

# International College Portsmouth

Coursework 2023/01

## LIAF105 - Quantitative Methods

This coursework is worth **40%** of the overall grade.

The deadline for submission on Turnitin is **Friday, 24<sup>th</sup> March, 4:00 PM**

You must do the assignment **individually**.

### **Aims:**

*The aim of this assessment is to develop and evaluate data-driven models based on bivariate and multivariate regression models, and to demonstrate ability to apply the coefficient of variation to given data.*

*The coursework allows students to:*

- (1) develop and demonstrate the application of the methods of ordinary least squares regression using Excel.*
- (2) show an understanding of the importance of the coefficient of variation.*

*The assessment will consist of graphs and statistical analysis within a written report, fully explaining results and findings for each question. This should be between 1000 and 1500 words (**excluding** figures) and must be typed as a Word Document, using ICP house style.*

### **Report writing requirements:**

- *There are 11 questions and you should answer all of these separately.*
- *Type your answers to each question in a word document, and number the questions clearly.*
- *Show all relevant Excel calculations / regression summary output within your answers and include relevant analysis / findings / conclusions for each question.*
- *Use references based on all the literature you have used in compiling this report. Use the APA referencing system.*
- *Pay attention to the overall presentation and structure, ensuring logical development of ideas.*

### **SECTIONS A and B:**

- *Use an introduction to set your aims, explaining the problem you are examining.*
- *Structure the main body of work, which should comprise a discussion of your findings within each question, including the following:*
- *Summarise the main regression results including (where relevant) the estimated regression coefficients and model, p-values / significance of F values, coefficient of determination and regression summary analysis.*
- *Explain your regression line graphs and statistical results clearly.*
- *Show an understanding of the coefficient of determination.*
- *Carry out hypothesis tests on regression coefficients and interpret your findings.*

### **SECTION C:**

- *Show an understanding of the coefficient of variation and decisions based upon it.*

### **Assessment Criteria**

- *Demonstration of competence in the production and presentation of results from Microsoft EXCEL.*
- *Providing appropriate analysis, explanation and interpretation of results.*
- *Showing understanding of methods employed in analysis of data.*
- *Structuring and presenting the report clearly (including labelling of graphs and tables).*

## **Coursework Brief**

### **SECTIONS A and B:**

*You are required to examine a time series data set for demand for chocolate in from 1990 to 2018. You will examine the relationship between market demand of chocolate, and two variables, price and income. You will evaluate the significance of the variables within your models with a view to influence on consumer behaviour.*

**In section A**, use a bivariate regression model to investigate the following relationships separately:

*(1) Demand for chocolate and Price of chocolate.*

*(2) Demand for chocolate and Income.*

*You are expected to analyse the regression results, and comment on your findings.*

**In section B**, you are expected to use multivariate regression analysis for Demand, Price and Income, and comment on your findings.

**In section C**, you are expected to use the coefficient of variation to analyse the given data, and comment on your findings.

***For all sections (A, B and C), you may give your answers to 2 decimal places when appropriate; otherwise, use your judgement to give a suitable degree of accuracy, or follow the stated accuracy requirements.***

### **Data**

*Download the data from the MS Excel file in Moodle to answer the questions in Sections A and B.*

*The table shows time series data for demand for chocolate, the price of chocolate, and the personal disposable income of consumers over the years 1990 to 2018 (units are not given for the data and this will not affect analysis).*

**COURSEWORK QUESTIONS:**

**Answer each question separately, clearly showing the relevant question number.**

**Give your answers to 2 decimal places when appropriate; otherwise, use your judgement to give a suitable degree of accuracy or follow the stated accuracy requirements.**

**Section (A): Bivariate Regression Analysis [40 marks]**

**1).** Using Excel, plot *separate* scatter diagrams for the following:

- (i) Demand for chocolate (Y), against Price of chocolate ( $X_1$ ).
- (ii) Demand for chocolate (Y), against Income ( $X_2$ ).

*Note that Demand should be plotted on the **y axis** for all graphs in this coursework.*

Comment on the relationship between the variables in each of the graphs (i) and (ii).

**[6 marks]**

**2).** Assuming that Demand for chocolate (Y), and Price of chocolate ( $X_1$ ), are linked by a linear relationship, **use the regression summary output in Excel** to estimate a model for this regression in the form

$Y = \alpha_1 + \beta_1 X_1$ , and **interpret** the value of the gradient.

(The full regression summary output should be presented to support your answers).

**[10 marks]**

**3a).** Find the coefficient of determination,  $R^2$ , for demand for chocolate and price of chocolate, and comment on its value.

**b).** State whether there is a significant relationship between Demand and Price by carrying out an appropriate test, using the P-value at a 5% significance level.

(The regression summary output in Excel can be used).

**[7 marks]**

**4).** Assuming that Demand for chocolate (Y), and Income ( $X_2$ ), are linked by a linear relationship, **use the regression summary output in Excel** to estimate a model for this regression in the form  $Y = \alpha_2 + \beta_2 X_2$ , and **interpret** the value of the gradient.

(The full regression summary output should be presented to support your answers).

**[10 marks]**

**5a).** Find the coefficient of determination,  $R^2$ , for demand for chocolate and income, and comment on its value.

**b).** State whether there is a significant relationship between Demand and Income by carrying out an appropriate test, using the P-value at a 5% significance level.

(The regression summary output in Excel can be used).

**[7 marks]**

**Section (B) Multivariate Regression Analysis [50 marks]**

**Use multivariate regression analysis to investigate the relationship between Demand (Y), and Price ( $X_1$ ) and Income ( $X_2$ ) :**

**6).** **Use the regression summary output in Excel** to estimate the linear regression model for Demand (Y), and Price ( $X_1$ ) and Income ( $X_2$ ) in the form  $Y = \alpha_3 + \beta_3 X_1 + \beta_4 X_2$ . **Interpret** the values of the gradients

(The full regression summary output should be presented to support your answers).

**[10 marks]**



LIAF105\_Quantitative Methods\_202301

7). State and compare the estimated coefficient ( $\beta_1$ ) for Price of chocolate ( $X_1$ ), in the bivariate regression equation in **Section A, Question 2**, to the estimated coefficient ( $\beta_3$ ) for Price of chocolate ( $X_1$ ), in the multivariate regression equation in **Section B, Question 6**.

Are the coefficients different? If so, why? Explain your answer, stating whether or not you think it is reasonable to assume that Demand for chocolate depends on both Price of chocolate and Income.

[10 marks]

8). State and discuss the value of the coefficient of determination for the **multivariate regression analysis** for Demand ( $Y$ ), and Price ( $X_1$ ) and Income ( $X_2$ ), and compare it to the value of  $R^2$  in the **bivariate regression analysis found in Question 3, Section A**. *You must give your values to three significant figures.*

Giving reasons, state which coefficient of determination is best to use.

[10 marks]

9). Discuss the validity of the regression models used in Section A and B with reference to the evidence you have found, and perform an overall significance test to conclude which model provides a best fit to the data.

Were your findings as expected?

(Note: **Do not** simply re-state all your findings).

[10 marks]

10). Apart from Price and Income, what **other** variables do you think could influence the demand for chocolate in the United Kingdom?

**Provide factual reasons (rather than personal opinions), with references where needed to support your answers.**

[10 marks]

### **Section (C) Coefficient of Variation [10 marks]**

11). You are asked by an investor to analyse the stock risk of two companies: Vinca PLC and Rubus Ltd. You are provided with the **sample mean (X)** and **standard deviation (S)** over a five- year period for the stock of both companies, as shown in the table below:

Year	Stock: Vinca PLC		Stock: Rubus Ltd	
	X1	S1	X2	S2
2010	10.48	2.37	11.59	3.02
2011	16.82	1.81	9.46	4.21
2012	7.68	2.41	12.14	1.92
2013	13.68	2.39	11.25	2.94
2014	15.73	4.74	12.39	2.12

Use the **coefficient of variation** to state which stock was **less risky in each year**. Show your working and explain your answers.

[10 marks]

**TOTAL: 100 MARKS**