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Teaching Managerial Economics: Spreadsheet Exercises Integrate Economics within the Business Curriculum

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Abstract

Business students often have difficulty integrating economics reasoning into other business disciplines because of differences in the format and presentation of financial data across disciplines. Economics courses use one format while Accounting and other business courses use another. This paper shows how simple electronic spreadsheet exercises can help students visualize the relationships. It also presents two examples of using spreadsheet analysis to cover two topics covered in many business courses and economics courses: product pricing and the deciding on the optimal combination of production inputs.

JEL classification numbers: A12, A22, M10, M11, M21, M31
Keywords: managerial economics, teaching, spreadsheets, business education, pricing, marketing, production

1 Introduction

Most business school educators would agree that managerial decision-making should be informed by economic reasoning. To that end, business curricula typically include at least one course in microeconomics at the principles level, and many require an additional course in managerial economics. If economics principles are to be relevant to business students, these courses, should have a comfortable and logical relation to other business disciplines. Unfortunately, students often cannot recognize common themes in business courses and economics (including managerial economics) and fail to integrate economic reasoning with the other business disciplines. This failure to integrate economics has been discussed in business school research (Chonko and Caballero [1991], Chonko and Roberts

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[1996], Peterson, et al [2002] and Malhotra [2002]).

Underwood, Bush and Heath [2008, 2010] argue that part of the problem lays in the fact that economics and other business disciplines often present identical data in very different ways. Economics typically presents cost-volume-profit (CVP) data in a tabular format (see Thomas and Maurice [2011] for example) that looks very different from income statement data presented in the columnar "accounting" format. With this point in mind, we present a couple of exercises that will help to give managerial economics "a comfortable and logical relation to other business disciplines". First, we demonstrate how data presented in the tabular "economics" format can be recast in the columnar "accounting" format. Then we present two spreadsheet exercises dealing with topics covered in all managerial economics textbooks, one dealing with product pricing, the other with choosing the optimal combination of inputs.

2 A Tale of Two Formats

Table 1 is typical of the "economics" format. Various prices and levels of output result in data describing the typical cost and revenue data as shown in Table 1. However, accounting and finance textbooks tend to use column line items in income statements to show values for revenue, cost and profit. Table 2 shows selected operating results this way. The rows of Table 1 become the columns of Table 2. For the various pricing plans it shows the same information as Table 1, except that it identifies total variable cost (TVC) as Cost of Goods Sold (COGS). In each table, the optimal price strategy is shaded.

Table 1: CVP Data in "Economics" Format

Price	Quantity	TR	MR	TC	MC	TFC	TVC	ATC	AVC	AFC
$24.00	1.00	24.00	24.00	50.00	40.00	40.00	10.00	50.00	10.00	40.00
23.00	2.00	46.00	22.00	58.00	8.00	40.00	18.00	29.00	9.00	20.00
22.00	3.00	66.00	20.00	65.00	7.00	40.00	25.00	21.67	8.33	13.33
21.00	4.00	84.00	18.00	75.00	11.00	40.00	35.00	18.75	8.75	10.00
20.00	5.00	100.00	16.00	87.00	12.00	40.00	47.00	17.40	9.40	8.00
19.00	6.00	114.00	14.00	100.00	13.00	40.00	60.00	16.67	10.00	6.67
18.00	7.00	126.00	12.00	115.00	15.00	40.00	75.00	16.43	10.71	5.71
17.00	8.00	136.00	10.00	135.00	20.00	40.00	95.00	16.88	11.88	5.00
16.00	9.00	144.00	8.00	170.00	35.00	40.00	130.00	18.89	14.44	4.44

Table 2: Selected CVP Data in Columnar "Accounting" Format

Price	$24	23	22	21	20	19	18	17	16
Quantity	1	2	3	4	5	6	7	8	9
Revenue	24	46	66	84	100	114	126	136	140
TVC (Cogs)	10	18	25	35	47	60	75	95	130
Gross Profit	14	28	41	49	53	54	51	41	10
Fixed Cost	40	40	40	40	40	40	40	40	40
Net Profit	-26	-12	1	$9	13	14	11	$1	-30

These different formats can confuse students grappling with new concepts and terms. Students often fail to relate data in the "economics" format to even identical data in "accounting" format. What techniques reconcile conflicts and translate them to a format to help those oriented to income statements move in the right direction?

Applying economics rationale to statement data, crucial to planning and budgeting, is easier when students can *visualize*. Being able to *see* how things relate – being able visually to connect the dots, as it were, is the key. As we shall demonstrate, available technology provides the means to do so. In the next section we present a simple but innovative way for students to *see* how to integrate economics reasoning with income statements in the context managerial decision-making.

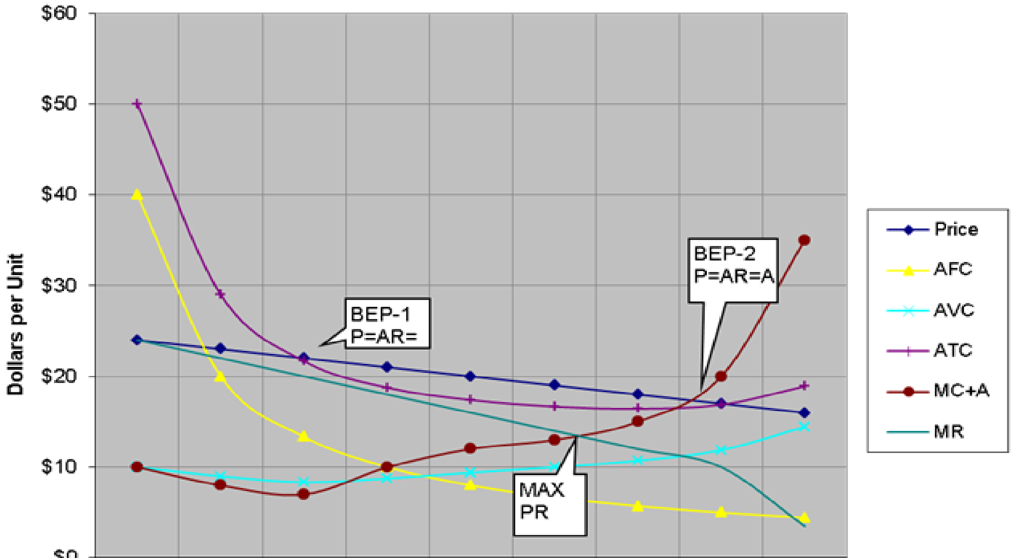
A simple set of Excel© exercises (referred to as *Dots I-II* in Underwood, Heath and Bush [2008, 2010] can help students visualize and integrate basic economics logic with *pro forma* CVP analysis for managerial decision making. We illustrate two problems. The first deals with product pricing. The second deals with choosing the optimal combination of production inputs.

2.1 Exercise 1 - Pricing Strategy

Consider a fairly simple illustration, a problem in which students must select the profit-maximizing price when the firm has a degree of market power, i.e., a downward-sloping demand curve for its product. This exercise presents students with demand and cost data (e.g., data in Table 1 for price, quantity, total cost and total fixed cost) for all the specified prices, and requires them to do the following:

a) Extend Table 1 to include TR, MR, ATC, AFC, AVC and MC data.
b) Graph ATC, AVC, MC, MR and AFC from the data in Table 1.
c) Create pro forma income statements (Table 2).
d) Graph total revenue (TR), total cost (TC) and net profit (NP) curves from the income statement data.

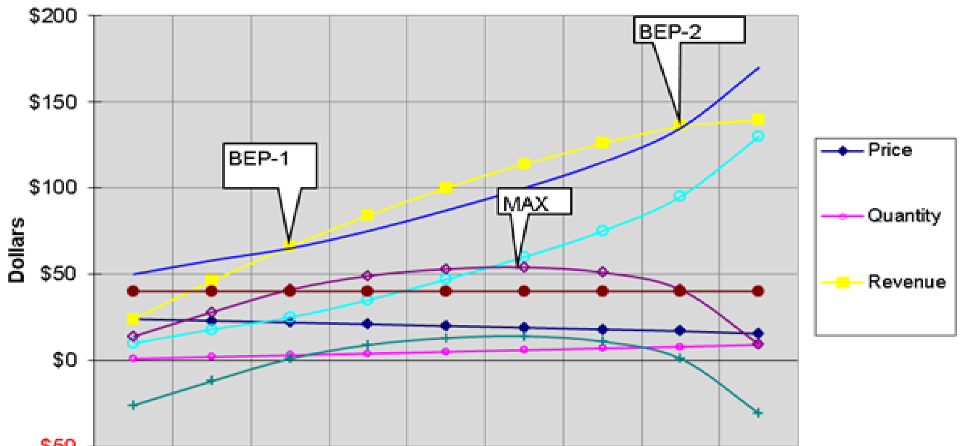
In this exercise TFC includes administrative overhead and other fixed costs of production; TVC includes cost of goods sold (COGS); and TFC plus TVC equals TC. Obviously a more elaborate analysis would include all line items necessary to detail projected costs and results. Creating graphs requires using column headings (MP-X) for x-variable *labels* and row (line item) *values* for y-variables. Results using data from Tables 1 and 2 are presented in Figures 1 and 2. Figure 1 depicts the usual family of cost curves: average variable cost (AVC), average fixed cost (AFC), average total cost (ATC); and marginal cost. It also presents demand/average revenue (AR); marginal revenue (MR). Students must then identify maximum profit (MR=MC), and may also be required to identify other key points on unit curves, including breakeven points, (ATC=AR); profitable range (between breakeven points); maximum revenue (MR=0); the elastic demand range (left of MR=0); and the inelastic demand range (right of MR=0).



	1	2	3	4	5	6	7	8	9
Price	$24	$23	$22	$21	$20	$19	$18	$17	$16
AFC	$40.00	$20.00	$13.33	$10.00	$8.00	$6.67	$5.71	$5.00	$4.44
AVC	$10.00	$9.00	$8.33	$8.75	$9.40	$10.00	$10.71	$11.88	$14.44
ATC	$50.00	$29.00	$21.67	$18.75	$17.40	$16.67	$16.43	$16.88	$18.89
MC+A	$10.00	$8.00	$7.00	$10.00	$12.00	$13.00	$15.00	$20.00	$35.00
MR	$24.00	$22.00	$20.00	$18.00	$16.00	$14.00	$12.00	$10.00	$3.50

Figure 1: Unit revenue and cost analysis

Figure 2 derives from the same revenue and cost data as Figure 1, but presents it in "accounting" format, specifically in terms of an income statement. Columns show projected results for proposed pricing plans. Figure 2 therefore, *visually connects statement values to specific dots on the economic cost curves depicted in Figure 1.*



	1	2	3	4	5	6	7	8	9
Price	$24	$23	$22	$21	$20	$19	$18	$17	$16
Quantity	1	2	3	4	5	6	7	8	9
Revenue	$24	$46	$66	$84	$100	$114	$126	$136	$140
TVC (Cogs)	$10	$18	$25	$35	$47	$60	$75	$95	$130
Gross Profit	$14	$28	$41	$49	$53	$54	$51	$41	$10
Fixed Cost	$40	$40	$40	$40	$40	$40	$40	$40	$40
Net Profit	-$26.00	-$12.00	$1.00	$9.00	$13.00	$14.00	$11.00	$1.00	-$30.50
Total Cost (TC)	$50	$58	$65	$75	$87	$100	$115	$135	$170

Figure 2: Total revenue/cost/profit analysis

2.2 Exercise 2 - Optimal Combination of Inputs

This is a slightly more complicated exercise in which students are given a production function, input prices, and a budget. Their tasks are to:

a) Use calculus to find the optimal combination of variable inputs (where marginal product per dollar spent is the same for all variable inputs), subject to a budgetary constraint.
b) Use spreadsheet analysis, rather than calculus, to find the maximum output over an affordable range of input combinations (Table 3).
c) Transform the spreadsheet analysis into the "accounting" format by creating income statements for selected output levels (Table 4). The rows in Table 3 become the columns in Table 4 as we reformat the data into accounting (income - statement) format. The rows in Table 3 and the columns of Table 4 relate to different combinations of variable inputs, N and K, and a fixed level of input F. Optimal results are in the shaded areas of the tables.
d) Create graphs which depict the level of output, and associated input expenditures, where gross and net profits are maximized.

Table 3: Input Combinations and Resulting Output Quantities

Input Combination	Input N	Input K	Input F	Output Quantity (Q)
1	0	14	5	100
2	1	12	5	121
3	2	10	5	136
4	3	8	5	145
5	4	6	5	148
6	5	4	5	145
7	6	2	5	136
8	7	0	5	121

Table 4: Pro Forma Income Statements and Output for Various Input Combinations

	Input combination							
Cost and Revenue ($)	1	2	3	4	5	6	7	8
Price	300	300	300	300	300	300	300	300
Output (Q)	100	121	136	145	148	145	136	121
Revenue	30000	36300	40800	43500	44400	43500	40800	36300
Cost of goods								
Input N	0	4000	8000	12000	16000	20000	24000	28000
Input K	28000	24000	20000	16000	12000	8000	4000	0
Other Input	0	0	0	0	0	0	0	0
Total COGS	28000	28000	28000	28000	28000	28000	28000	28000
Gross Profit	2000	8300	12800	15500	16400	15500	12800	8300

Assume the following production function.
$Q = 5L + 20N – N^2 + 12K – 0.5K^2$

Assume also that the cost of N is $4,000 per unit, the cost of K is $2,000 per unit, and the cost of L is $1,000. The total budget is $33,000, including $5,000 in fixed costs. The student’s answers would be as follows:

a) MPL/$L = MPK/$K is the optimization condition, so

$$\frac{\partial Q/\partial N}{\$N}, \text{ or } \frac{20-2N}{4000} = \frac{\partial Q/\partial K}{\$K}, \text{ or } \frac{12-K}{2000}$$

Thus,

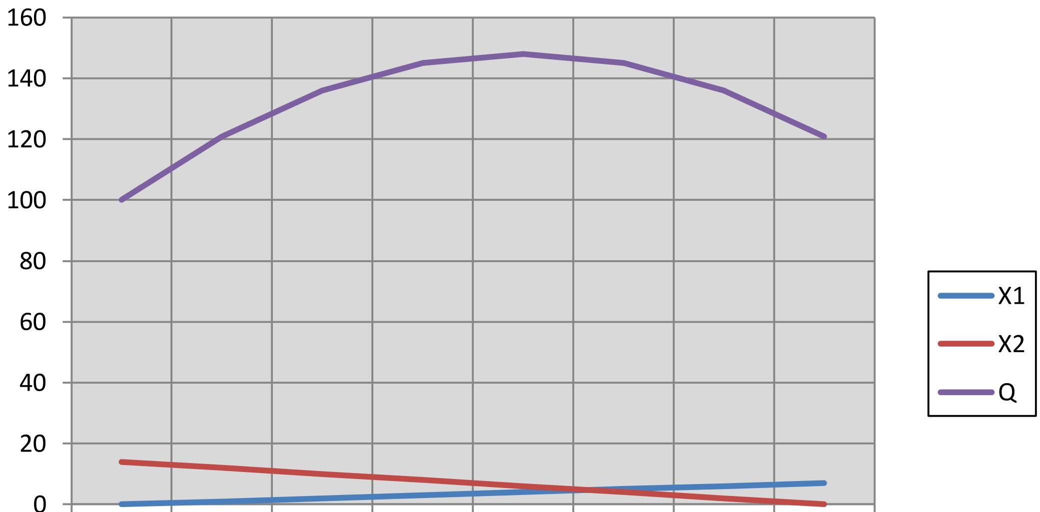
40 – 4N = 48 – 4K.

The budget constraint for variable costs is:
$4,000N + $2,000K = $28,000; therefore
2,000 K = 28,000 – 4,000N or K = 14 – 2N.
Substituting (14 – 2N) for K and solving for N yields an optimal of N = 4; subsequently substituting 4 for N yields an optimal of K = 6. The optimal combination of inputs is 4N and 6K.

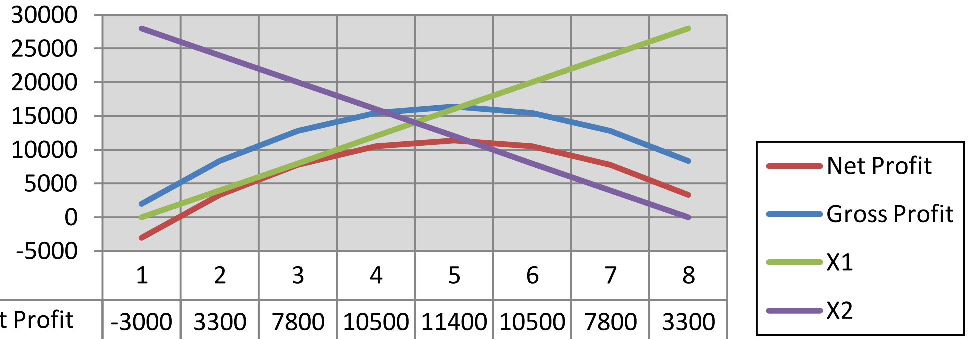
b) The spreadsheet analysis, in which the production function is inserted as the formula for cells presenting Q for various combinations of N and K, yields Figure 3 (below).

c) The corresponding income statement is in Table 4.

d) Graphing the data (top and bottom panels of Figure 3) really “connects the dots” for students. They see clearly how production leads to costs, how cost and revenue data identify the profit maximizing level of output, and how all of this looks in the accounting format of an (admittedly simple) income statement.



	1	2	3	4	5	6	7	8
X1	0	1	2	3	4	5	6	7
X2	14	12	10	8	6	4	2	0
Q	100	121	136	145	148	145	136	121



	1	2	3	4	5	6	7	8
Net Profit	-3000	3300	7800	10500	11400	10500	7800	3300
Gross Profit	2000	8300	12800	15500	16400	15500	12800	8300
X1	0	4000	8000	12000	16000	20000	24000	28000
X2	28000	24000	20000	16000	12000	8000	4000	0

Figure 3: Connecting the Dots by Graphing the Data

3 Conclusions and a Caveat

Different formats often inhibit students' motivation or ability to use needed tools in business disciplines, including management and marketing. Spreadsheet exercises offer several advantages to reduce the problem. One, they convert traditionally presented demand and cost data to financial statement format connecting economics and related business concepts with those of accounting and finance. Two, they help students visualize relationships between unit demand and cost curves and data and associated total revenue and cost curves. Three, they clarify how students can establish basic managerial plans with goals that seem to conflict. Four, they more clearly link break-even and target profit concepts to income statements.

A caveat: students lacking facility with spreadsheets may need a refresher on graphing techniques. But this should not be a problem in today's instructional environment. If these kinds of exercises strengthen students' computing skills, it is so much the better.

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