



## DEPARTMENT OF ECONOMICS AND ECONOMETRICS

### FINAL ASSESSMENT 2014

**Course:** Honours in Economics and Econometrics

**Subject:** Advanced Microeconomics (EKN 01X7)  
Microeconomics 4 (MIE 8X01)

**Assessor:** Prof G van Zyl (UJ)

**Moderator:** Dr M Louw (MakroSA)

**Date:** 17 June 2014

**Time:** 3 hours

**Marks:** 100

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THIS PAPER CONSISTS OF 6 PAGES

(Please show all calculations)

Question 1: Game theory, risk & microeconomic impact study

[40]

- 1.1 Vikings and Catchalot are the two main sellers of fish products in the Mossel Bay area. Vikings is the market leader. The main selling activities of the two firms are fresh fish products and processed fish products (canned fish & vacuumed packed fish). Analysts are of the opinion that no gains are possible if both firms increase their activities in the same sector (fresh fish and processed fish). Vikings should gain 6% of the market share and Catchalot should gain 4% of the market share if Vikings expand its fresh fish activities and Catchalot at the same time expands its processed fish product activities. On the other hand, Vikings should gain 4% of the market share and Catchalot should gain 3% of the market share if Vikings expand its processed fish product activities and at the same time Catchalot expands its fresh fish activities.

State the conditional format of the strategies (in tabular format), plot the sequential payoff matrix (in tabular format), determine the formal Nash equilibria and determine the sub-game perfect equilibrium (illustrate with the aid of a diagram). (12)

- 1.2 Assume that the competition for certain product lines between these two firms is so strong that it can be described as a zero gain situation. Vikings has decided to concentrate its activities on fresh line-fish and prawn processing while Catchalot has decided to concentrate its activities on mussel processing and canned fish. Vikings preferred option is fresh line-fish while Catchalot's preference is to expand its canned fish activities. The payoff matrix is as follow:

		Catchalot	
		Canned fish	Mussels
Vikings	Fresh line-fish	+R5m / -R5m	+R3m / -R3m
	Prawn	+R4m / -R4m	+R6m / -R6m

Determine the Nash equilibrium probabilities of Vikings opting for fresh line-fish activities (**ff**) and Catchalot opting for canned fish (**cf**). What would the success rates be for the companies at Nash equilibrium? (8)

- 1.3 The management of Vikings must determine whether to expand its fresh fish activities or to expand its fish processing activities. From market studies management constructed the following payoff matrix of the present value of all future net profits under different time frames:

Fresh fish			Processed fish	
Time frame	Probability	Profit	Probability	Profit
1 year	0.3	R3m	0.4	R2m
2 years	0.4	R5m	0.4	R3m
3 years	0.3	R7m	0.2	R4m

The management's risk utility function is estimated as:

$$U = 8M - 0.4M^2 \text{ (Where M refers rand).}$$

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- 1) What is the risk profile of management in terms of the two options?
- 2) If management's objective was profit maximisation regardless of risk, which project should they introduce?
- 3) If the management's objective was utility maximisation, which project should they introduce?
- 4) Assume i) that the present value cost outlay of the new fresh fish infrastructure is R4m ii) the discount rate is 12% and the certainty-equivalent coefficient is 0.90. Use the valuation model to indicate whether Viking should continue with its fresh fish expansion program (explain your answer).
- 5) Assume that the present value cost outlay of the extension of the processed fish facility is R3m. Use the maximin and minimax regret criteria to determine whether Viking should proceed with the expansion program.

(14)

1.4 Vikings is requesting you to perform an economic impact study (specifically on indirect and combined income generating and job creation aspects) on its expansion of its fish processing facilities. The following information is given to you.

- **The present values per product/service category**

Product/service category	PV of forecasted sales
Processed fish	R8 000 000

- **The GDP multipliers**

Sector	Initial direct impact	1 <sup>st</sup> round direct impact	Indirect effect	Induced effect
Processed food	0.1972	0.3361	0.2913	0.3853

- **Projected direct employment opportunities**

	Construction employment	On-site employment
Total	100	30

- **The employment multipliers**

Sector	Initial direct impact	1 <sup>st</sup> round direct impact	Indirect effect	Induced effect
Construction	1.5732	1.4662	1.5495	2.5031
Processed food	1.2271	4.1721	1.7919	2.3807

Compile a brief report for management.

(6)

**Question 2: Demand analysis**

[40]

2.1 Market research clearly indicates that the consumer demand for fresh fish are determined by the average price of fresh fish per kilogram, the average price per kilogram of other proteins (such as red meat and chicken), amount spend of advertising, the monthly disposable income of households and the

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variety of fresh fish available at any period of time. The following demand function for the fresh fish market of Viking's was estimated. A sample period of 16 quarters was used.

The following table contains i) the parameter estimates ii) the standard errors iii) the  $R^2$  and iv) the D-W statistics.

**Demand function**

$R^2$ : 0.87

Variable	Estimate	Standard error
Intercept	42.89	3.25
$P_{\text{average fresh fish per kg}}$	-15.20	2.95
$P_{\text{average price of other proteins per kg}}$	18.28	2.45
Marketing expenses	2.5	1.11
Number of fresh fish outlets in the region	-2.50	1.04
Disposable income of households	2.72	1.05
Availability index of fish variety	6.51	2.25

( $P_{\text{average fresh fish per kg}}$  and  $P_{\text{average price of other proteins per kg}}$  are expressed in tens of rand per kilogram; marketing expenses are expressed in tens of thousands of rand; the number of construction firms in actual numbers; the disposable income of households in tens of thousands of rand and the availability of fish variety on an index scale (closer to 1 reflects a higher availability index of variety). The sales of fresh fish are expressed in hundreds of units). Consensus forecasts for the different variables for the next quarter are listed in the following table.

**Quarters**

Variable	1
$P_{\text{average fresh fish per kg}}$	R 16.14
$P_{\text{average price of other proteins per kg}}$	R 20.05
Marketing expenses	R 25 000
No of fresh fish outlets	7
Monthly disposable income of households	R14 755
Availability index of fresh fish	0.63

- Are the estimates of the variables statistically significant?
- Use the forecasted values of the first quarter and determine the elasticity coefficients of the demand function. How would you explain the degree of sensitivity of each elasticity coefficient?
- Assume the following scenario for quarter 2. The price of fresh fish increases with 1½%; the average price of other proteins increases to R21.05 per kilogram; marketing expenses increases by ½%, the number of fresh fish outlets remain the same, the disposable income of households decreases by 1% and the availability index decreases to 0.55. Estimate sales for the 2<sup>nd</sup> quarter.
- Assume that the aim of the firm is to maximise its revenue position. What should the price per unit be in quarter 1.

(18)

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2.2 Viking needs advice on the setting of a profit-optimal price for its canned pickle fish (per 100g can). The current average market price is R5.20 per can. The variable cost is R3 per kilogram. The estimated monthly demand for its product is:

$$Q = 80\,000 + 1200P^A - 15000P^V.$$

(where  $P^A$  = average price per kilogram in the market and  $P^V$  = price per kilogram that Viking charges) (8)

2.3 Viking has estimated a multiplicative demand function for its 1kg sealed prawn pack.

$$Q_p = 2.8P_o^{-2.66}P_{COMP}^{2.37}A^{0.9}N_{OUTLET}^{-1.86}P_{RELATED}^{-2.78}Inc^{3.12}$$

(where  $Q_p$  = quantity,  $P_o$  = own price,  $P_{COMP}$  = average price of competitors,  $A$  = advertising expenses,  $N_{OUTLET}$  = number of outlets selling the prawn packs,  $P_{RELATED}$  = average price other related fish products and  $Inc$  = disposable income of households)

Advice Viking on the interpretation of the estimated demand function. (6)

2.4 Assume the following estimated trend forecast equation for canned mussels sold by Viking.

$$Q_{CM} = 14.07(1.02)^t$$

The sample period for the estimated function was 2010:1 – 2013:4. Do a trend forecast for the four quarters of 2014.

In order to cater for any seasonal variation dummy variables were introduced for each quarter. The estimated function after the introduction of these dummy variables is;

$$S_T = 270.55 - 25.45D_{1T} - 9.98D_{2T} + 11.55D_{3T} + 24.15D_{4T} + 0.03t$$

(where  $D_{1T}$  is the dummy for the 1<sup>st</sup> quarter,  $D_{2T}$  the dummy for the 2<sup>nd</sup> quarter,  $D_{3T}$  the dummy for the 3<sup>rd</sup> quarter and  $D_{4T}$  the dummy for the 4<sup>th</sup> quarter).

Adjust the trend forecast for seasonal variation. (8)

**Question 3: Production & cost analysis [20]**

4.1 Proof that the Cobb-Douglas function coefficient ( $\frac{\% \Delta \text{ in } Q}{\% \Delta \text{ in input usage}}$ ) is equal to the sum of the output elasticity's ( $E_K + E_L$ ). (6)

4.2 Viking is concerned about the returns to scale, optimality of its input mix and its cost efficiency. A Cobb-Douglas estimation as well as and cost estimations were done for a sixteen quarter period. The following estimation results apply:

**Dependent variable: Log Q**

**R<sup>2</sup>: 0.78**

Variable	Estimate	Standard error
Intercept	-2.7	0.66
Log K	0.47	0.05
Log L	0.40	0.03

Variance-covariance matrix

	Intercept	LogK	LogL
Intercept	0.030	-0.002	0.009
Log K	-0.002	0.0025	-0.003
Log L	0.005	-0.003	0.0009

The average values for output and input usage (all in thousands of units) are:

Q	34
K	78
L	4.1
r (price of capital)	0.35
w (price of labour)	62

Dependent variable:  $\text{Log}(\text{TC}/r)$

$R^2: 0.71$

Variable	Parameter estimate	Standard error
Intercept	-0.48	0.02
LogQ	1.25	0.08
Log(w/r)	1.09	0.30

You have to advice Viking on i) the statistical significance of the estimates ii) the returns to scale position iii) the optimality of the input mix and iii) the long-run cost efficiency.



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**Assessor:** Prof G van Zyl (UJ)

**Moderator:** Dr M Louw (MakroSA)

**Date:** 15 July 2014

**Time:** 3 hours

**Marks:** 100

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**Question 1: Game theory**

[20]

1.1 Alcock cc & Buildo are the two major firms in the window frame industry in Bloemfontein. Assume a sequential game between the two firms in which Alcock has the edge over Buildo (Alcock always make the strategic first move). In order to increase market share both firms can either import new frames or they can expand their production capacity. Buildo has the following options at its disposal: i) It could also import new frames when Alcock imports new frames or it could also increase its production capacity when Alcock expand its production capacity ii) It could simply decide to persist with the importation of new frames irrespective of the strategy adopted by Alcock or it could persist with an production capacity expansion program irrespective of the strategy adopted by Alcock and iii) it could decide to import new frames if Alcock adopts a production capacity expansion program or it could decide to implement a production capacity expansion program if Alcock imports new frames. Market strategists are of the opinion that the following payoff gains are possible:

- If both Alcock & Buildo imports new frames Alcock's payoff gain will be R10m and Buildo's payoff gain R6m;
- If Alcock chooses the production capacity expansion strategy and Buildo persists with the importation of new frames, both firms will experience no gains;
- If Alcock chooses to import new frames and Buildo persists with the capacity expansion strategy, both firms will experience no payoff gains;
- If both Alcock & Buildo chooses the production capacity expansion campaign Alcock's payoff gains will be R6m and Buildo's payoff gain will be R10m.

1. State the conditional format of the strategies (in tabular format).
2. Plot the sequential payoff matrix (in tabular format).
3. Determine the formal format Nash equilibria.
4. Determine the sub-game perfect equilibrium (also illustrate with the aid of a figure). (12)

1.2 Assume the following payoff matrix.

		Argo	
		Imports	Specialisation
Cisco	Advertising	Argo R4m Cisco R8m	0,0
	Capacity expansion	0,0	Argo R6m Cisco R4m

Assume that for Argo imports (im) is the preferred option and for Cisco the preferred option is advertising (ad). For each choice (ad) that Cisco makes, let  $b_a(ad)$  be a best response for Argo, and for each choice (im) that Argo makes let  $b_c(im)$  be a best response for Cisco. What would the expected payoff equations for the two firms be and what are the Nash equilibrium positions. (8)



**Question 2: Risk & impact study**

[25]

**2.1** Assume that Alcock has the opportunity to invest in a one-off new development. The total investment amount would be R4.5m. A financial analyst is of the opinion that i) there are risks involved in the undertaking of the investment and that the firm might lose the total investment amount but ii) that the firm can realise a one-off return of R7.7m (initial R4.5m plus R3.2m) if the project is successful.

Determine by means of a) the maximin criterion and b) the minimax regret criterion whether Alcock should undertake the development. (6)

**2.2** You are currently researching the risk profile of management. From the risk-based questionnaires that management completed a risk-specialist is of the opinion that your managements' utility function for net returns is estimated as:

$$U = 50NR - NR^2$$

(where NR refers to rand of net returns)

Your economic strategist indicated the following probabilities on adopting a new five-year investment strategy:

	Aggressive investment strategy		Cautious investment strategy	
	Probability	Expected NPV	Probability	Expected NPV
Very favourable conditions in the industry	0.3	R100m	0.3	R70m
Normal conditions in the industry	0.5	R60m	0.4	R40m
Unfavourable conditions in the industry	0.2	R10m	0.3	R5m

- Would you classify management as risk seekers, risk neutral or risk averse? Why?
- If managements' objective is maximum net return regardless of risk, which capacity option should they choose?
- Evaluate the risk associated per rand of net returns with each capacity option.
- If managements' objective was utility maximisation, which capacity option should they introduce?
- Explain briefly what the choice of a discount would be (when calculating the NPV) if the financial policy of management is very conservative. (9)

**2.3** Assume that a manager regards the sum of R36m with certainty as equivalent to the expected (risky) net cash flow or return of R45m per annum for the next five years. The initial cost outlay of the project is R100m and the discount rate is 10%. Use the valuation model for risk and determine whether the manager should proceed with the project. (5)

**2.4** You are required to perform an economic impact study (specifically on indirect and combined income generating and job creation aspects) for a company that are contemplating the erection of a new plant called Maco. This plant will manufacture cleaning material to be sold to wholesalers. It would also run an outlet store for the general public. The following information is given to you. (5)

- **The present values per product/service category**

Product/service category	PV of forecasted sales
Cleaning materials	R15 030 000
Outlet store	R2 500 000

• The GDP multipliers

Sector	Initial direct impact	1 <sup>st</sup> round direct impact	Indirect effect	Induced effect
Other chemicals	0.2367	0.2246	0.2754	0.3700

• Projected direct employment opportunities

	Construction employment	On-site employment
Total	200	80

• The employment multipliers

Sector	Initial direct impact	1 <sup>st</sup> round direct impact	Indirect effect	Induced effect
Construction	1.5732	1.4662	1.5495	2.5031
Other chemicals	0.7991	1.0230	1.2169	2.2862

Question 3: Demand analysis

[30]

3.1 Alcock is currently running two window frame production lines (wooden frames & aluminium frames). The commercial analyst has conducted a thorough market research on both product lines and she made the following important remarks in her report to management.

- The demand for both product lines is driven by average real prices, the price levels of competitors ( $P_{com\ wood}$  is the competitor price for wooden frames and  $P_{com\ aluminium}$  is the competitor price for aluminium frames), the average income level of a household in the target market, the number of outlets in the local building sector and the amount spend on advertising.
- Aluminium frames is also exported to African countries and the export demand is mainly driven by the rand/dollar exchange rate.

Real quarterly data series for all the applicable variables were constructed for the period 2008:1 – 2013:4. The following table represents the estimated coefficients, standard errors, other statistics and quarterly real average values of all variables for both product lines.

Variable	Estimated coefficient	Standard error	Real average quarterly value for data series
Intercept for wooden frames	20.39	3.77	N/A
Intercept for aluminium frames	11.23	2.12	N/A
$P_w$	-13.11	2.43	511
$P_a$	-9.55	2.55	366
Advertising on wooden frames	2.88	0.65	165 400
Advertising on aluminium frames	2.78	0.78	126 500
Real average income per household in the target market	1.95	.73	10 555
$P_{com\ wooden}$	19.15	2.44	839
$P_{com\ aluminium}$	8.22	1.42	465
Number of outlets selling wooden frames in the targeted market	-3.47	0.86	16
Number of outlets selling aluminium frames in the targeted market	-2.52	0.78	18
Rand/dollar exchange rate	1.86	0.48	8.25

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In the specification of the estimated demand functions for both product lines i)  $P_w$  and  $P_a$  were expressed in hundreds of rand per frame ii) advertising was expressed in hundreds of thousands of rand iii) the real average income per household was expressed in tens of thousands of rand iv)  $P_{com}$  wooden and  $P_{com}$  aluminium were expressed in hundreds of rand per frame and v) the number of building outlets were expressed in tens of outlets.

Consensus real forecasts for the different variables for the first two quarters of 2014 are listed in the following table.

Variable	Quarters	
	1	2
$P_w$	R508	R515
$P_a$	R445	R475
Advertising on wooden frames	R172 000	R166 000
Advertising on aluminium frames	R112 000	R114 000
Real average income per household in the target market	R11 400	R11 600
$P_{com \text{ wood}}$	R935	R955
$P_{com \text{ aluminium}}$	R428	R503
Number of outlets selling wooden frames	16	16
Number of outlets selling aluminium frames	18	18
Rand/dollar exchange rate	9.54	9.43

You are expected to:

- do a full elasticity analysis for both wooden frames and aluminium frames (based on the real average values of the variables in the estimation period);
- forecast sales for aluminium frames for the second quarter of 2014;
- do a scenario forecast for aluminium frames for the third quarter of 2014 if the price of aluminium frames should increase by 2%, the quarterly income of households should decrease by 1% and the number of outlets selling aluminium frames should increase by 0.5%. Base this scenario forecast on the sales forecast of the 2<sup>nd</sup> quarter of 2014;
- determine the price of wooden frames for the 1<sup>st</sup> quarter of 2014 if it is the aim of the firm to maximise its sales revenue. (20)

4.2 The following is an abstract of the quarterly trend regression output for a particular product.

**Sample period:** First quarter 2010 – fourth quarter 2013

**R<sup>2</sup>:** 0.64

**F-statistic:** 68.24

	Constant	t
<b>Coefficients</b>	140.16	1.798
<b>Standard error</b>	5.02	.44

Research results clearly indicate the existence of seasonal variation in demand for the product in the sense that sales in the first and fourth quarters are better than the second and third quarters. In order to cater for seasonal variation dummy variable time series were constructed and a new regression was run on all the time series. The resultant regression equation is:

$$Q_T = 47.15 + 2.47D_1 - 3.27D_2 - 4.10D_3 + 4.56D_4$$

( $D_1$ ,  $D_2$ ,  $D_3$  and  $D_4$  are the dummy variables for the first, second, third and fourth quarters respectively).

- Do a forecast for the next four quarters.
- Assume that 58% of the SARB leading indicators are experiencing a downward trend in real terms. How will you adjust your forecasts? (5)

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4.3 A multiplicative demand function was estimated for a certain product.

$$Q_{PR} = 2.8P_{OP}^{-0.76}P_{COMP}^{1.24}A^{3.6}N_{OUTLET}^{-0.68}P_{RELATED}^{-0.98}I^{0.32}$$

(where  $Q_{PR}$  = quantity,  $P_{OP}$  = own price,  $P_{COMP}$  = average price of competitors,  $A$  = advertising expenses,  $N_{OUTLET}$  = number of outlets selling the product,  $P_{RELATED}$  = average price other related fish products and  $I$  = disposable income of households)

You are requested to interpret the estimated demand function.

(5)

**Question 5: Production & cost analysis**

[25]

5.1 Assume a bottling company specialising in fizzy drinks. The firm has appointed an economist to do a detailed analysis of its production and cost efficiency. The following information applies.

- The following is a computer printout of an estimated Cobb-Douglas production function. Twenty-four quarters worth of data were used in the estimation.

**Dependent variable: Log Q**

$R^2$ : 0.78

Variable	Estimate	Standard error
Intercept	-2.5	0.77
Log K	0.48	0.06
Log L	0.45	0.05

Variance-covariance matrix

	Intercept	LogK	LogL
Intercept	0.30	-0.02	0.09
Log K	-0.02	0.0036	-0.03
Log L	0.09	-0.03	0.0025

The average values for output and input usage (all in thousands of units) are:

Q	83
K	58
L	4.4
r (price of capital)	0.63
w (price of labour)	47

- The following is a computer printout of an estimated combined short-run cost function for both plants. The sample period used for the estimation is twenty weeks.

**Dependent variable: AVC**

$R^2$ : 0.88

Variable	Estimate	Standard error
Intercept	40	4.8
Q	-12	2.2
$Q^2$	5.4	1.6

- A long-run average cost estimation [ $\log(TC/r) = \log\alpha + \beta\log Q + \gamma\log(w/r)$ ] was done for a twenty quarter period. The results are contained in the following printout.

**Dependent variable: Log(TC/r)**

$R^2$ : 0.82

Variable	Parameter estimate	Standard error
Intercept	-0.44	0.04
LogQ	0.64	0.06
Log(w/r)	2.24	0.38

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You are required to comment on the:

- forecasting power the estimated parameter estimates;
- returns to scale;
- current input mix of the firm;
- short-run cost efficiency;
- long-run cost efficiency of the firm.

(18)

5.2 Explain the concept of learning curves. Illustrate with fully-annotated figures.

(7)