Intermediate Microeconomics: An Interactive Approach

WORKBOOK ANSWERS

Stephen Erfle

Preface

The best way to learn microeconomics is to do problems. This is a book of problems that will aid you in that learning process. This book is coordinated with *Intermediate Microeconomics: An Interactive Approach* (IMaIA) but it can be used as a supplement to other intermediate level textbooks as well. Many texts provide end of chapter questions in the text, IMaIA included. Those questions typically test for reading comprehension, or provide basic problem-solving scenarios. Such questions only bring us part of the truly understanding the material.

By contrast, the problems in this Workbook dig more deeply into the material than do the end of chapter questions in IMaIA. These problems test your ability to synthesize what you have read and prompt you to apply that reading to new situations … or to create and explain new situations yourself.

A number of the problems in this Workbook key off of the dynamic Excel figure files that form the centerpiece of IMaIA. All files mentioned in the Workbook (and more) are available from the IMaIA e-book.

These problems are designed to be turned in as homework. Sometimes the problems build off of earlier problems. Problems that are likely to be handed in on different days are placed on different sheets of paper. For the same reason, this Workbook is delivered to you 3-ring binder ready and is single sided.

TABLE OF CONTENTS
(*Note*: Links will not exist with hard-copy (obviously).)

Workbook Answers

Chapter 1: Preliminary Issues

1. Consider the first two rows of data in Table 1.1 (reproduced below). The price of each of the six goods listed in 1981 is larger than the corresponding price in 1980.

	Electricity	Utility gas	Gasoline	Eggs	Bananas	Medical
1980	$29.83	$38.53	$1.25	$0.84	$0.34	74.9
1981	$34.19	$44.42	$1.38	$0.90	$0.36	82.9

A) Area each of these prices real or nominal prices? _____*nominal*_____

B) Calculate the percentage price increase for each of these goods for the year using 1980 as the base. (You can do this with a calculator or by using the Excel file for this table.)

Electricity	Utility gas	Gasoline	Eggs	Bananas	Medical
14.6%	*15.3%*	*10.7%*	*6.5%*	*5.9%*	*10.7%*
14.6%	*15.3%*	*10.4%*	*7.1%*	*5.9%*	*10.7%*

The first row is based on the unrounded numbers in Table 1.1 (these answers would be what students obtain if they use Excel and Table 1.1).

If students use a calculator slightly different answers result. These are the numbers in the second row.

C) Without calculating the inflation rate for 1980, suppose you have been told that electricity is more expensive in real terms in 1981 than in 1980. Based on this information and your answers in part B alone, can you say whether any of the other five goods are also more expensive in real terms in 1981 than 1980? Can you tell whether any of the other five goods are less expensive in 1981 than 1980?

Since you do not know the inflation rate, you only know that it is less than 14.6%. Therefore you can tell that utility gas is also more expensive in 1981 but you cannot tell about any of the other four goods.

2. (This does not require Question 1.) Consider the first two rows of data in Table 1.1 (reproduced at the start of Question 1 above). CPI information is also included in Table 1.1 for those years: $CPI_{1980} = 82.4$ and $CPI_{1981} = 90.9$.

A) Calculate the real price for each of these goods in 1981 using 1980 dollars.

Electricity	Utility gas	Gasoline	Eggs	Bananas	Medical
$30.99	*$40.26*	*$1.25*	*$0.81*	*$0.33*	*75.15*
$30.99	*$40.27*	*$1.25*	*$0.82*	*$0.33*	*75.15*

(Two rows are provided for the same reason as in 1B above. Both answers are valid.)

B) Which goods became better buys and which have become worse buys in 1981 on a real basis based on the change in real price between 1980 and 1981 derived in part A?

The real price of electricity, utility gas and medical increases so they are worse buys.
The real price of bananas and eggs declines so they have become better buys.
The real price of gasoline has not changed.

3. (Requires Questions 1 and 2.) Consider inflation directly using the CPI data for those years: $CPI_{1980} = 82.4$ and $CPI_{1981} = 90.9$.

A) Using this CPI data, what is the inflation rate between 1980 and 1981?

The inflation rate is 10.3% = $(CPI_{1981} – CPI_{1980})/CPI_{1980}$.

B) Compare this inflation rate to the percentage price increases in your answer to Question 1B. Are your answers to Question 2B confirmed for each good? Explain.

The real price increase and real price decrease goods are confirmed.
Gasoline is becoming slightly more expensive according to the comparison of percentage change in gasoline price with inflation (since 10.4% or 10.7%) is higher than 10.3%.
But of course a 0.1% difference in inflation does not show up as a penny difference for a good whose price is $1.25.

4. Suppose your exam score as a function of study time is given by Equation 1.1b: $S(t) = 50 \cdot t^{0.5}$. How much time would you have to devote to studying to get a 75 on an exam? Do this by algebraic manipulation.
Hints: You do not have to provide this in hours and minutes, you can simply provide a decimal answer for t. You know the answer is a bit more than two hours because points **A** and **B** on the PPF in Figure 1.4 shows that you get a 70.7 on such an exam if you devote 2 hours to the exam: $70.7 = 50 \cdot 2^{0.5}$.

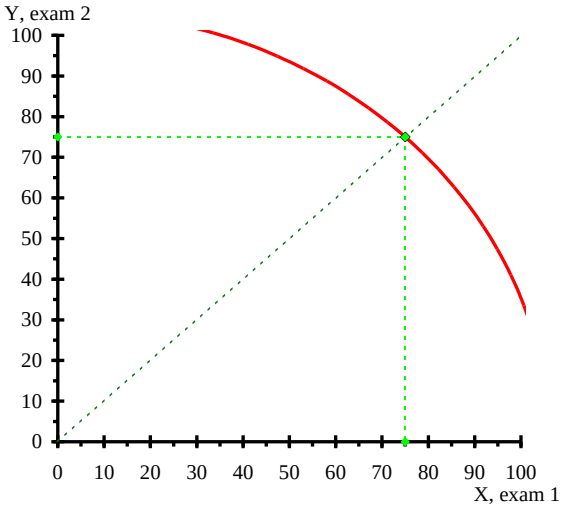
You need to solve for t in the equation $75 = 50 \cdot t^{0.5}$. Regrouping we see that $t^{0.5} = 3/2$, so by squaring we see that $t = 9/4 = 2.25$.
This is the same as 2 hours and 15 minutes.

5. Suppose you have two exams and both face the same score as a function of study time as given by Equation 1.1b: $S(t) = 50 \cdot t^{0.5}$. Suppose you wish to get a 75 on both exams.
A) How much time do you have to devote to studying for both exams and how do you apportion study time across exams?
B) What is the opportunity cost of a point on exam 1 in units of exam 2 score? Provide a PPF graph that is consistent with your answer.
Hint: This is easy to do using the Excel figure file and starting with **Figure 1.4** then click the blue PPF off in cell I20 and click on the red adjustable PPF in cell I22. This is also easy to answer if you have done Question 4.
If you wish to use the Excel figure instead of sketching the answer in the graph provided simply attach the figure as a separate page to your homework.

A) 4 hours and 30 minutes total to the two exams, allocated equally across both exams.

This is easily seen by adjusting the total study time slider in C21:D21 until the equal study time score in G23:H23 equals 75.

This occurs when total study time is 4 hours and 30 minutes.

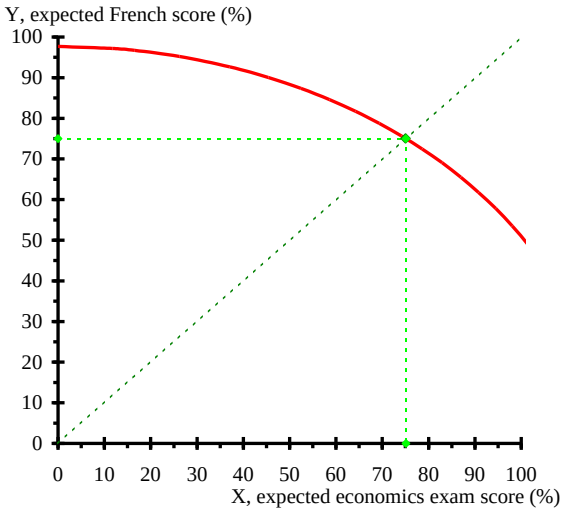


B) Opportunity cost of a point on exam 1 is 1.0 units of exam 2 (due to equal grade production function and equal expected scores)

6. Start from Figure 1.5 in which you find economics is 20% easier to study for than French (so the production functions are given by Equations 1.2.economics and 1.2.French in the text). You need not use the equations but you can confirm your answers with them if you wish.
A) Suppose you wish to obtain a 75 on each exam. How much study time total should you devote to studying and how should you apportion study time across subjects?
B) What is the opportunity cost of economics in units of French score at this allocation of study time?
C) Provide a PPF graph that is consistent with your answer.
Hints: This is easy to do using the Excel figure file and starting with **Figure 1.5** then adjusting the total time slider. Part of your answer is already done if you did Question 4. Do not worry about one minute differences in answers on the worksheet – such differences are due to rounding.

A) Total study time is 3:49 of which 1:33 (or 1:34) is devoted to economics and 2:15 is devoted to French.

B) The opportunity cost of a point on the economics exam at this point is 0.7 according to the information in cell I26.



7. Start from Scenario 1W.1 described above in which the paper is worth twice as much as the exam and you have 4 hours to devote to both. We showed in Figure 1W.1 at the start of this workbook chapter that a maximum expected score of 77.7 occurs if we devote 1:04 to studying for the exam with the remaining 2:56 devoted to the paper (by looking at that answer in cell K6 in the calculating area). How sensitive is this answer to getting the allocation right? Put another way, determine the range of values of study time devoted to the exam will we be within ONE point of the maximum score by answering the questions below. There is no need to provide graphical support for your answer.

A) What is the smallest amount of time you can devote to the exam and be within one point of the top score? ___*0:33*_____

B) What is the largest amount of time you can devote to the exam and be within one point of the top score? ___*1:39*_____

C) How large is the range of exam times over which you lose less than a point in expected score as a result of your choice of allocation time? ____*1:06_ = 1:39 – 0:33*____

You have more than a half hour leeway on both sides of the optimal answer.

8. Suppose you begin to use a language lab to study for your French exams and it increases your productivity over your previous productivity level. (As a result, the two production functions are: $S_{French}(t) = 55 \cdot t^{0.5}$ while your economics production function remains $S_{economics}(t) = 60 \cdot t^{0.5}$.) Do this by modifying **Figure 1.6**.

A) What percentage increase in productivity occurred in your French exam as a result of using the language lab? ___*10%*_____

B) Given the new French and economics exam score production functions, would you expect to study the same amount of time in each class if you wish to have equal scores across exams? Explain.

No, if you have equal time you will get a better score in economics than in French. You need to reallocate some minutes from economics to French.

C) If you wish to devote three hours to economics and French total, how should you allocate study time so as to equalize expected scores in both classes? What score do you expect on each exam?

You expect to get 70.2 on each exam. You should devote 1:22 to economics and 1:38 to French.

9. (Requires Question 8.) Provide an algebraic proof that the allocation of study time you derived in Question 8 equalizes expected score across exams.

Let t be the amount of time devoted to the economics exam, then 3-t is devoted to French.

If we wish to equalize expected score across exams, then t must satisfy the following:

$$S_{economics}(t) = 60\cdot t^{0.5} = 55\cdot(3-t)^{0.5} = S_{French}(3-t)$$

Squaring both sides we obtain: $60^2\cdot t = 55^2\cdot(3-t)$

Regrouping to solve for t we obtain: $(60^2 + 55^2)\cdot t = 3\cdot 55^2$.

Solving for t we obtain: $t = 3\cdot 55^2/(60^2 + 55^2) = 1.3698$

This value of t equals 1 and 22 minutes (since 22 = 0.3698·60) as derived geometrically in Question 8 above.

10. We argued in the text that most exams exhibit diminishing returns to extra study time. This need not be the case. For example you might be studying for a class that is quite complex and for which you only see the "full picture" if you devote a sufficient amount of time to the class. How would you model this production function? (In order to be able to use the file that produced Figures 1.1-1.3, assume you see the "full picture" (by getting a perfect score) with 4 hours of studying. How would you adjust the score given 1 hour of study time slider in row 17 to model this situation? Explain and provide graphical support.

If you produce a perfect score in 4 hours but there are increasing returns to studying up to that point then the 1 hour expected score must be less than 25.

The graph shown is 10 after 1 hour.

After 2 hours the table shows an expected score of 32 and after 3 hours the expected score is 62. This exhibits increasing productivity for extra studying.

11. (This is more challenging than the rest of the questions.) Prove that the PPF in Figure 1.4 is a quarter circle (and will remain a quarter circle as long as both exams are equally hard).

If both x and y are equally hard then the following is a general equation for each exam:

$$x(t) = a\cdot t^{0.5} \quad \text{and} \quad y(t) = a\cdot t^{0.5}.$$

Let t be devoted to studying for exam x and H be total study time. In that event, the score for each exam as a function of the time devoted to exam x is:

$$x(t) = a\cdot t^{0.5} \quad \text{and} \quad y(t) = a\cdot(H-t)^{0.5}.$$

If we square both equations we obtain: $x^2 = a^2\cdot t$ and $y^2 = a^2\cdot(H-t)$.

Adding x^2 and y^2 we obtain: $x^2 + y^2 = a^2\cdot t + a^2\cdot(H-t) = a^2H = c > 0$.

The sum of squares of scores equals a constant greater than zero – that is, the PPF is a quarter circle.