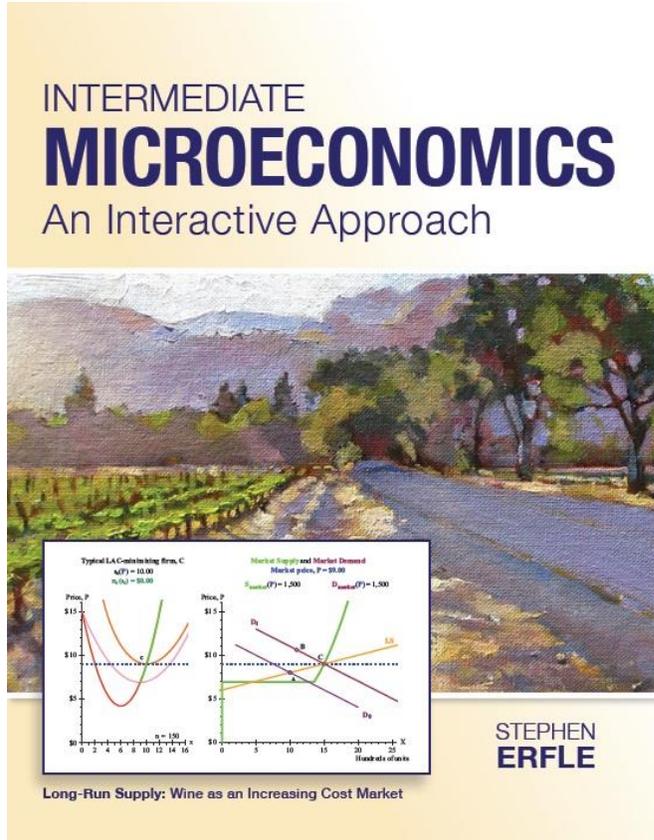


# Intermediate Microeconomics: An Interactive Approach Workbook



Textbook Media Press

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## 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.

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## Workbook Chapter 1: Preliminary Issues

The starting point for our analysis is to acknowledge what you have already learned in your introductory microeconomics class. Chapters 1 and 2 of *Intermediate Microeconomics: An Interactive Approach* (IMaIA) are provided as a quick review of that material. The centerpiece of microeconomics, the supply and demand model, is examined in Chapter 2. Prior to this, in Chapter 1, we examine more preliminary issues such as the use of models in economic analysis, the notions of opportunity cost, positive and normative economics and the distinction between real and nominal prices. Typically your professor will not spend more than a lecture or two on these chapters because this material should not be “new” although it may well not be sitting in the front of your short-term memory. These chapters are provided as a way to quickly remind you of things you have previously learned but may have forgotten since you last used microeconomics.

The other goal of an initial chapter is that it allows us to describe the basic structure of the text and to note any special characteristics or strategies that will be used to help you master the material in the text.

***This text was written to provide a more visual approach to understanding microeconomics by incorporating technology into the learning process.***

Most students have computers of their own or they have ready access to computers and computers can provide the option for open-ended experimentation with graphs if those graphs are available for manipulation.

***The static graphs in the text have interactive counterparts available from the IMaIA website.***

The only requirement to use these files is that you have Excel on your computer (you do not need to know how to use Excel because you manipulate the files with sliders and with click boxes).

Computer generated graphs are not a substitute for creating your own graphs, but they can provide a useful complement to the static graphs in the text (and the ones you create) because, by necessity, they must be “right.” In this context “right” means that the curves that you can move via sliders act in exactly the way economists expect them to act. Given this, the intersection points change as they should as well: comparative statics analysis is made easier if you know that the graph you are manipulating changes in a way that maintains the logic of the economic analysis. Comparative statics analysis examines how economic outcomes (intersection points) change when an underlying parameter changes.

Economists think graphically: “a picture tells a thousand words” is an aphorism that is especially appropriate for economic analysis. Whenever you begin to work on a problem, or even as you read, keep a piece of scratch paper available for doodling and make sure you label your axes as you begin to sketch out a graph that helps to answer a question. An even better strategy is to keep some graph paper available because it is often useful to describe locations of points and curves with precise regard to specific numerical values. It is also useful to have at least 2 different colored pens as well as a pencil available to depict curves and changes in curves.

Graphical solutions for many of the problems in this workbook can be obtained using the Excel figures from the text. Once you read the problem you should immediately begin to sketch out a solution with paper and pencil, even if you know you will eventually use an Excel figure.

This “doodling” is an invaluable part of learning microeconomics. Think back through the chapter to diagrams that seem like they describe similar behavior.

Some problems will tell you to work with explicit files, but others leave the choice up to you. Part of the learning experience is figuring out what works and what does not. As a result, some problems are posed in a more open-ended fashion than others, while some problems may require you to go beyond the graphs provided in the text and sketch out your own solution on graph paper.

**NOTE:**

The material below will help you manipulate Excel figures so you can use the figures to answer workbook problems. This information will be presented in the context of answering a problem that is a variation on a question asked in the chapter.

Since instructors often assign the introductory chapters of a text as self-study or ignore these chapters, we will provide a similar discussion of manipulating the Excel files again in Chapter 3.

In Chapter 3, repeated material will be boxed (like this notice), so you can skip it if you already know how to transfer figures into Word and do calculations in Excel.

### **An Initial Example**

Consider an extension of the model presented in Section 1.2. The starting point for the present analysis is the model described in Figure 1.7. This figure examined how to allocate time between writing an economics paper and studying for an economics exam given a total of 4 hours available for both tasks. That analysis concluded that point **G** produces the highest expected average score given an equal weight between the exam and the paper (and the production constraints described by Equations 1.2.economics and 1.2.paper in the text). Point **G** is based on 2 hours and 21 minutes devoted to the exam. This produces an average score of 78.1, the average of the 92.2 exam score and the 64.0 paper score. This result occurs because point **G** has an opportunity cost of 1 point on the exam for 1 point on the paper (put another way, the slope of the tangent at **G** is  $-1$ ).

Suppose we replace the equal weight assumption by an assumption that places twice as much weight on the paper as the exam.

**Alternative Assumption:**     **The paper is worth twice as much as the exam.**

Q) Based on this alternative assumption, how much of the four hours should be devoted to the paper and how much should be devoted to the exam?

We will return to this question once we provide some preliminary information about the Excel files available by hyperlinks on the online version of IMAIA.

### **About Excel figure files**

Some problems will require you to turn in graphs that are at least partially completed within Excel, but which you might further label prior to turning in as homework. The Excel figures were used to create each figure in the text but they are more “generic” in nature in order to provide maximum flexibility for answering problems. Excel figures maintain the numbering

system from the chapter, but do not expect to always use them in numerical order in working on problems in the workbook.

One Excel figure file may well be used to create more than one static image in the text. For example, all seven figures in Chapter 1 are based on one Excel figure file. Sometimes this is done on one worksheet but sometimes it is done on multiple worksheets. **You should have the Excel file for Chapter 1 open as you read this page.**

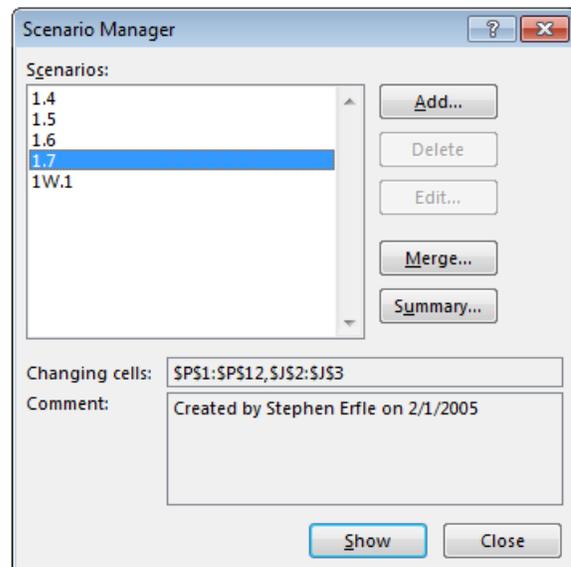
*About worksheets.* This file has two **worksheets**. (You can move between worksheets in Excel by clicking on the tabs at the bottom of the screen. Specific commands or references in Excel are printed in **Bold** in the text (and in this workbook).) If you want to see the production function that produced Figures 1.1 – 1.3, click on the tab labeled **1.1-1.3Score on One Exam**. If you want to work with the PPF depicted in Figures 1.4-1.7 click on the other tab.

These files have been modified to allow you to add your own labels and do your own calculations (in the blue cells and the green cells). Sliders and click boxes will allow you to modify the curves and lines in the figure to create your own answer.

*Using existing scenarios.* The **Scenarios** function allows the user to recall specific settings of the sliders and click boxes that are used to create textbook figures. An easy way to move from figure to figure is to use the **Scenarios** function if you do not want to manipulate the sliders and click boxes to match a figure in the text.

For example, open the file for Figures 1.1-1.7 and click on the

**1.4-1.7EconVsFrench** worksheet tab (at the bottom of the screen). Click **Data, What If Analysis, Scenario Manager** if using Excel 2007 (or **Tools, Scenarios** if using Excel 2003). The **Scenario Manager** popup menu will appear (this menu looks slightly different in Excel 2003 but has the same functionality).



From here you can choose the scenario you wish to see on the screen by clicking on that scenario, then click **Show, Close** and the figure will now look like the figure in the text (with the possible exception that the text version may have further labeling added).

*Creating your own scenarios.* Once you have a picture you wish to save, you can create your own scenario. (This is not necessary but can be done if you wish to come back to this same graph at another time.) To do so, set the sliders and click the check boxes as you wish to have them and click: **Data, What If Analysis, Scenario Manager** if using Excel 2007 (or **Tools, Scenarios** if using Excel 2003), then click **Add**. *Type in your scenario name*, then click: **OK, OK, Show, Close**. Note: the **Scenarios** function will remember the location of sliders and click boxes, but it may not remember the labels you may have typed into the light blue boxes.

**Back to the question:** Figure 1.7 is a useful starting point but it is based on equal weights for the exam and the paper. If we want the paper to have double the weight then the appropriate weighted average score is:

$$W = (1/3) \cdot E + (2/3) \cdot P \quad \text{where } E \text{ is the exam score and } P \text{ is the paper score.}$$

Paper points are twice as valuable as exam points given this weighting scheme. Point **G** in Figure 1.7 represents the point where the tradeoff between paper and exam is 1:1. This represents an inefficiently large amount of time studying for the exam (since it is only worth half as much as the paper).

In terms of opportunity cost, we will maximize the weighted average score on the exam plus paper if we choose the point on the PPF associated with trading 0.5 points on the paper for 1 point on the exam. In numbers, we want the opportunity cost to be  $\frac{1}{2}$  rather than 1.0. We can use the slider in cell D26:E26 to adjust the time devoted to the exam. As we decrease this time, the opportunity cost declines (starting at 1.0 given the starting point of **G** in Figure 1.7). If you adjust the slider down you will find that the opportunity cost is  $\frac{1}{2}$  (see cell E27) when the amount of time devoted to the exam is 1:04 (one hour and 4 minutes). This is also included as Scenario 1W.1 but you would benefit by moving the slider yourself and watching what happens on the graph as you decrease exam time from that shown at point **G**.

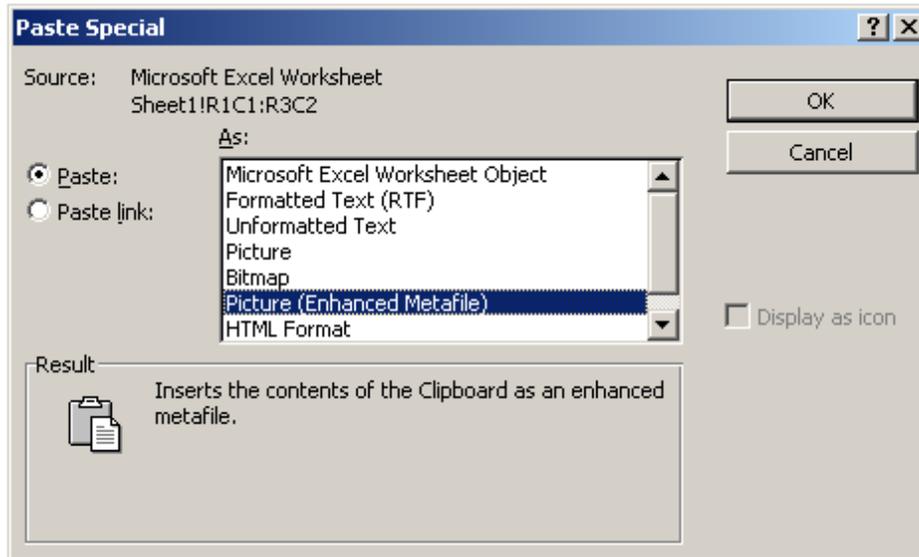
Once you get to this point, you are ready to copy the file onto your answer sheet. We now return to our Excel discussion to see how to accomplish this task.

### How to Transfer an Excel Diagram to Word

When you have a diagram you wish to use to answer a question, you can transfer it to Word using the following mechanism (a simple **Copy** in Excel and **Paste** in Word will not provide you with a usable diagram):

1. Open a Word document into which you wish to insert the figure.
2. Go back to the Excel file whose figure you wish to transfer into Word.
3. Highlight the cells you wish to transfer into Word. There are a couple of ways to do this but the easiest to learn is to do the following:
  - A. Click on a cell and use the arrow keys to move to a corner of the area you wish to transfer into Word. (*For example, move to cell G19 in the 1.4-1.7EconVsFrench worksheet.*)
  - B. Hold down the Shift key and move the arrow keys until the area you wish to transfer has been highlighted. (*In this instance, you would move the left arrow to highlight from G19 back to A19 and the up arrow so that rows 19 to row 1 become highlighted.*)

Once you release the Shift key the highlighted area should show as blue-gray. (*For example, the cells A1:G19 from the 1.4-1.7EconVsFrench worksheet have been highlighted to create Figure 1W.1.*)
4. Click **Copy** in Excel (using either the **Edit** pulldown menu or by clicking the **Copy** icon on the **Standard** toolbar in Excel 2003 or main ribbon in Excel 2007).
5. Return to the Word document and move to where you want to place the figure. Click **Edit, Paste Special, Picture (Enhanced Metafile)** (the Paste Special popup menu should look as shown below), **OK**.



The result will be a picture of the highlighted area, just as you see it on the screen. If you are doing much editing of your document, it is worthwhile to place the figure just after a hard page break so that you do not have to move it until you are finished working on the document. (Click **Insert, Break, Page Break, OK** to create a hard page break.)

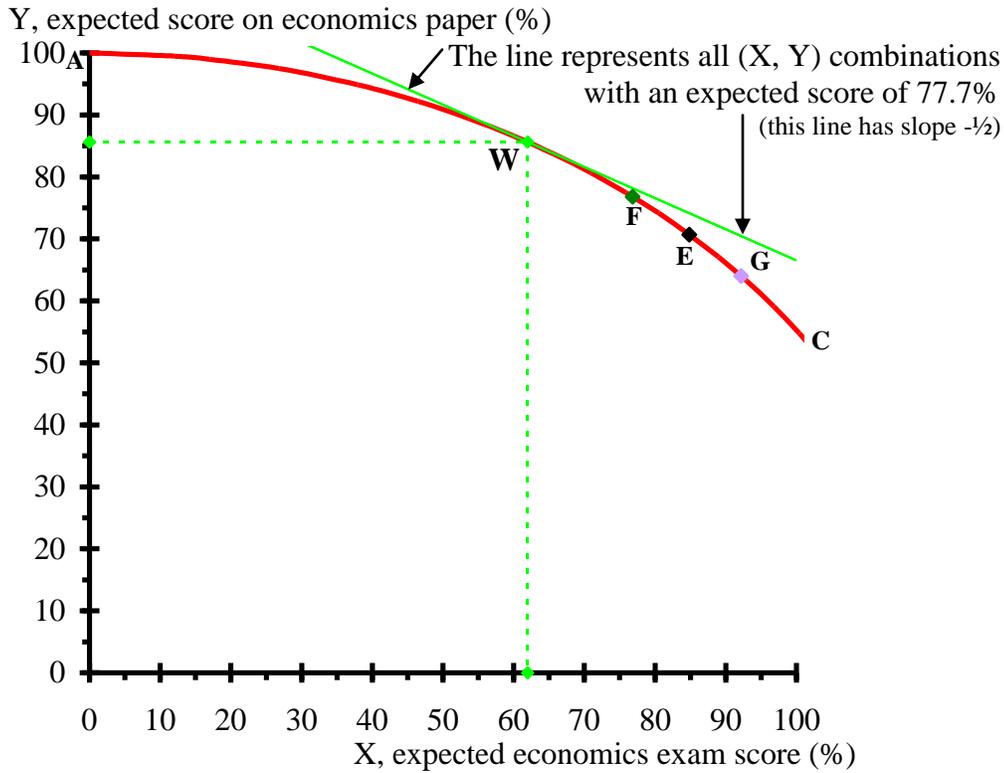
*Modifying a picture in Word.* From here you can modify the picture if you wish using Word. The diagram on the next page shows some of the basic modifications discussed below.

To see the range of modifications you can make to an image within Word, right click on the picture, then click **Format Picture**, and you can see a number of things you can do with the picture by looking at the various tabs. Two tabs in particular are useful, the **Size** tab and the **Layout** tab. The **Size** tab allows you to resize the picture up or down. The **Layout** tab allows you to place the picture where you wish within the Word document. If you have a picture you do not want to modify, use the **In line with text, Square** or **Tight** options. These options do not allow you to add information to the picture.

If you wish to add information to the picture, use the **In front of text** option then navigate underneath the picture using the arrow keys and the space bar. For example, I typed the statement “The line represents all (X, Y) combinations with an expected score of 77.7% (this line has slope  $-1/2$ )” on three lines by simply navigating “beneath” the picture of Figure 1W.1 in Word. I also added arrows pointing at the tangent opportunity cost line and the label **W**.

Inserting an arrow requires clicking the **Insert** ribbon then **Shapes** in Word 2007. (In Word 2003, use the **Drawing** toolbar. To add this to your standard setup within Word (typically the **Standard** and **Formatting** toolbars are shown), click **View, Toolbars, Drawing**.) When drawing arrows and lines you can move them in large increments by placing it in the rough location, then clicking on the object and then using the arrow keys. For fine movements, hold down the **Ctrl** key as you use the arrow keys. Unfortunately, letters such as **W** cannot be micro-moved in the same way, nonetheless, you can get close to where you want the letter placed by adding or taking away blank spaces (alternatively you can micro-move the figure one you have roughed in the letters).

Figure 1W.1  
 Allocating study time given the paper is twice as important as the exam.



**Doing Simple Calculations in Excel**

Excel is basically a large calculator that is able to adjust its calculations as you adjust the data on which those calculations are based. Extended discussions of using Excel are provided in the Mathematical Appendix and in Section 19.2 but the basics are described here. There are numerous pieces of data that are available in the typical Excel file and these pieces of data can be used to help answer questions. The graph above, for example, shows the result of one such calculation in the labeling of the green line as having an expected score of 77.7%. This number is based on the following calculation:  $77.7 = 1/3 \cdot \text{Exam score} + 2/3 \cdot \text{Paper score}$  given an exam score of 62.0 (based on spending 1:04 studying for the exam) and a paper score of 85.6 (based on spending the remaining 2:56 on the paper).

You can check that this is the right solution by calculating the weighted average score in the calculating area (the block of green cells on a worksheet). This is done in cell K6 in order to show how to create equations in Excel. An equation in Excel is very easy to create: simply start with an equal sign and follow the normal rules used for algebraic calculations. The slider time devoted to the economics exam is shown in A26:B26 in hours and minutes and in cell D27 in decimal form of the **1.4-1.7EconVsFrench** worksheet. The resulting scores on the exam and paper are shown in cells G26:H26 if the check box in G26 is clicked on. The equation in cell K6 is simply  $=G26/3+H26*2/3$ .

This equation can be seen by clicking on cell K6 and looking at the contents of the cell in the **Formula Bar** (the white area above the E and F column labels). This equation weights the exam score by 1/3 and the paper score by 2/3 as expected based on the *Alternative Assumption* at the start of this workbook chapter (the paper is worth twice as much as the exam). Although cell

K6 looks like the number 77.74583 occupies the cell, in actuality, that number is simply the result of the equation in the cell.

You can easily check that this is the correct amount of time to devote to studying for the exam by moving the time slider in both directions away from 1:04. As you do so, even by a minute, the weighted average in cell K6 will decline. The farther time moves away from 1:04 the lower is the weighted average score. (You should make sure to open up the file and check this for yourself. If you want to start at the maximum point you can call up the final answer using the **Scenario** function (since this scenario has been saved as 1W.1 in the file).

The above example has shown how one can use the Excel figures to help attack problems. The problems to which we now turn provide further opportunities to explore these issues.

The goal of this workbook chapter is to remind you about some basic aspects of economic modeling described in Chapter 1. The model developed in Section 1.2 involves reinterpreting the production possibilities frontier but the focus was really on model building rather than on the model itself. The problems below allow you to further develop your modeling skills and to explore the difference between various concepts discussed in Chapter 1.

- You should be able to derive information from price and inflation data.
- You should be able to use the concept of opportunity cost to make decisions.
- You should begin to become comfortable using the Excel figures in order to explore how the results of the model change as the underlying parameters of the model change.

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) Are each of these prices real or nominal prices? \_\_\_\_\_

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

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?

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Can you tell whether any of the other five goods are **less** expensive in 1981 than 1980?

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

A) Using this CPI data, calculate the real price for each of these goods in 1981 using 1980 dollars.

Electricity	Utility gas	Gasoline	Eggs	Bananas	Medical

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?

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3. (Requires Problems 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?

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

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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:  $70.7 = 50 \cdot 2^{0.5}$ .

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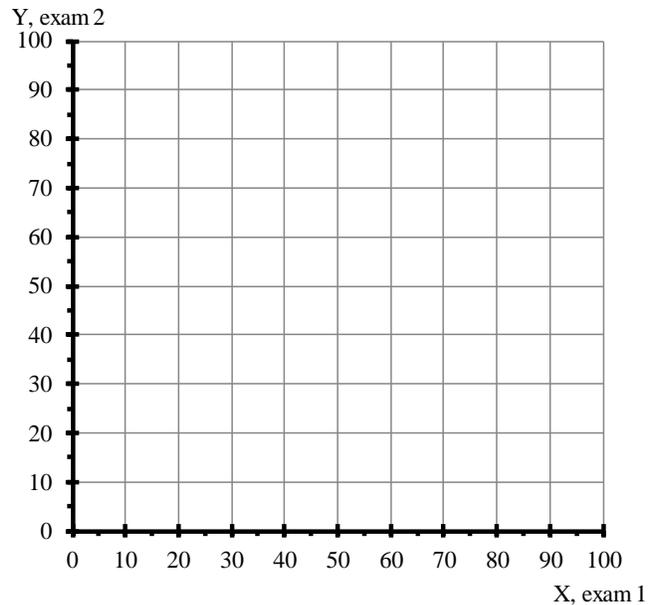
5. Suppose you have two exams and both face the same score as a function of study time as given by Equation 1.1b:  $S(t) = 50 \cdot t^{0.5}$ . Suppose you wish to get a 75 on both exams.

A) How much time do you have to devote to studying for both exams and how do you apportion study time across exams?

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B) What is the opportunity cost of exam 1 in units of exam 2 score at this allocation of study time?

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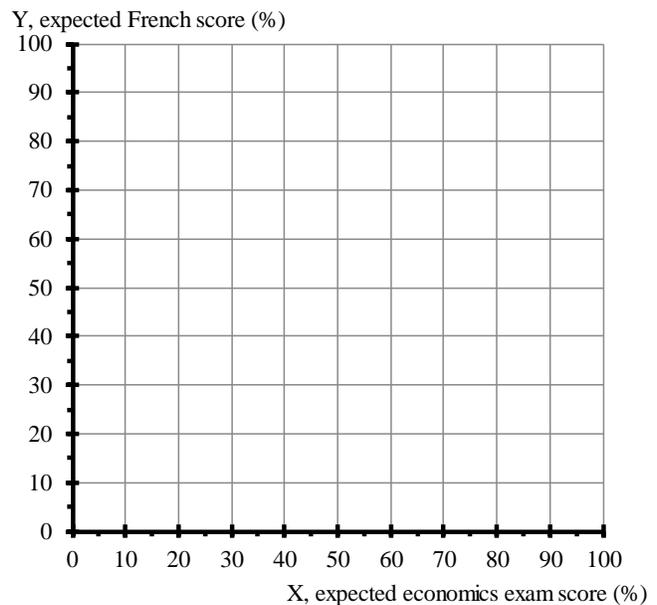
Provide a PPF graph that is consistent with your answer. If you wish to use the Excel figure instead of sketching the answer in the graph provided simply attach the figure as a separate page to your homework.

*Hint:* This is easy to do using the Excel figure 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 Problem 4.

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 Problem 4. Do not worry about one minute differences in answers on the worksheet – such differences are due to rounding.

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 that will be within ONE point of the maximum score by answering the questions below. There is no need to provide graphical support for your answer.

*Hint:* This is easy to answer if you simply copy the maximum number (77.74583) into another one of the green cells then place the difference between this number and K6 in a third cell. As you move the slider in D26:E26, you will be able to see when the difference becomes larger than 1.00.

- A) What is the **smallest** amount of time you can devote to the exam and be within one point of the top score? \_\_\_\_\_
- B) What is the **largest** amount of time you can devote to the exam and be within one point of the top score? \_\_\_\_\_
- 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? \_\_\_\_\_

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:  $S_{\text{French}}(t) = 55 \cdot t^{0.5}$  and your economics production function remains  $S_{\text{economics}}(t) = 60 \cdot t^{0.5}$ .) 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? \_\_\_\_\_
- 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.

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- 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?

*Hint:* You can do this algebraically but it is easier to use the Excel file.

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

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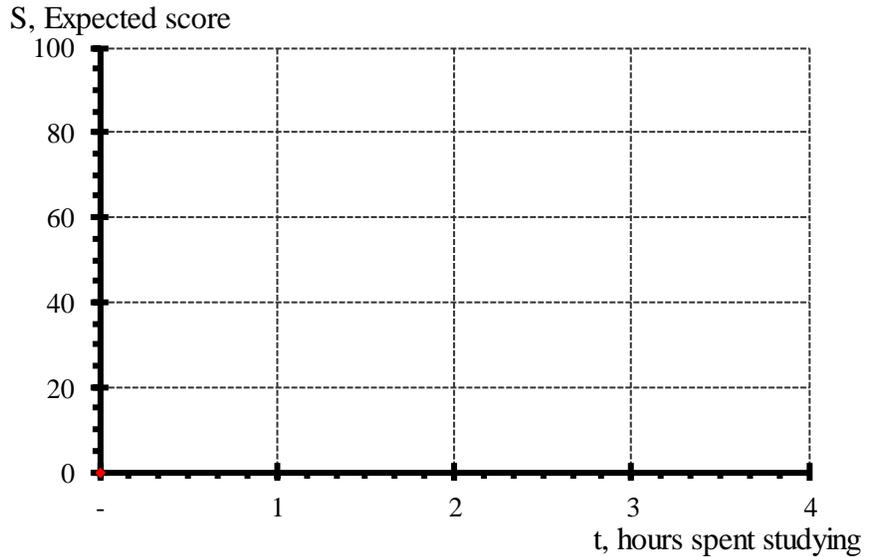
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10. We argued in the text that most exams exhibit diminishing returns to extra study time. This need not be the case. For example you might be studying for a class that is quite complex and for which you only see the “full picture” if you devote a 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.



11. (This is more challenging than the rest of the problems.) 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).  
*Hints:* To prove this you must recall that the equation for a circle is  $x^2 + y^2 = c$  where  $c > 0$ . If  $x$  is written as  $x(t)$  then  $y$  is  $y \cdot (H - t)$  where  $H$  is the time devoted to studying.

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## Workbook Chapter 2: A Review of Supply and Demand

The supply and demand model is the centerpiece of microeconomics. This model is most effectively understood if care is taken to conceptually separate notions of demand from notions of supply prior to putting them together to examine market interaction. The market equilibrium that results is stable. If jostled out of equilibrium, changing inventory levels provide signals that ultimately return the market to equilibrium. This equilibrium will maintain unless economic circumstances change. Comparative statics analysis examines what happens if economic circumstances affecting the market change. Elasticity describes responsiveness of supply and demand to changes in price, or other economic variables. Finally, this chapter examines what happens when the government intervenes to alter the market outcome by imposing price controls. Such price controls void the self-correcting nature of the market and cause market imbalance. Although these imbalances exist because of political expediency, they have unintended consequences that often directly oppose the stated goals of the program.

The goal of this workbook chapter is to remind you about some basic aspects of supply, demand, and elasticity described in Chapter 2. Some of this material will not have been presented in the same algebraic detail in your introductory microeconomics class. As a result, the workbook problems will also provide you the opportunity to do simple algebraic manipulation as well as graphical interpretation.

- You will work on creating linear demand and supply functions from observed data.
- You should be able to distinguish change in demand from change in quantity demanded as well as the symmetric notion from the supply side.
- You will learn the distinction between demand and inverse demand as well as supply and inverse supply.
- You will sharpen your understanding of elasticity and learn about some geometric interpretations of this concept.
- You will be asked to use the Excel figures in order to explore how the results of the model change as the underlying parameters of the model change.