UNIVERSITI SAINS MALAYSIA
Second Semester Examination

Academic Session 1996/97
April 1997

AGW602 - RESEARCH METHODOLOGY

Time: [2 hours]

INSTRUCTION:
Please make sure that this examination paper consists of 12 printed pages before you begin.
Answer question 5, and two others.

1. Developing measures can be thought of as involving the following sequence of steps: concept development → concept specification (dimensions) → selection of indicators (items) → formation of indices.
   (i) Using this framework, develop a measure of "corporate image".
   (ii) Give at least two items for each of the dimensions you have identified and
   (iii) Indicate how you would form an index to get a measure of "corporate image".
   (iv) How would you interpret your index?

   (25 marks)

2. The major types of validity that a researcher has to be concerned with in relation to the choice of research design are internal and external validity. What are they? Describe the major threats to them and what can be done to control these threats?

   (25 marks)

3. Consider the following statement:

   People high in their Need for Achievement and who have high work ethic values, will be highly motivated to work. When they get motivated, they become more involved in their job.

   Develop a theoretical framework (arguments and the schematic diagram) and three hypotheses for the above statement.

   (25 marks)

...2/-

4. For the following two situations, identify the relevant population, and suggest the appropriate sampling design, explaining why. Wherever necessary, identify the population frame.

a. *A manager would like to assess the extent of pilferage in the materials storage godowns of manufacturing firms in the Klang Valley.*

b. *A HRM Director wants to investigate the relationship between drug abuse and dysfunctional behaviors of blue collar workers in a particular government organization.*

(25 marks)

5. Answer 5a OR 5b.

The following data from 120 companies were collected:

Rate = Rating by investment experts as investment potentials
(1 = Class AAA, 2 = Class AA, and 3 = Class A)
Sales = Annual Sales in RM million
Profits = Annual Net Profits in RM million,
Assets = Assets in RM million,
Value = Market Value in RM million,
Cash = Cashflows in RM million, and
Employ = Number of Employees (in thousands).

5a. A Multiple Discriminant Analysis (MDA) was run to predict the rating based upon the above variables with the following SPSS output. Note that a random selection was made for selecting cases into the analysis(n = 67) and holdout(n = 53) samples.

...3/-

- - - - - - - D I S C R I M I N A N T A N A L Y S I S - - - - - -

RATE Expert Rating of Investment Potential

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Class A companies	1.00	73	60.8	60.8	60.8
Class AA companies	2.00	17	14.2	14.2	75.0
Class AAA companies	3.00	30	25.0	25.0	100.0
	Total	120	100.0	100.0	

On groups defined by RATE Expert Rating of Investment Potential

120 (Unweighted) cases were processed.
53 of these were excluded from the analysis.
0 had missing or out-of-range group codes.
53 were excluded by the select= variable.
67 (Unweighted) cases will be used in the analysis.

Number of cases by group

	Number of cases		
RATE	Unweighted	Weighted	Label
1	44	44.0	Class A companies
2	5	5.0	Class AA companies
3	18	18.0	Class AAA companies
Total	67	67.0	

Group means

RATE1	ASSETS	CASH	EMPLOY	PROFITS
1	5613.25000	132.23636	13.75000	43.67727
2	10690.80000	480.78000	22.82000	299.12000
3	19001.66667	1449.66111	77.70556	842.34444
Total	9589.05970	512.18209	31.60896	277.30746

RATE1	SALES	VALUE
1	2250.65909	1599.29545
2	4686.20000	4070.80000
3	3699747.55556	11642.88889
Total	995789.79104	4482.01493

...4/-

Group standard deviations

RATE	ASSETS	CASH	EMPLOY	PROFITS
1	8800.76833	211.92945	18.59095	195.59735
2	16752.16015	75.02068	28.62904	87.02084
3	18745.42187	1366.15640	99.24881	576.48165
Total	13884.26963	919.96916	60.08374	484.23421

RATE	SALES	VALUE
1	1864.11452	1667.83890
2	1898.23436	1515.95290
3	15649580.00581	8368.86407
Total	8112288.54281	6287.24510

Pooled within-groups correlation matrix

	ASSETS	CASH	EMPLOY	PROFITS	SALES	VALUE
ASSETS	1.00000					
CASH	.29620	1.00000				
EMPLOY	.02354	.50119	1.00000			
PROFITS	.37453	.89140	.41008	1.00000		
SALES	-.08381	-.02689	.23771	-.01485	1.00000	
VALUE	.20217	.84836	.42409	.83370	.01268	1.00000

Analysis number 1

Direct method: all variables passing the tolerance test are entered.

Minimum tolerance level..... .00100

Canonical Discriminant Functions

Maximum number of functions..... 2
Minimum cumulative percent of variance... 100.00
Maximum significance of Wilks' Lambda.... 1.0000

Prior probabilities

Group	Prior	Label
1	.65672	Class A companies
2	.07463	Class AA companies
3	.26866	Class AAA companies
Total	1.00000	

...5/-

Canonical Discriminant Functions

Fcn	Eigenvalue	Pct of Variance	Cum Pct	Canonical Corr	After Fcn	Wilks' Lambda	Chi-square	df	Sig
1*	1.3998	99.32	99.32	.7637	: 0	.412767	54.420	12	.0000
2*	.0095	.68	100.00	.0971	: 1	.990568	.583	5	.9888

* Marks the 2 canonical discriminant functions remaining in the analysis.

Standardized canonical discriminant function coefficients

	Func 1	Func 2
ASSETS	.14900	.04260
CASH	-.92709	.61880
EMPLOY	.17564	.40609
PROFITS	1.07746	-1.78020
SALES	.12692	.26068
VALUE	.61714	1.10019

Structure matrix:

Pooled within-groups correlations between discriminating variables and canonical discriminant functions
(Variables ordered by size of correlation within function)

	Func 1	Func 2
PROFITS	.89151*	-.13277
VALUE	.83513*	.32514
CASH	.68567*	.17443
ASSETS	.39619*	-.23071
EMPLOY	.44823	.51575*
SALES	.17294	.37738*

* denotes largest absolute correlation between each variable and any discriminant function.

...6/-

Canonical discriminant functions evaluated at group means (group centroids)

Group	Func 1	Func 2
1	-.77063	.02674
2	.02231	-.33584
3	1.87758	.02793

Test of Equality of Group Covariance Matrices Using Box's M

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Group	Label	Rank	Log Determinant
1	Class A companies	6	71.419632
2	Class AA companies	< 5	(Too few cases to be non-singular)
3	Class AAA companies	6	101.223723
	Pooled within-groups covariance matrix	6	96.775291

Since some covariance matrices are singular, the usual procedure will not work. The non-singular groups will be tested against their own pooled within-groups covariance matrix. The log of its determinant is 97.1625

Box's M	Approximate F	Degrees of freedom	Significance
1037.90384	42.32012	21, 4101.1	.0000

Classification results for cases selected for use in the analysis -

Actual Group	No. of Cases	Predicted Group Membership 1	2	3
Group 1	44	44	0	0
Class A companies		100.0%	.0%	.0%
Group 2	5	5	0	0
Class AA companies		100.0%	.0%	.0%
Group 3	18	6	0	12
Class AAA companies		33.3%	.0%	66.7%

Percent of "grouped" cases correctly classified: 83.58%

...7/-

Classification results for cases not selected for use in the analysis -

Actual Group	No. of Cases	Predicted Group Membership 1	2	3
Group 1	29	28	0	1
Class A companies		96.6%	.0%	3.4%
Group 2	12	11	0	1
Class AA companies		91.7%	.0%	8.3%
Group 3	12	4	0	8
Class AAA companies		33.3%	.0%	66.7%

Percent of "grouped" cases correctly classified: 67.92%

i. How would you interpret the standardized canonical discriminant function coefficeints and the structure matrix? Gives examples using figures given above.

ii. How well does the model predict the classification? Does it perform significantly better than without the model? (Note: You need to make comparison with maximum chance criterion or proportional chance criterion, or you can use the use the Press's Q statistic = [N - (n*k)]2/N(k-1))

(50 marks)

OR

5b. Supposing the Market Value is treated as a dependent variable while the other variables were taken as the predictors (note that rate variable has to be transformed using two dummy variables r1 and r2 as it is categorical). Two regressions were carried out: one without any interaction effect between r1 and r2 with the other variables and the second one with interactions. The results obtained using the METHOD = ENTER are as follows:

...8/-

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. VALUE Market Value (million $)

Block Number 1. Method: Enter
R1 R2 SALES PROFITS ASSETS CASH EMPLOY

Variable(s) Entered on Step Number
1.. EMPLOY Number of Employees ('000)
2.. ASSETS Assets (million $)
3.. R1 Dummy 1 for rate1
4.. SALES Annual Sales (million $)
5.. R2 Dummy 2 for rate1
6.. CASH Cash Flow (million $)
7.. PROFITS Net Profits (million $)

Multiple R .93975
R Square .88313
Adjusted R Square .87583
Standard Error 2176.81611

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	7	4010525097.59812	572932156.79973
Residual	112	530715177.39355	4738528.36959

F = 120.90930 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	Tolerance	VIF	T	Sig T
R1	-53.84	607.08	-.0030	.8811	1.135	-.089	.9295
R2	1059.85	722.63	.0746	.4033	2.480	1.467	.1453
SALES	2.7E-05	3.5E-05	.0261	.8995	1.112	.766	.4453
PROFITS	4.94	1.40	.3726	.0940	10.637	3.537	.0006
ASSETS	-1.1E-05	1.7E-04	-.0021	.9953	1.005	-.065	.9486
CASH	3.33	.63	.5201	.1100	9.094	5.339	.0000
EMPLOY	1.06	5.03	.0086	.6267	1.596	.211	.8329
(Constant)	782.21	263.27				2.971	.0036

...9/-

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	-6907.4473	36087.6367	4318.0083	5805.3330	120
*RESID	-5015.0796	9148.4121	.0000	2111.8218	120
*ZPRED	-1.9336	5.4725	.0000	1.0000	120
*ZRESID	-2.3039	4.2027	.0000	.9701	120

Total Cases = 120

Durbin-Watson Test = 1.53262

*** * * * MULTIPLE REGRESSION * * * ***
SECOND EQUATION

Equation Number 1 Dependent Variable.. VALUE Market Value (million $)

Block Number 1. Method: Enter

R1	R2	SALES	PROFITS	ASSETS	CASH	EMPLOY	ASSET1
ASSET2	CASH1	CASH2	PROFIT1	PROFIT2	EMPLOY1	EMPLOY2	R1
R2	SALES1	SALES2					

Variable(s) Entered on Step Number

1..	SALES2	Sales * r2
2..	ASSETS	Assets (million $)
3..	ASSET2	Assets * r2
4..	SALES1	Sales * r1
5..	EMPLOY	Number of Employees ('000)
6..	PROFIT1	Profits 8 r1
7..	EMPLOY1	Employ * r1
8..	CASH	Cash Flow (million $)
9..	R2	Dummy 2 for rate1
10..	ASSET1	Asset * r1
11..	CASH1	Cash * r1
12..	PROFITS	Net Profits (million $)
13..	EMPLOY2	Employ * r2
14..	PROFIT2	Profit * r2
15..	R1	Dummy 1 for rate1
16..	CASH2	Cash * r2

Multiple R	.95635
R Square	.91460
Adjusted R Square	.90134
Standard Error	1940.38550

...10/-

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	16	4153435399.79242	259589712.48703
Residual	103	387804875.19925	3765095.87572

F = 68.94638 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	Tolerance	VIF	T	Sig T
R1	88.53	2458.71	.0050	.0427	23.428	.036	.9713
R2	-404.13	820.76	-.0284	.2484	4.026	-.492	.6235
PROFITS	-4.50	3.58	-.3396	.0114	87.813	-1.259	.2110
ASSETS	4.9E-07	1.5E-04	9.2E-05	.9926	1.008	.003	.9975
CASH	7.24	3.32	1.1289	.0031	324.235	2.177	.0317
EMPLOY	17.16	17.28	.1392	.0422	23.711	.993	.3232
ASSET1	.04	.05	.0453	.2960	3.379	.856	.3942
ASSET2	-9.7E-07	.01	-3.2E-06	.6376	1.568	.000	.9999
CASH1	-4.88	4.94	-.1559	.0333	30.065	-.988	.3255
CASH2	-6.00	3.40	-.9712	.0027	365.199	-1.765	.0805
PROFIT1	10.96	5.77	.1749	.0977	10.235	1.899	.0604
PROFIT2	15.89	3.99	1.2018	.0091	110.369	3.973	.0001
EMPLOY1	-3.40	22.38	-.0117	.1410	7.095	-.152	.8794
EMPLOY2	-22.44	18.04	-.1778	.0406	24.660	-1.244	.2165
SALES1	-.08	.05	-.0734	.3709	2.696	-1.553	.1235
SALES2	3.2E-05	3.1E-05	.032	.8781	1.139	1.036	.3024
(Constant)	520.10	329.74				1.577	.1178

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Tolerance	VIF	Min Toler	T	Sig T
SALES	158.49	.085644	2.49E-08	40104028.2	2.49E-08	.868	.3873

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	-1425.9285	37388.5859	4318.0083	5907.8607	120
*RESID	-5175.6797	7876.9473	.0000	1805.2325	120
*ZPRED	-.9723	5.5977	.0000	1.0000	120
*ZRESID	-2.6673	4.0595	.0000	.9303	120

Total Cases = 120

Durbin-Watson Test = 1.68161

...11/-

- - Correlation Coefficients - -

	ASSETS	CASH	EMPLOY	PROFITS	SALES	VALUE	RATE1
ASSETS	1.0000	-.0312	-.0345	-.0327	-.0086	-.0343	-.0609
	(120)	(120)	(120)	(120)	(120)	(120)	(120)
	P= .	P= .736	P= .708	P= .723	P= .926	P= .710	P= .509
CASH	-.0312	1.0000	.5456	.9374	.0711	.9241	.6508
	(120)	(120)	(120)	(120)	(120)	(120)	(120)
	P= .736	P= .	P= .000	P= .000	P= .440	P= .000	P= .000
EMPLOY	-.0345	.5456	1.0000	.5125	.2715	.5222	.4636
	(120)	(120)	(120)	(120)	(120)	(120)	(120)
	P= .708	P= .000	P= .	P= .000	P= .003	P= .000	P= .000
PROFITS	-.0327	.9374	.5125	1.0000	.1045	.9216	.7250
	(120)	(120)	(120)	(120)	(120)	(120)	(120)
	P= .723	P= .000	P= .000	P= .	P= .256	P= .000	P= .000
SALES	-.0086	.0711	.2715	.1045	1.0000	.1164	.1465
	(120)	(120)	(120)	(120)	(120)	(120)	(120)
	P= .926	P= .440	P= .003	P= .256	P= .	P= .206	P= .110
VALUE	-.0343	.9241	.5222	.9216	.1164	1.0000	.6845
	(120)	(120)	(120)	(120)	(120)	(120)	(120)
	P= .710	P= .000	P= .000	P= .000	P= .206	P= .	P= .000
RATE1	-.0609	.6508	.4636	.7250	.1465	.6845	1.0000
	(120)	(120)	(120)	(120)	(120)	(120)	(120)
	P= .509	P= .000	P= .000	P= .000	P= .110	P= .000	P= .

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

i. Are the assumptions of multiple regression met? Use the figures given above to support your arguments. If the information required is not available indicate how would you go about determining whether or not a particular assumption is satisfied.

ii. How good is the model?

iii. How would you interpret the coefficients of the dummy variables in the first equation (had it been significant)?

...12/-

iv. In the second equation, interaction effects were included. Interpret the differences between the first and second equation results. Should you be alarmed at the high Variance Inflation Factors (VIF)? Why or why not?

v. What interpretation can you make regarding the factors influencing the market value of the company? What precautions would you provide to readers who are trying to interpret the above output?

(50 marks)

...oooOOOooo...