a specification error;
   b) Imperfect multicollineartity is a deterministic linear relationship existing between two or more independent variables;
   c) Imperfect multicollinearity is a strong but not deterministic linear relationship between two or more independent variables;

4. Serial correlation is likely to cause the following problem:
   a) Biased estimates of the coefficients;
   b) Biased estimates of the standard errors;
   c) Biased estimates of the error terms;

5. For the detection of a serial correlation one usually calculates one of the following:
   a) VIFs (high variance inflation factors);
   b) t-statistics;
   c) Durbin-Watson d statistics;

6. Heteroscedasticity means that:
   a) The error term does not have a constant variance;
   b) The explanatory variables do not have a constant variance;
   c) The dependent variable does not have a constant variance;

Problem 2: (20 points)

Imagine you are the manager of "Divine Scent", a small perfume and cosmetic shop. Every year your shop is creating and launching two new women' fragrances – one during the first half of the year (Jan-Jun) and one during the second half of the year (Jul-Dec). You have just developed another new women' fragrance but before you launch it, you want to get a feeling about the sales revenue this new product is going to generate. That is why, based on data from the last 10 years, you run a linear regression and you receive the following equation (standard errors in parenthesis):

$$\hat{S}_t = 500 - 50P_t + 30V_t + 48A_t + 15C_t - 4AC_t$$

$$(25) \quad (10) \quad (16) \quad (6.5) \quad (1)$$

$$\bar{R}^2 = 0.78 \qquad \text{N=20 (semiannual model)}$$

S_t – Sales revenue generated by a given new fragrance in period t;

P_t – Price of the new fragrance in period t;

V_t – Number of visitors of "Divine Scent" in period t;

A_t – A dummy variable equal to 1 if "Divine Scent" advertises its new fragrance in period t and 0 otherwise;

C_t – The number of new fragrances developed by a nearby competitor in period t;

AC_t – A dummy variable equal to 1 if the nearby competitor advertises its new fragrances in period t and 0 otherwise;

a) Hypothesize expected signs, calculate the correct t-scores, and test the significance at the 5 percent level for each of the coefficients. (6 point)
b) What econometric problems, if any, appear to be in the equation? Explain. (6 points)
c) One of your coworkers advises you that maybe you should include one of the following variables in your regression model. (8 points)

H_t – A dummy variable equal to 1 if the relevant time period is the first half of the year and 0 otherwise. (An attempt to account for the fact that during the first half of the year the demand for perfumes might be higher because of the Valentine's Day, the Woman's day and Mother's Day).

AG_t – A dummy variable equal to 1 if the nearby competitor advertises its whole shop, not just its new fragrances in period t and 0 otherwise;

Do you think that the inclusion of one of the above variables will improve the specification of your regression model? If your answer is confirming, which of the two suggested variables would you choose to include? Explain.

Problem 3: (9 points)

Please explain simultaneity bias. (You might use an example).

Problem 4: (9 points)

How does two-stage least squares (2SLS) work? Why is 2SLS a good method?

Problem 5: (15 points)

a) Please write down the equation of distributed lag model (consider p lags)? (3 points)
b) Dynamic models are the most commonly used simplification of distributed lag models. Transform the distributed lag model you wrote down in part a) into a dynamic model? (Note: Write down only the final result, the derivation is not required). (3 points)
c) Are distributed lag models and dynamic models likely to have any of the following problems – bias, multicollinearity, serial correlation? If your answer is confirming, specify which problem is likely to exist for which model. (3 points)
d) A time series is said to be stationary if it satisfies three conditions. Please write these conditions down. (6 points)

Problem 6: (21 points)

a) What is meant under univariate time series modeling? (3 points)
b) What are the three basic types of linear univariate time series models? (Note: Simply enumerate them). (3 points)
c) Please write down the equation of an ARMA (3, 1) process. (3 points)
d) Assume that the following AR(1) process is stationary and ε_t is white noise:

$$y_t = \alpha y_{t-1} + \varepsilon_t$$

Please derive the expectation, the variance ($\sigma_y^2 = \gamma_0$), the first, second and k-th order autocovariance ($\gamma_1, \gamma_2, \gamma_k$) and the autocorrelation function (ρ_k) of the above process. (Hint: $Var(X) = E\left[(X-\mu)^2\right] = E(X^2) - (E(X))^2$,

$Cov(X,Y) = E\left[(x-\mu_X)(Y-\mu_Y)\right] = E(XY) - E(X)E(Y), corr(X,Y) = \frac{Cov(X,Y)}{\sqrt{Var(x)}\sqrt{Var(Y)}}$).

(12 points)

Critical Values of the t-Distribution

Level of Significance

d.f.	One Sided:	10.0%	5.0%	2.5%	1.0%	0.5%
	Two Sided:	20.0%	10.0%	5.0%	2.0%	1.0%
1		3.078	6.314	12.706	31.821	63.657
2		1.886	2.920	4.303	6.965	9.925
3		1.638	2.353	3.182	4.541	5.841
4		1.533	2.132	2.776	3.747	4.604
5		1.476	2.015	2.571	3.365	4.032
6		1.440	1.943	2.447	3.143	3.707
7		1.415	1.895	2.365	2.998	3.499
8		1.397	1.860	2.306	2.896	3.355
9		1.383	1.833	2.262	2.821	3.250
10		1.372	1.812	2.228	2.764	3.169
11		1.363	1.796	2.201	2.718	3.106
12		1.356	1.782	2.179	2.681	3.055
13		1.350	1.771	2.160	2.650	3.012
14		1.345	1.761	2.145	2.624	2.977
15		1.341	1.753	2.131	2.602	2.947
16		1.337	1.746	2.120	2.583	2.921
17		1.333	1.740	2.110	2.567	2.898
18		1.330	1.734	2.101	2.552	2.878
19		1.328	1.729	2.093	2.539	2.861
20		1.325	1.725	2.086	2.528	2.845
21		1.323	1.721	2.080	2.518	2.831
22		1.321	1.717	2.074	2.508	2.819
23		1.319	1.714	2.069	2.500	2.807
24		1.318	1.711	2.064	2.492	2.797
25		1.316	1.708	2.060	2.485	2.787
26		1.315	1.706	2.056	2.479	2.779
27		1.314	1.703	2.052	2.473	2.771
28		1.313	1.701	2.048	2.467	2.763
29		1.311	1.699	2.045	2.462	2.756
30		1.310	1.697	2.042	2.457	2.750
40		1.303	1.684	2.021	2.423	2.704
60		1.296	1.671	2.000	2.390	2.660
120		1.289	1.658	1.980	2.358	2.617
∞		1.282	1.645	1.960	2.326	2.576