

Student Manual

Managerial Economics

An Interactive Microeconomics Simulation Game

FOURTH EDITION

Steven C. Gold



Gold Simulations Educational Software Beat The Market On Line: An Interactive Microeconomics Game

Beat The Market: Student Manual

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SECTION 1: DESCRIPTION OF THE SIMULATION

Overview

Beat The Market (abbreviated BTM) is an interactive on line simulation game that will help you learn microeconomics in a new and exciting way. This is accomplished by giving you the opportunity to apply microeconomic terms, concepts, and models in a decision-making setting to achieve the objectives of the firm, reinforce microeconomic tools of analysis, and practice critical thinking. This program puts you inside the world of the textbook. You do not just read about market behavior and resource allocation. You live it! You are asked to manage a firm in different markets (perfect competition, monopoly, monopolistic competition and oligopoly), similar to the way top-level executives manage in the real world. The purpose is to show you how microeconomics can be used to better understand the market environment and improve the performance of the firm. BTM is more than just a game. It is a dynamic hands-on simulation of the standard market structures that provides an important link between economic theory and application. The game allows you to see how different markets function and apply microeconomic tools of analysis to try to beat the market.

The mechanics of playing the game are very simple. As part of a student team or individually, you compete against firms in a simulated market that are managed by the computer or other students in the class. The program is menu-driven and requires very little explanation. The general process is to enter your firm's operating decisions for a given period. You advance to the next time period by pressing the execute button, and you receive immediate feedback. The simulation evaluates your decisions relative to the competition and market environment and generates a set of reports that show how well you are doing. You are given a performance rating between 0 and 100 percent based on your profits compared to the best firm.

The microeconomics game will help illustrate and clarify several important theoretical concepts including:

- How equilibrium is achieved in different markets.
- How price and production decisions change under various market conditions.
- How elasticities are used to forecast demand and revenues.
- How marginal analysis can be effectively utilized for decision-making.
- How costs are related to plant size and optimal levels of production.
- How non-price factors (such as advertising or wage rates) change market demand and supply.
- How the macroeconomy can affect the firm's performance.

The Four Market Structures

The characteristics of each of the market structures in the game selected by the “Instructor” are summarized below:



Perfect Competition

- ✓ One thousand firms are in the market at the start of the simulation.
 - Each firm starts with an equal market share of 0.10%.
 - Market share is limited by plant size. Production capacity is a very small fraction of the total market.
- ✓ Each firm is selling identical products.
 - There is no ability to differentiate each firm's product.
 - Advertising and product development decisions are not permitted.
- ✓ The firm faces a horizontal demand
 - The firm can sell all it wants at the current market price.
 - Firm price set above the market price will result in no demand.
- ✓ Full information on the market is provided.
 - Information on 20 "representative" firms is provided each period.
 - The performance details of the representative firms are reported in the market research and competitive analysis reports.
- ✓ Entry and exit of firms occurs as profit levels change in the market
 - New firms enter the market if profits exceed normal levels (defined as \$100,000)
 - Firms exit the market if profits fall short of normal levels.

Monopoly

- ✓ Only 1 firm is in the market.
 - The firm has a 100% market share and this does not change.
 - Firm demand is equal to the market demand.
 - Plant capacity can be changed with 20 different plant sizes.
 - Economies and diseconomies of scale exist, meaning average costs of production change with plant size and the level of production.
- ✓ No entry of rival firms is permitted.
- ✓ Non-price factors such as advertising and product development may be used to shift market demand.
- ✓ Student success is based on a comparison with other monopolists.
 - Ten monopoly markets are reported in the simulation game.
 - Each monopoly market is independent.

Monopolistic Competition

- ✓ Twenty-five firms are in the market at the start of the simulation.
 - Each firm starts with an equal market share of 4%.
 - Market share is limited by plant size. The largest plant size and production capacity are a small fraction of the total market.
- ✓ Product differentiation is possible but limited.
 - Advertising and product development decisions are permitted.
- ✓ Firm demand is negatively sloped but there is limited market power.
 - Firm price sensitivity of demand is high (elastic) and affected by the number of firms in the market.
- ✓ Entry and exit of firms occur as profit levels change in the market
 - New firms enter the market if profits exceed normal levels (defined as \$100,000)



- Firms exit the market if profits fall short of normal levels.
- ✓ Information is provided on 15 of the 25 firms in the market.
 - The performance details of the 15 “representative” firms are reported in the market research and competitive analysis reports.

Oligopoly

- ✓ Five firms are in the market.
 - Each firm starts with an equal market share of 20%.
 - Market share may grow significantly with increases in plant size and productive capacity.
- ✓ Economies and diseconomies of scale exist, meaning average production costs change with plant size and the level of production.
- ✓ Significant product differentiation is possible.
 - Advertising and product development decisions are permitted.
 - Price elasticity is affected by non-price factors such as product development.
- ✓ Market power exists but mutual interdependence is high.
 - One firm can significantly affect its rivals in the market.
 - Rivals react to changes in market share and to pricing policies of competitors.
 - Price wars may occur
 - A dominant firm or price leader may emerge.
- ✓ No entry or exit of firms is permitted.

Macroeconomic Conditions and Random Events

One of the five conditions are selected for each game by the “Instructor”:

- ✓ Stable Economy – no change in GDP or CPI
- ✓ Economic Growth – increasing GDP and CPI
- ✓ Business Cycles – period growth followed by decline in GDP and CPI
- ✓ Unknown Economy – randomly selected GDP and CPI
- ✓ Random Economic Events (shocks) – select yes to allow or no to disallow

The macroeconomy will affect the market demand and costs of doing business. During the game you will receive forecasts of the GDP (gross domestic product index), CPI (consumer price index), and other relevant economic events.

The level of economic growth and the severity of the business cycles will change with each new game. If random economic events are allowed, there is a 30% chance each period of the game that an important economic event will occur that will affect either market demand or supply. The nature and magnitude of the random events will change with each new game. You will be informed a period in advance in the market research report of any random economic events that will occur so you may adjust your decisions.



Section 2: How to Register & Simulation Game Procedure

On Line Registration

You will be given a Course ID by the instructor which is necessary to register for the correct course. Go to the log on screen at www.btmgame.com. Press "Subscribe" for New Students to register and follow the instructions for a student. The promo code is optional and only available if given to you by the instructor. In most cases, it is not provided to students. If you are given a promo code, enter it when you subscribe.

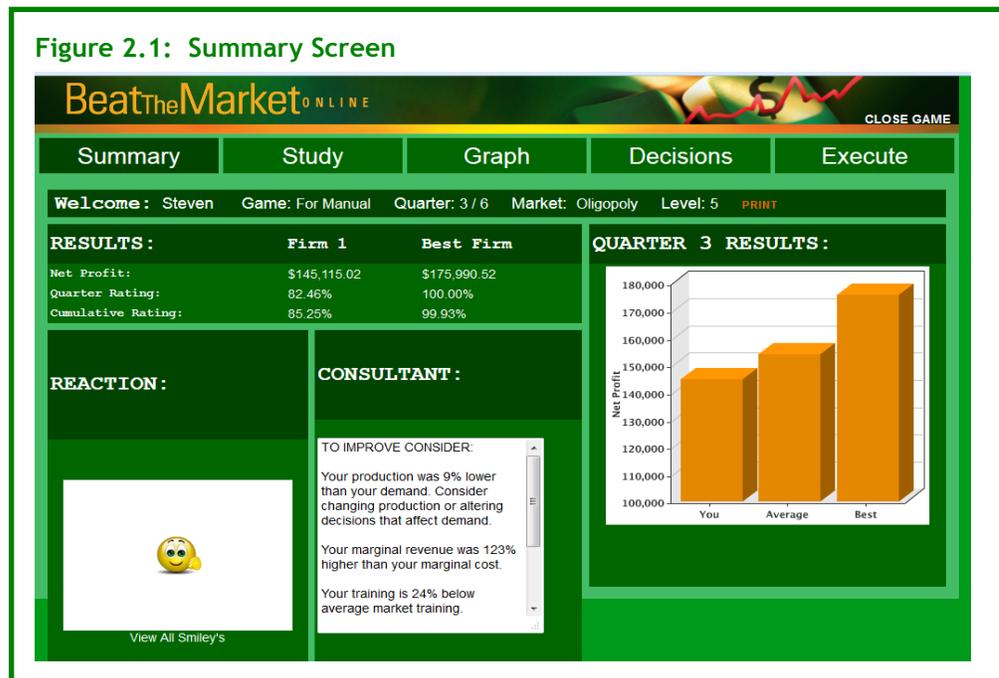
You need a valid email address to register because your confirmation receipt and password for your account will be emailed there. After receiving the password, you will go back to the login screen, enter the username and the password. Once on-line as a student, to change the password go to Account, Other Information, Password, press EDIT and follow the instructions.

Simulation Game Procedure

1. Obtain the Simulation

It is now time to play the game and see how it works. Go to www.btmgame.com, enter your user name and password, press the coursework tab and then select the GAME your instructor assigned from the list. The details of the game are summarized on this screen. Simply press PLAY to begin.

The **SUMMARY** screen (figure 2.1 below) provides a summary report on your results compared to the best firm in the marketplace, an animated Reaction of your performance, a graphical representation & guidance by a CONSULTANT. The consultant is an expert in the field & will be very helpful.





2. Game Objective and Decision Making Process

Objectives:

The game objective is to maximize the long-run profits of your firm. Long-run profits are measured by cumulative net profits over the number of periods of simulated play.

You have been hired as the President of the Company and/or are a Vice President and Board Member. The owners selected you hoping that you will be able to help them achieve the highest level of profits in the long run. You have been given full authority to implement whatever strategies and tactics you believe are most effective. Your performance as President or member of the management board will be measured each period by your firm's profit compared to the other firms in the market. At the start of the simulation your rating is 100%, and will stay that level if you are the top performing company.

Decision Making Process:

Many students ask the question "How do we begin to make decisions to achieve our objectives in the game?" There are three major suggestions:

1. Review what the on line "CONSULTANT" suggests.
2. Click on the INFORMATION BUTTON next to each decision and read the suggested process.
3. Utilize the scientific method described below.

The scientific method involves the following steps:

- a. Define the problem (what is going wrong or right?) by studying the reports
- b. Formulate a hypothesis (or strategy)
- c. Enter decisions and make predictions of your results applying the economic concepts learned in the class and textbook.
- d. Evaluate performance by testing the accuracy of the predictions by comparing it to the game performance.
- e. Accept or revise the hypothesis (or game strategy) based on the test results.

We view the application of the scientific method as an important educational benefit that the game provides to you. The game is an excellent pedagogical tool to help you learn "critical thinking" skills. These skills will help you to succeed in many different situations in your chosen career as well as in life.

3. Study Reports

Begin by reviewing the information on the SUMMARY tab which includes guidance from your on-line CONSULTANT. Then select the STUDY tab (see Figure 2.1) which will reveal the following reports:

-  **Firm Profit Statement:**
 - Revenues, costs, and profits each period.
-  **Demand and Supply Reports:**
 - Firm demand, supply, shortages, and market share
-  **Market Research:**
 - Number of firms, market demand and market supply
 - Economic news relevant to market



- Macroeconomic data on GDP and CPI
- ☞ **Competitive Analysis:**
- Decisions and key results of rivals

Section 4 gives a detailed discussion of each of these reports.

4. Make Decisions

Make and enter decisions after reviewing your reports. A detailed description of each decision and its likely impact is given in Section 3. Depending on the game there can be as little as just two decisions.

Note the information buttons listed to the right of each decision entry box. Clicking these buttons will give you valuable information and advice about each of these decisions (Fig. 2.2).

Figure 2.2: Enter demand and supply decisions
 (Simpler Games may only have two decisions: Price & Production)

Enter Decisions for quarter (1) :

Demand Decisions : View Decision Graphs

Price:	<input type="text" value="75.11"/>	<input type="button" value="info"/>
Advertising:	<input type="text" value="3000.0"/>	<input type="button" value="info"/>
Product Development:	<input type="text" value="3000.0"/>	<input type="button" value="info"/>
E-Commerce Enhancement:	<input type="text" value="3000.0"/>	<input type="button" value="info"/>

Supply Decisions :

Production:	<input type="text" value="4100"/>	<input type="button" value="info"/>
Plant Size (for period 2):	<input type="text" value="6"/>	<input type="button" value="info"/>
Process Improvements:	<input type="text" value="1000.0"/>	<input type="button" value="info"/>
Training:	<input type="text" value="1000.0"/>	<input type="button" value="info"/>

View Decisions For Quarter:

5. Execute Simulation

This only applies to the single player game when you are competing only against computer managed firms. For the multi-player game the Instructor or Game Administrator will execute the simulation. The “execute button” will advance the simulation to the next period of play. You can assume a period of play is 3 months in time. Simply press the execute button on the top right hand side of the screen for the single player game.

”Executing” the simulation will take all the decisions of your firm, and the rival firms managed by the computer or other players, and given the state of the economy and current events, evaluate your



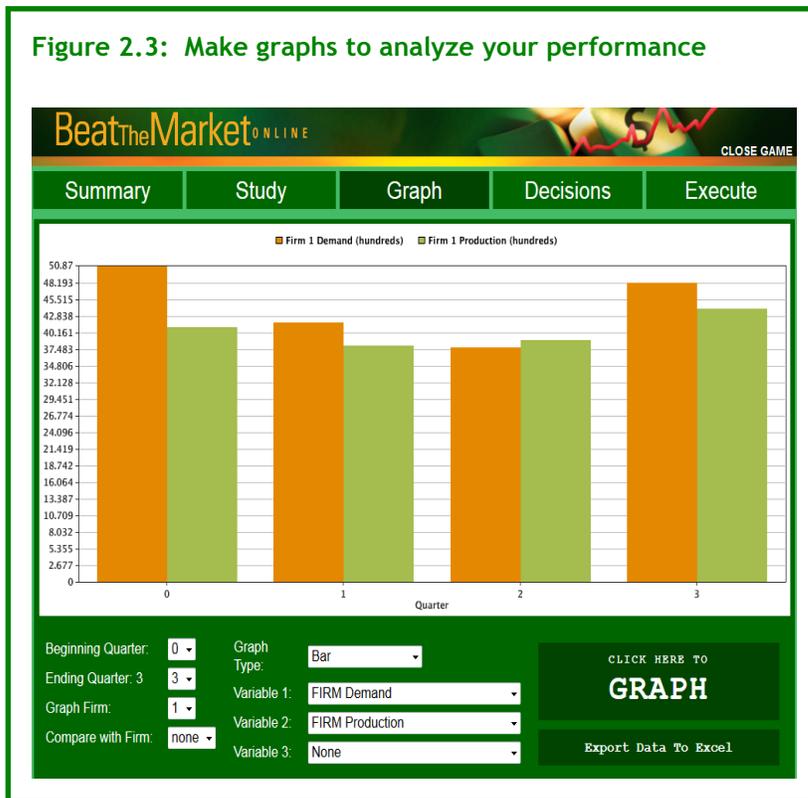
performance. A new set of reports will be generated, and you will be informed of your profit rating from 0-100%.

6. Save Simulation

The simulation is automatically saved upon “execution” including all prior periods of the simulation game. This will enable you to review and better understand your performance after you completed a game. You may study your decisions and results each period of the game and evaluate what you have done.

7. Evaluate and Graph Results

A graphics module may be accessed by clicking the “Graph” tab on the toolbar. This is a powerful tool to help you visualize the relationships between the decisions and results in the game.



Up to three variables are able to be graphed for each period. A drop-down menu button on the right offers a list of different variables you may choose to graph. You may select different types of graphs including: BAR, LINE, SCATTER, CURVED, AREA and STEP.

You may select a subset of periods to graph by clicking the down arrow key next to “Select Beginning Period” and “Select Ending Period”. You may select any two firms to graph; it does not have to be your own firm, by choosing “Graph Firm” and “Compare with Firm”.



Once you have made all your selections simply click on “Graph” to see the results.

If you have the spreadsheet program Excel, you may “Click To View Data in Spreadsheet Format”. The data for each period in the game and for each firm is exported. This option opens up the door to a wide array of sophisticated statistical data analysis and other graphics.

Section 3: Description of Game Decisions

Overview

The purpose of this section is to describe the game decisions and their effects on the firm in the simulation. The decisions, based on their impacts on the firm, are placed into two broad categories: *demand and supply*. The demand decisions affect, directly, the quantity of units demanded and the revenues of the firm whereas the supply decisions affect the production and costs of goods.

The DECISION ENTRY FORM, (Figure 3.1) accessed from the main menu by clicking DECISIONS, lists the demand and supply decisions. **The number of decisions that appear on the screen depend on the learning level of the game selected by the instructor.** The most advanced games may include 8 decisions. The simplest game only has price and production. At the start of each new quarter, the decision values are the same as those from the previous quarter. It is up to you to decide to change the decisions or keep them the same as last quarter.

Figure 3.1: Sample Decisions for Quarter or Quarter 1
 (Simpler Games may only have two decisions: Price & Production)

Enter Decisions for quarter (1):		
Demand Decisions:		View Decision Graphs
Price:	<input type="text" value="75.11"/>	info
Advertising:	<input type="text" value="3000.0"/>	info
Product Development:	<input type="text" value="3000.0"/>	info
E-Commerce Enhancement:	<input type="text" value="3000.0"/>	info
Supply Decisions:		
Production:	<input type="text" value="4100"/>	info
Plant Size (for period 2):	<input type="text" value="6"/>	info
Process Improvements:	<input type="text" value="1000.0"/>	info
Training:	<input type="text" value="1000.0"/>	info
SAVE Decisions		

Demand Decisions

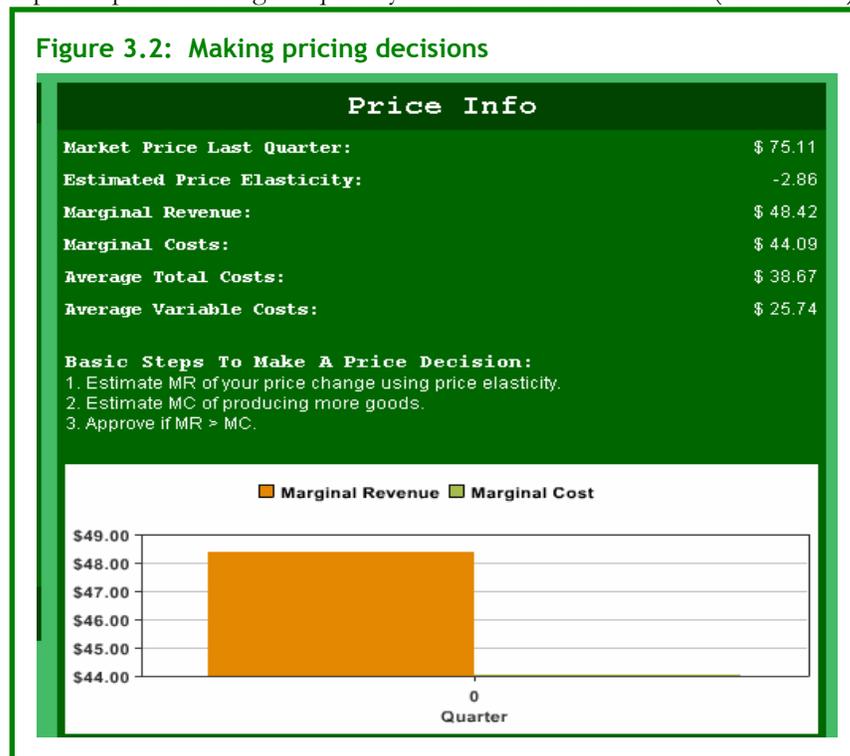
The demand decisions will vary from one to four depending on the level of the game selected by the instructor. The four demand decisions are price, advertising, product development, and e-commerce enhancements. Each decision and its impact on the firm are explained below.

Price

The price is the dollar amount you are asking your customers to pay for your product. In quarter 1 it is listed as \$75.11 unless you change it. In general, if you raise price you should expect to lose some customers (assuming your competitors do not raise price). How significantly a change in your price will impact firm demand depends on the market structure and the price elasticity of demand. Clicking the information button next to the price decision (Fig. 3.1) will give you the PRICING INFORMATION screen (Fig. 3.2).

You are given the price elasticity from last quarter. For example, a price elasticity of -2.86 means that a 1% increase in price will decrease quantity demanded by 2.86%; or lowering price 1% will increase quantity demanded by 2.86%.

The price elasticity is a useful tool to forecast demand. As an example, suppose the firm was considering lowering price from \$75.11 to \$72.11, which is a *decrease* of 4%. The percent change in quantity demanded is equal to the percent change in price times the elasticity value. Using the price elasticity of -2.86, the expected percent change in quantity demanded would be 11.4% ($-4\% \times -2.86$).





Remember the price elasticity could change from quarter to quarter. Price elasticity depends on a number of factors in the game, including:

- ☞ Competitiveness of the market reflected by the number of rivals
- ☞ Price level (a higher firm price will increase elasticity)
- ☞ Advertising and e-commerce enhancements relative to the competition
- ☞ Product quality affected by product development expenditures
- ☞ Macroeconomic conditions (growth versus contraction)
- ☞ Other economic factors such as changing consumer preference, demographics, etc.

Studying the market research reports in the game will help you assess how these factors are changing.

The impact of price on revenues is measured by marginal revenues. In this example, the marginal revenue (MR) for last quarter is reported as \$38.67. This means a one unit increase in quantity demanded will increase revenues by \$38.67. The marginal revenue depends on the price elasticity of demand. As the price elasticity increases (becomes more elastic) the marginal revenue increases and becomes closer to the firm's price.

Costs should be considered in setting price and are reported in Figure 3.2 for last quarter. If the price you set does not cover the costs of production, it is not possible to make a profit. In this example, average total costs last quarter were \$38.67. If this does not change, then a price below \$38.67 will cause the firm's profits to be in the "red" (negative). The factors that influence costs, including average variable (AVC) and marginal costs (MC), are discussed with the supply decisions: production, process improvements, plant size, and training (Fig. 3.1). An itemized listing of the costs of the firm is given in the Profit Report and explained in Section 4 "Description of Reports" (Fig. 4.1).

The BASIC STEPS TO MAKE A PRICE DECISION is given at the bottom of Fig. 3.2. The general rule in economics is to change price so marginal revenues (MR) are equal or close to marginal costs (MC).

Advertising

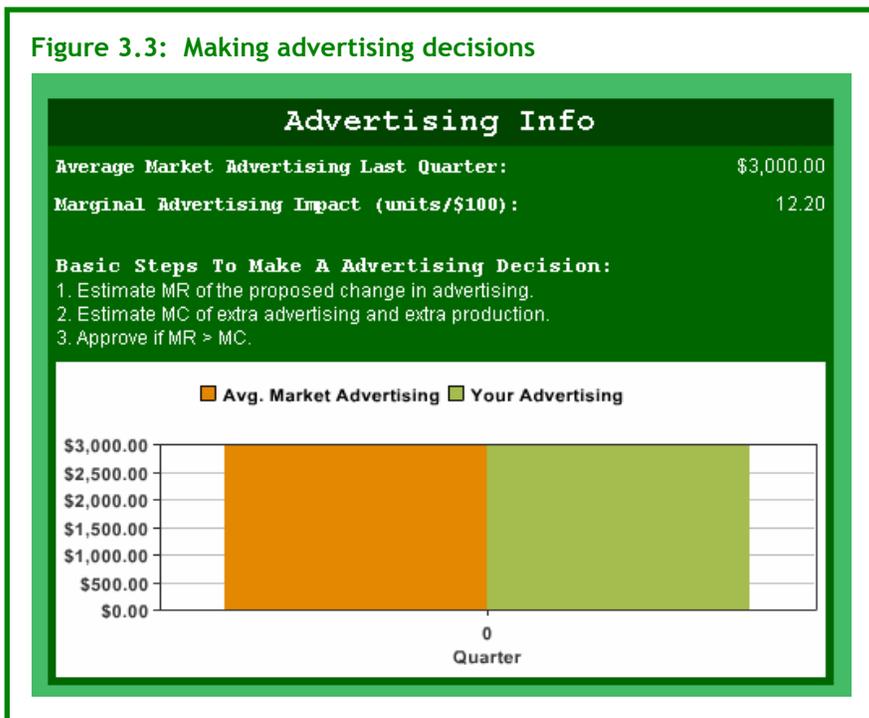
Advertising expenditures will affect a firm's demand as customers become more aware of the product and its advantages. (Advertising is not permitted in the perfect competition market structure).

Clicking the information button next to the advertising decision (Fig. 3.1) will give you the marginal impact of advertising on demand from the prior quarter as shown in the ADVERTISING INFORMATION screen (Fig. 3.3). Given a marginal impact of 12.2 means a hundred dollar increase in advertising from \$3000 to \$3100 would be expected to increase demand by 12.2 units. Be cautious. Advertising is subject to the laws of diminishing returns.

The degree to which advertising will increase demand depends not only on the level of advertising but the nature of the market, the amount your rivals spend on advertising relative to your own budget, and

general macroeconomic conditions. Studying the market research report in the game will help you assess these conditions.

It is important to compare your advertising budget with your rival's (unless you are a monopolist). For example, if you increase your advertising budget 5% but your rivals increase their advertising 15% you may lose customers!



The BASIC STEPS TO MAKE AN ADVERTISING DECISION is given at the bottom of Fig. 3.3. The general rule in economics is to change advertising as long as the marginal revenues (MR) is equal or close to marginal costs (MC) of both the advertising and the extra production needed to meet the extra demand.

Product Development

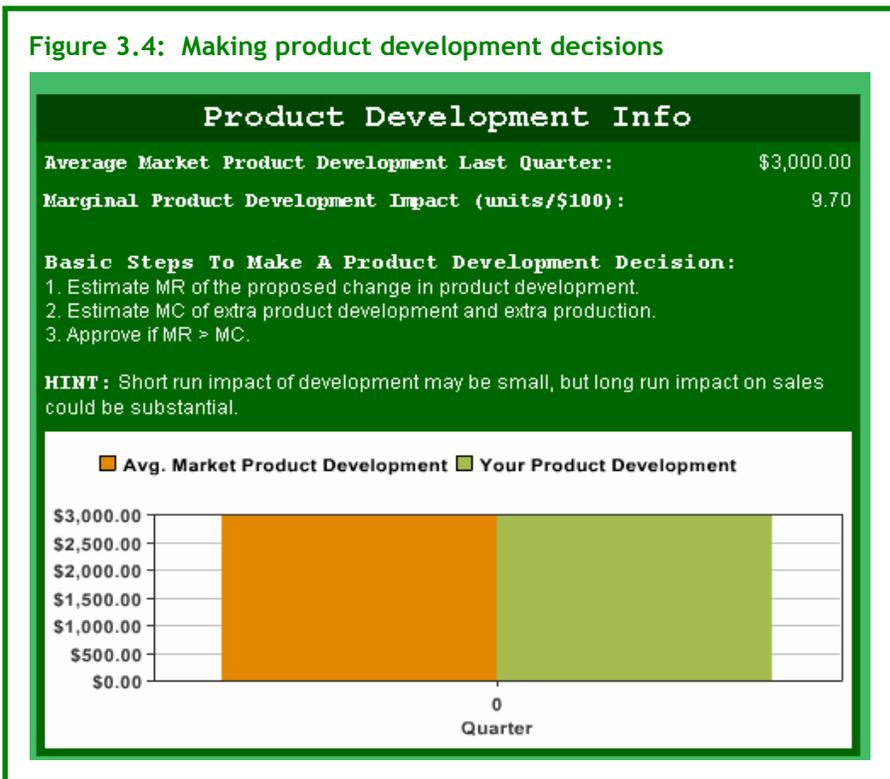
Expenditures on product development will improve the quality of the product, making it more suited to the needs and wants of the customers.

Improving quality takes time and is a long-term investment. Demand for your product will increase as resources are allocated to development. Be cautious. Development expenditures are subject to the law of diminishing returns.

Clicking the information button next to the product development decision (Fig. 3.1) will give you the marginal impact of development on demand from the prior quarter as shown in the PRODUCT DEVELOPMENT INFORMATION screen (Fig. 3.4). Given a marginal impact of 9.7 units per hundred

dollars means that a hundred dollar increase in product development from \$3000 to \$3100 would be expected to increase demand by 9.7 units.

The degree to which product development will increase demand depends on several factors, including: the nature of the market, the historical pattern of your development expenditures (a consistent pattern is most effective in the long run), and the development budgets of your rivals relative to your own (unless you are a monopolist).



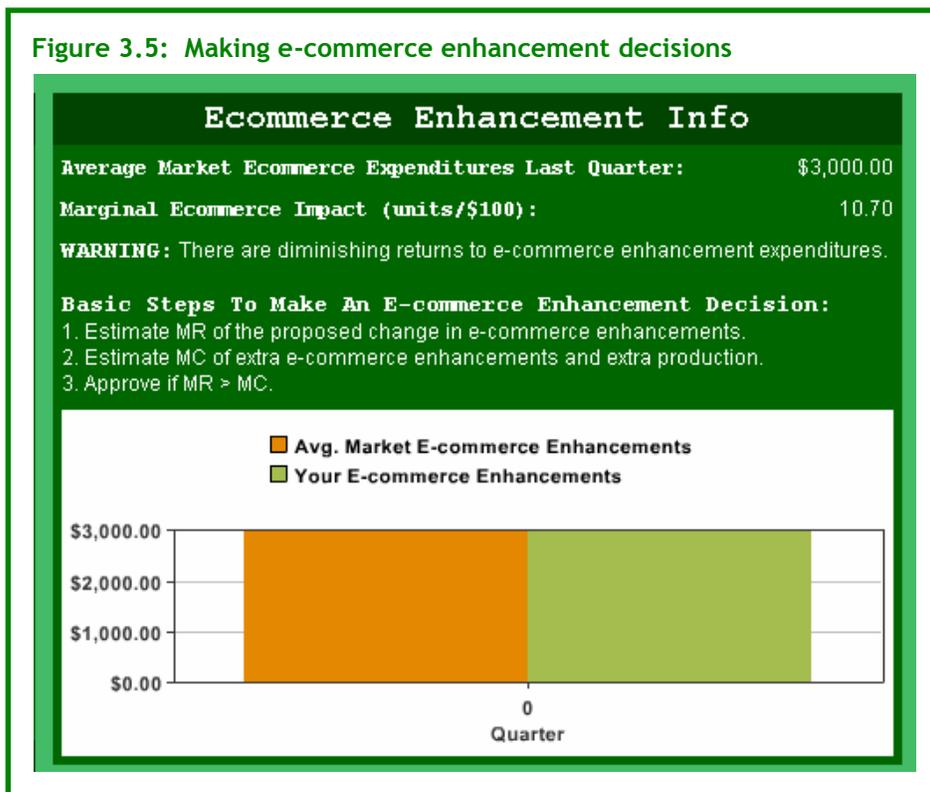
The BASIC STEPS TO MAKE A PRODUCT DEVELOPMENT DECISION is given at the bottom of Fig 3.4. The general rule is to increase development expenditures if the estimated marginal revenue is equal or close to marginal costs in the long run.

E-Commerce Enhancements

Doing business on the net is becoming an effective way to attract more customers. E-commerce includes having an on-line store, providing on-line services, web marketing, email marketing, and Internet payment. E-commerce enhancements will improve your website design, helping you meet the needs of your on-line customers and dealing more effectively with issues such as credit cards, shipping, and security. (E-commerce enhancements are not permitted in the perfectly competitive market structure).

Clicking the information button next to the e-commerce decision (Fig. 3.1) will give you the marginal impact of e-commerce on demand from the prior quarter as shown in the E-COMMERCE INFORMATION screen (Fig 3.5).

The degree to which e-commerce will increase demand depends not only on the level of expenditures but the nature of the market, the amount your rivals spend on e-commerce relative to your own budget (unless you are a monopolist), and general macroeconomic conditions. Studying the market research report in the game will help you assess these conditions.



The BASIC STEPS TO MAKE AN E-COMMERCE DECISION, (Fig. 3.5), are similar to advertising.

Supply Decisions

The supply decisions will vary from one to four depending on the level of the game selected by the instructor. At the simplest level your game may include only the production decision. The four supply decisions are: production, process improvements, plant size and training. These decisions will influence the quantity of goods produced, inventory levels, productivity, and the costs of the firm. The profits of the firm are highly dependent on these decisions.

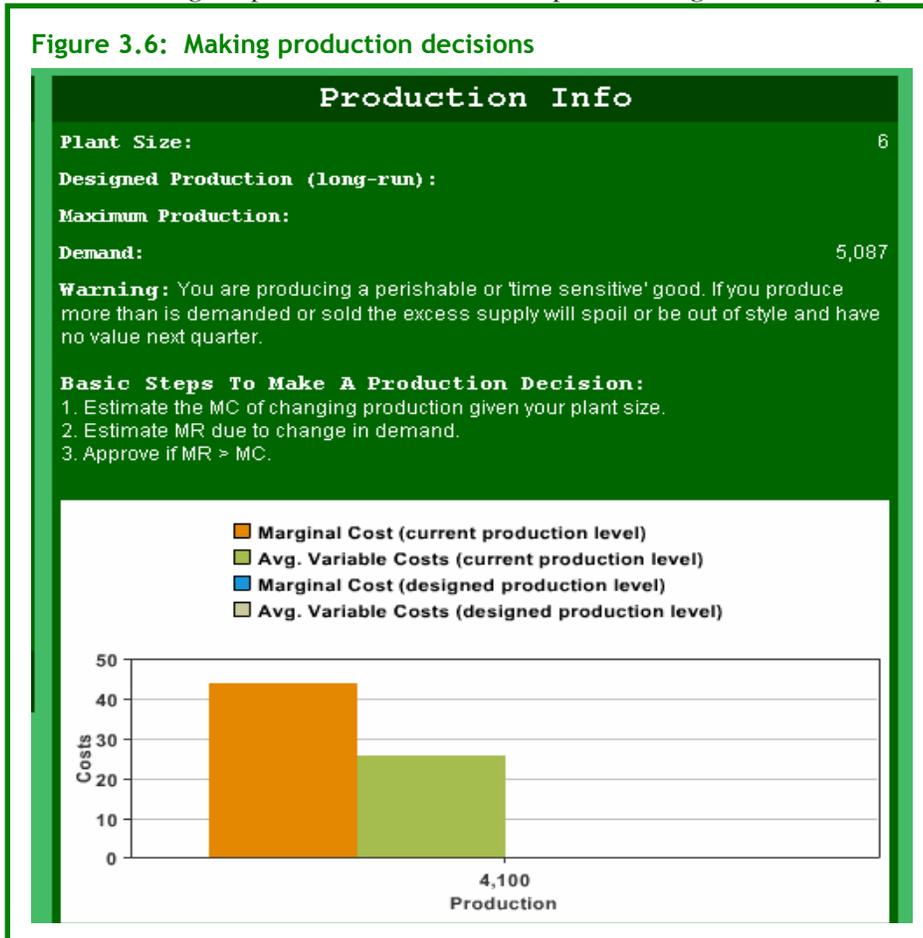
Production

You must decide the quantity to schedule for production (in units) each quarter. This decision is critical because you are producing a “perishable” or “time-sensitive” product that cannot be stored in inventory. If you produce more than is demanded, the excess supply will be spoiled or will be out of style and cannot be sold in future quarters. If you do not produce enough goods to meet demand you will stock-out and disappoint your customers. There is an opportunity cost of lost sales equal to the profits that could have been earned if you were able to meet demand.

To help you make the production decision, click the information button on the decision screen from (Fig. 3.1). In this example, in quarter zero the quantity demanded was 5,087 units but the firm produced only 4,100 units. The firm was not able to meet the excess demand of 987 units over the amount produced.

The maximum production you may schedule depends on the firm's capacity based on its plant size. In this example, at the start of the game the plant size is 6. This size plant was designed to produce a “maximum” of 6,000 units per quarter. But production efficiency changes with the level of production. The most efficient level of production (measured in terms of output per unit of input or the average product of labor) for plant size 6 is around 3,000 units. It may be more *profitable* to produce up to 6,000 units if the selling price is high enough. A list of the designed production levels for each plant size is given under the plant size decision.

Figure 3.6: Making production decisions

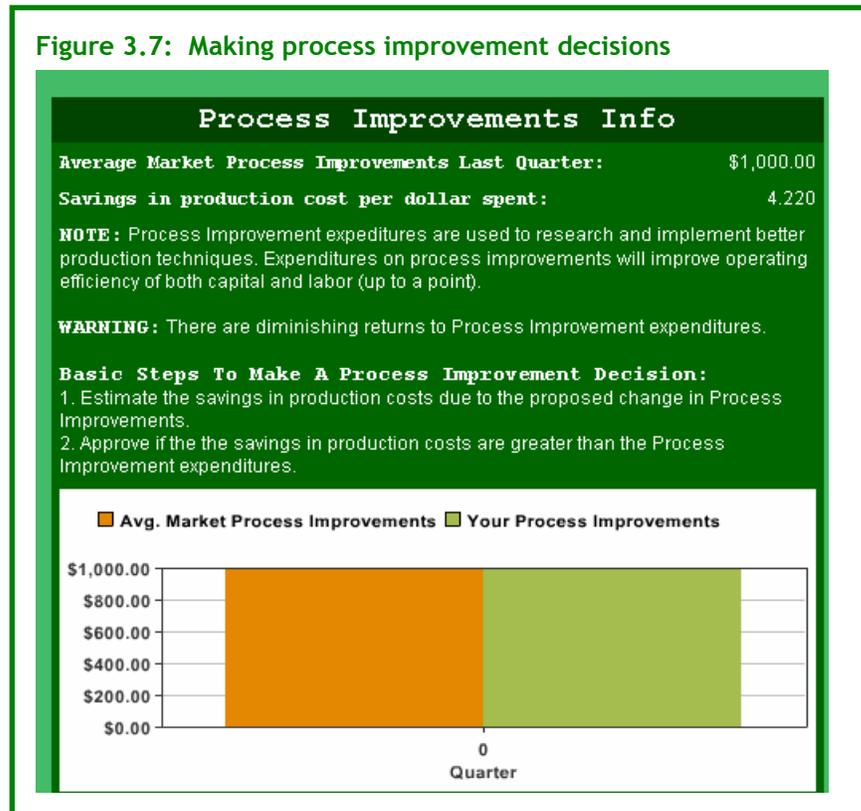


The general rule to make an effective production decision (Fig. 3.6) is to change production until the marginal revenues (MR) are equal or close to the marginal costs (MC).

Process Improvements

Expenditures on process improvements will increase the operating efficiency of both capital and labor. Clicking the information button next to the process improvement decision (Fig. 3.1) will give you last quarter's cost savings resulting from these expenditures as shown in the PROCESS IMPROVEMENT INFORMATION screen (Fig. 3.7).

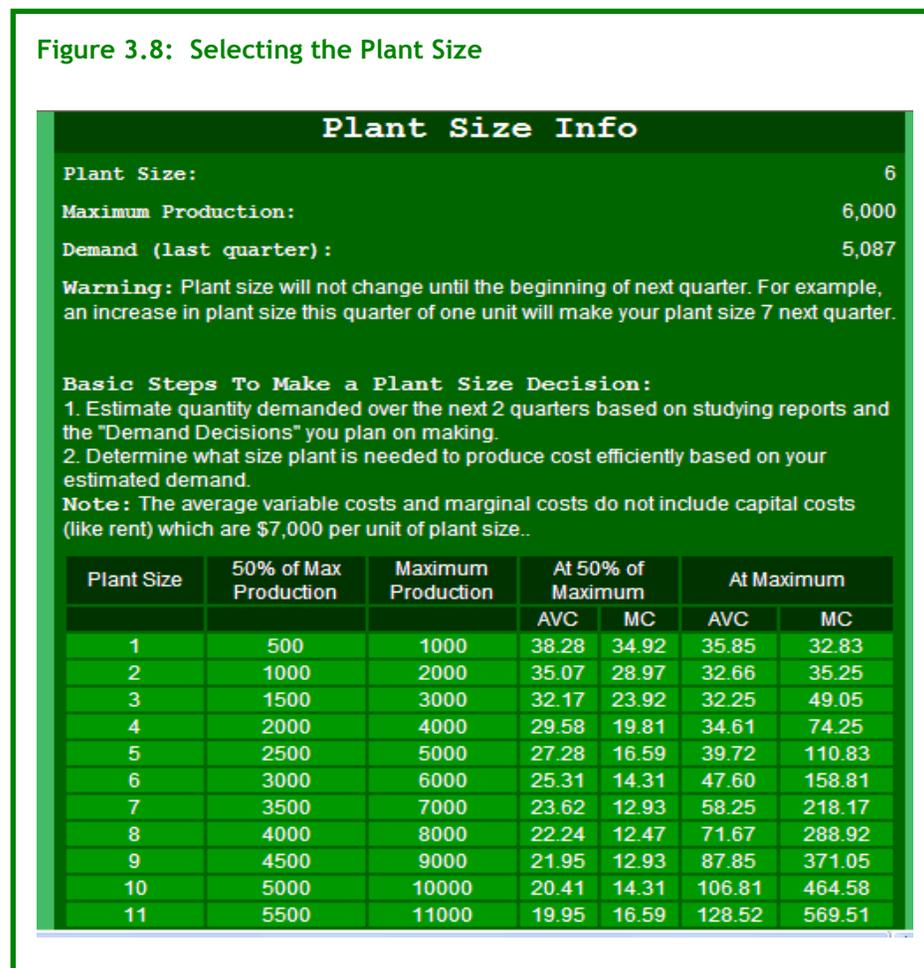
The BASIC STEPS TO DECIDE ON PROCESS IMPROVEMENTS are shown in Figure 3.7. It is recommended to increase expenditures as long as the incremental (marginal) savings exceed the incremental (marginal) costs. At the optimal point the marginal savings will be equal to the marginal costs. In this example, at the start of the game, the savings per dollar spent on process improvements were estimated to be \$4.22. Because \$1000 was spent on process improvements, the total savings were \$4,222. In this case the savings exceeded the incremental costs. The net savings are \$3,222, the difference between total savings and process improvement expenditures. However, you are warned that there are diminishing returns to these expenditures.



Plant Size (change in units)

The plant size determines the production capacity of the firm. In this example, at the start of the game the plant size is 6. You may increase or decrease the plant size by up to 2 units per quarter. This change in plant size does not occur immediately, it takes one quarter to build or reduce the plant size. This means that in the *short-run* you are constrained to operate with a given plant size.

Clicking the information button next to the plant size decision (Fig. 3.1) will give you the maximum production and the variable costs associated with each plant size as shown in Figure 3.8. The plant size may be increased to as high as 20 (not shown in Figure 3.1). This will help you select the best plant size.



Each plant was designed to produce efficiently at around 50% of the maximum. For example, a plant size of 6 was designed to produce 3000 units per quarter, but a maximum of 6000 units may be scheduled. But be careful, average and marginal costs rise significantly as production is increased from the design to the maximum levels. At a production level of 3000 units in this example, average variable costs (AVC) are \$25.31 per unit; but increase to \$47.61 at the maximum production level of 6000 units. Marginal costs rise even more, from \$14.31 to \$157.81. So increasing production to the maximum is



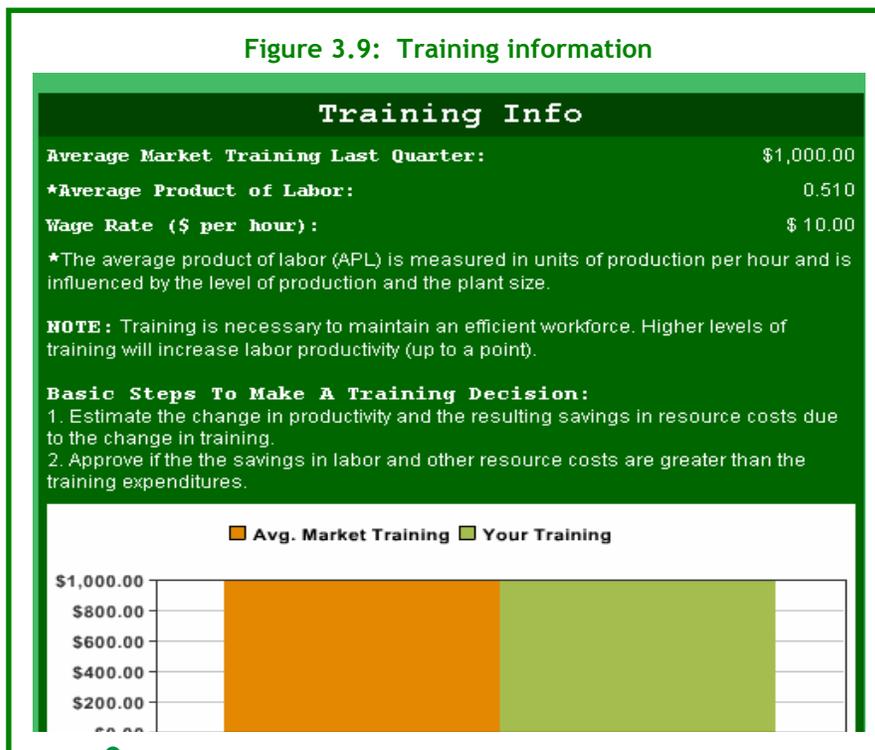
very expensive. There are clearly diminishing returns and productivity problems as a firm approaches maximum capacity for this plant size.

In selecting the best plant size, a rule of thumb is to increase plant size based on the expected demand of the firm. If demand is expected to be around 6000 units, it would be much more efficient to increase plant size to 12. Plant size 12 is designed to produce 6000 units efficiently (at 50% of maximum), with an average variable cost of only \$19.81 per unit. In the long-run you may change your plant to any size between 1 and 20, but it takes time. To increase plant size from 6 to 12, it would take 3 quarters because you can only increase plant size by 2 units per quarter. (You may also decrease plant size by up to 2 units per quarter if demand starts declining.)

Increasing plant size does have a risk, however, as overhead costs will increase. In this example, the capital costs (like rent) in this example game are reported as \$7,000 per unit of plant (see bottom of Figure 3.8). This means a plant of size 6 will cost \$42,000 in capital costs (fixed costs). A plant size of 12 will have double the overhead (fixed costs) of \$84,000 per quarter. These costs will increase with inflation. It is up to you to track your costs as you increase plant size to assess economies of scale. There are economies and diseconomies of scale in the game. Production efficiency will increase with plant size up to a point (economies) and then decrease (diseconomies).

Training

Training expenditures will improve the productivity of the workforce & help reduce the costs of production. Clicking the information button next to the training decision (Fig. 3.1) will give you last quarter's labor productivity and the average training in the market as shown in the TRAINING INFORMATION screen Fig 3.9.





From this information you can keep track of the savings in labor costs by investing in training. An average product of labor of 0.514 means that 1 hour of labor is required to produce 0.514 units; or 100 hours of labor is needed to produce 51.4 units. Given a wage rate of \$10 per hour, the labor costs per unit produced may be calculated as follows:

$$\begin{aligned}
 \text{Labor costs per unit produced} &= (\text{wage rate} \times \text{hours}) \div \text{production} \\
 &= \text{wage rate} \times \text{average product of labor} \\
 &= \$10 \div 0.514 \\
 &= \$19.46
 \end{aligned}$$

It is worthwhile to increase training expenditures as long as the reduction in labor costs exceeds the training expenditures. For example, if an increase in training of \$400 is estimated to reduce labor costs by \$1.00 per unit produced (from \$19.46 to \$18.46), and production is 5,000 units, then labor savings are \$5,000 (\$1.00 x 5000 units). The net savings are \$4600 (\$5000 - \$400). In this case it pays to increase training. Be careful. There are diminishing returns to labor productivity as training increases.

Training will also help reduce material, power, and repair costs as the organization becomes more productive. The savings in these costs should also be considered in a more comprehensive analysis and may be tracked by reviewing the Profit Report (Fig. 4.1) of your firm and clicking VIEW ITEMIZED COSTS. The Profit Report lists each of these costs and is discussed in Section 4.

As an example, a firm increased training expenditures from \$1,000 in quarter 0 to \$1,200 in quarter 1 (Fig. 3.10). The firm's production level was kept constant at 4,100 units and the plant size was kept at 6.

Figure 3.10: Impact of training on variable costs of the firm

TOTAL VARIABLE COSTS ITEMIZED		TOTAL VARIABLE COSTS ITEMIZED	
Labor	\$79,823	Labor	\$79,269
Materials	\$11,443	Materials	\$11,364
Power	\$4,559	Power	\$4,528
Repairs	\$9,723	Repairs	\$9,655
TOTAL VARIABLE	\$105,548	TOTAL VARIABLE	\$104,816

The marginal increase in Training of \$200 reduced total variable costs from \$105,548 to \$104,816, a savings of \$732. In this case the training expenditures paid off. After subtracting the incremental training expenditures of \$200, net savings is \$532.

All costs will also increase with the inflation rate or consumer price index (CPI). The CPI index is provided in the game under the Market Research Macroeconomic Report (Fig. 4.6). This report is discussed in Section 4.

Total Fixed Costs are easy to estimate if you do not change plant size. Fixed costs do not change with production. In this example, plant size is not changed so Total Fixed Costs are kept at \$42,000. The



impact of increasing plant size on fixed costs is discussed in Section 4.

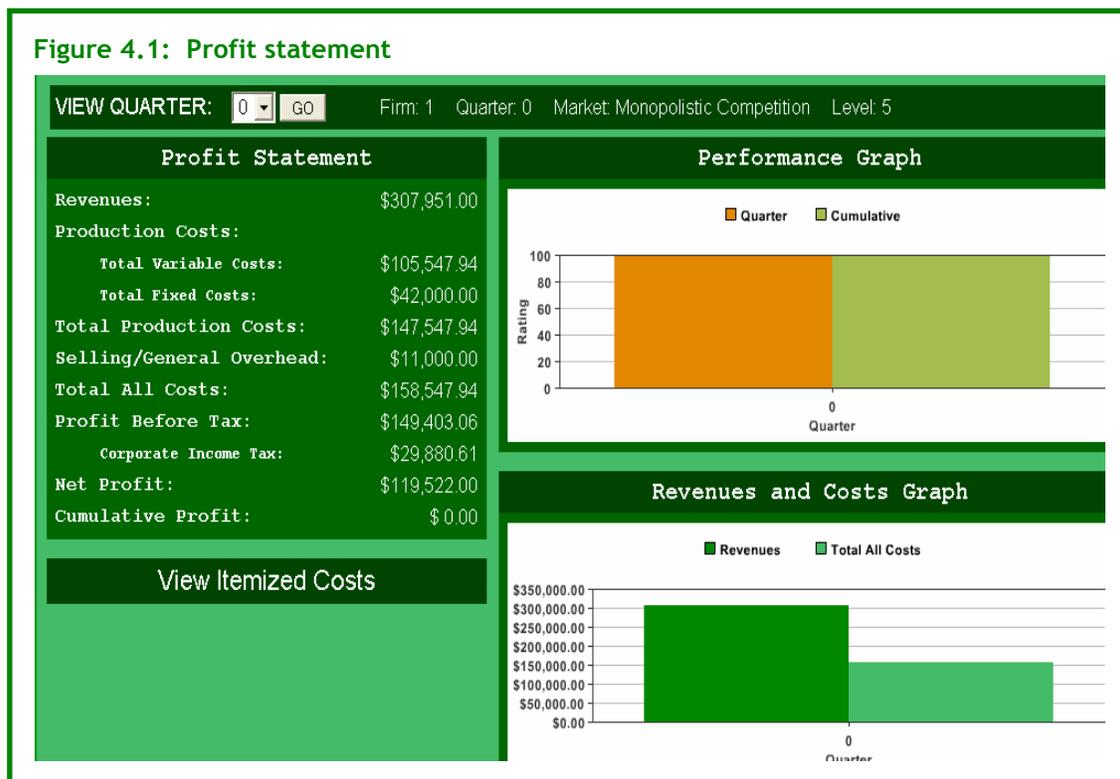
SECTION 4: DESCRIPTION OF REPORTS

You are provided with a set of reports each quarter of play that will help you understand your profit performance and how to *beat the market*. It is critical to study these reports before making decisions.

The purpose of this section is to explain these reports and the significance of the information. To view the reports from the main menu, simply click on “STUDY” and make a selection. Initially, the reports from quarter 0, the starting point, will be discussed.

Profit Statement - Revenues and Costs Itemized

The PROFIT STATEMENT is one of the most important reports because it shows the calculation of your firm’s net profit (Fig. 4.1). Net profit is the difference between revenues and costs, and is the criteria used to rate your performance in the game. The quarter 0 results in this example are displayed as they appear on the computer screen.



At the top of the report the quarter number, firm, team number and name are given. Each time you play a new game, a different identification number is automatically given. The purpose is to guard against the possibility of incorrectly mixing results from different games when printed copies are used.



An explanation of each item in the Profit Statement follows (Figs. 4.2, 4.3, 4.4).

Revenues

Total revenues are the dollars received from selling the products of the firm. Revenues are equal to the current selling price multiplied by the units sold. In this example, the quarter 0 selling price (\$75.11) and the units sold (4,100) are shown in the DEMAND AND SUPPLY REPORT (Fig. 4.5). In quarter 0, revenues are \$307,951 (Fig. 4.1). Revenues equal $\$75.11 \times 4,100$ (Fig. 4.5).

Production Costs

These are the direct costs of producing the goods or services of the firm. Total production costs are the sum of total variable costs and total fixed costs.

Total Variable Costs

These are the costs that vary with the level of production. Clicking TOTAL VARIABLE COSTS (Fig. 4.1) on the computer screen will give you an itemized listing of the variable costs (Fig. 4.2).

Figure 4.2: Variable Costs

TOTAL VARIABLE COSTS ITEMIZED	
Labor	\$79,823
Materials	\$11,443
Power	\$4,559
Repairs	\$9,723
TOTAL VARIABLE	\$105,548

In this example, in quarter 0, the total variable costs of producing 4,100 units are \$105,548 which is the sum of labor, material, power and repair costs. The average variable costs are \$25.74 per unit ($\$105,548 / 4,100$ units). These costs change with the level of production, plant size, and inflation.

Training expenditures, a controllable decision variable of the firm, should improve lower the average costs of all your resources (up to a point).

Total Fixed Costs

These are costs that do not change with the level of production, but will increase with plant size (or inflation). Clicking TOTAL FIXED COSTS (Fig. 4.1) will give you an itemized listing of the fixed costs (Fig. 4.3).

In this example, in quarter 0 the plant size is 6 and the total fixed costs are \$42,000. These costs are fixed in the short-run and will not change with the level of production. Average fixed costs are \$10.24 (\$42,000/4,100 units). Fixed costs will change, however, with plant size as follows:

Increasing plant size by 1 unit from 6 to 7 will increase total fixed costs by \$7,000, i.e. from \$42,000 to \$49,000.

Figure 4.3: Fixed costs

TOTAL FIXED COSTS ITEMIZED	
Supervision/Staff Salaries	\$15,000
Factory/Equipment Rent	\$18,000
General Maintenance	\$6,000
Property Tax	\$3,000
TOTAL FIXED COSTS	\$42,000

Selling/General Overhead

Clicking SELLING/GENERAL OVERHEAD (Fig. 4.1) on the computer screen will give you an itemized listing of these costs (Fig. 4.4).

Figure 4.4: Overhead Expenses

SELLING/GEN OVERHEAD ITEMIZED	
Advertising	\$3,000
E-Commerce	\$3,000
Product Development	\$3,000
Training	\$1,000
Process Improvement	\$1,000
TOTAL OVERHEAD	\$11,000



Note that these items, in blue ink, are all “controllable” decisions of the firm. You decide on the budget for each of these items, and enter the new expenditure levels on the DECISION ENTRY FORM (Fig 3.1) by simply clicking the main menu choice “MAKE DECISIONS” (Fig. 2.1). For example, increasing advertising from \$3,000 to \$6,000 will increase TOTAL OVERHEAD from \$11,000 to \$14,000. Although each decision variable (such as advertising, e-commerce, etc.) benefits the firm in some way, they add to the costs of doing business. The budget for these items should only be increased if the benefits exceed the costs. The beneficial impacts of each of these decision items were discussed in Section 3.

Total All Costs

These are the sum of Total Production Costs (\$147,548) (Fig. 4.1) plus Selling/General Overhead (\$11,000) (Fig. 4.4), which is equal to \$158,548 in quarter 0.

Profit before Tax

This is Revenues (\$307,951) minus Total All Costs (\$158,548) which equals \$149,403 in quarter 0.

Net Profit

This is Profit before Tax (\$149,403) minus Corporate Income Tax (\$29,881) which equals \$119,522 in quarter 0 (Fig. 4.1). Corporate Income Tax in the game is 20% of Profit before Tax. The tax rate of 20% is fixed unless you are notified in the MARKET RESEARCH REPORT under “Relevant Economic News” that it will change (Fig. 4.6).

It is interesting to note that if the Profit before Tax is negative, then the Corporate Income Tax will be negative. What this means is that the firm will receive a tax rebate of 20% of the loss. This occurs because, according to tax law, a firm is allowed to *carry back* losses, re-calculate their prior tax liabilities, and qualify for a rebate in the current quarter based on the fact that their prior tax liabilities have been reduced.

Cumulative Net Profit

This is the sum of all net profits earned in each quarter. In quarter 0, the starting point, cumulative net profits are zero (Fig. 4.1). So, if your firm has net profits of \$100,000 in quarter 1, then the cumulative net profits in quarter 1 would be also \$100,000. In quarter 2, if your firm earns \$150,000 in net profits, then the cumulative profits would be \$250,000 in quarter 2. For simplicity, interest income is not considered in the game (i.e. the time value of money is ignored).

Overall Performance

Performance is measured by quarter rating and cumulative rating. In quarter 0 all firms start with the top rating of 100%. The QUARTER RATING is the percent of your firm’s net profits compared to the best firm for the quarter. For example, if the best firm in net profits earned \$100,000 and you earned only \$90,000 then your Quarter Rating would be 90% (90000/100000). The CUMULATIVE RATING is the percent of your firm’s cumulative net profit compared to the best firm. The cumulative



profit is simply the sum of all net profits for all quarters of play. For example, if you had net profits of \$100,000 in quarter 1 and \$100,000 in quarter 2 your firm's cumulative net profits would be \$200,000 after two quarters. If the best firm had cumulative profits of \$250,000 your firm's Cumulative Rating would be 80% ($200000/250000$). The profits of the best firm are shown in the COMPETITIVE ANALYSIS Report (Fig. 4.7).

Demand & Supply Reports

The Demand & Supply Reports (Fig. 4.5) are economic reports that summarize some significant results about the firm that are not readily apparent on the Profit Statement Report (Fig. 4.1). The quarter 0 results are displayed as they appear on the computer screen and each line item is explained below. The blue ink items represent "controllable" decisions you make in the game.

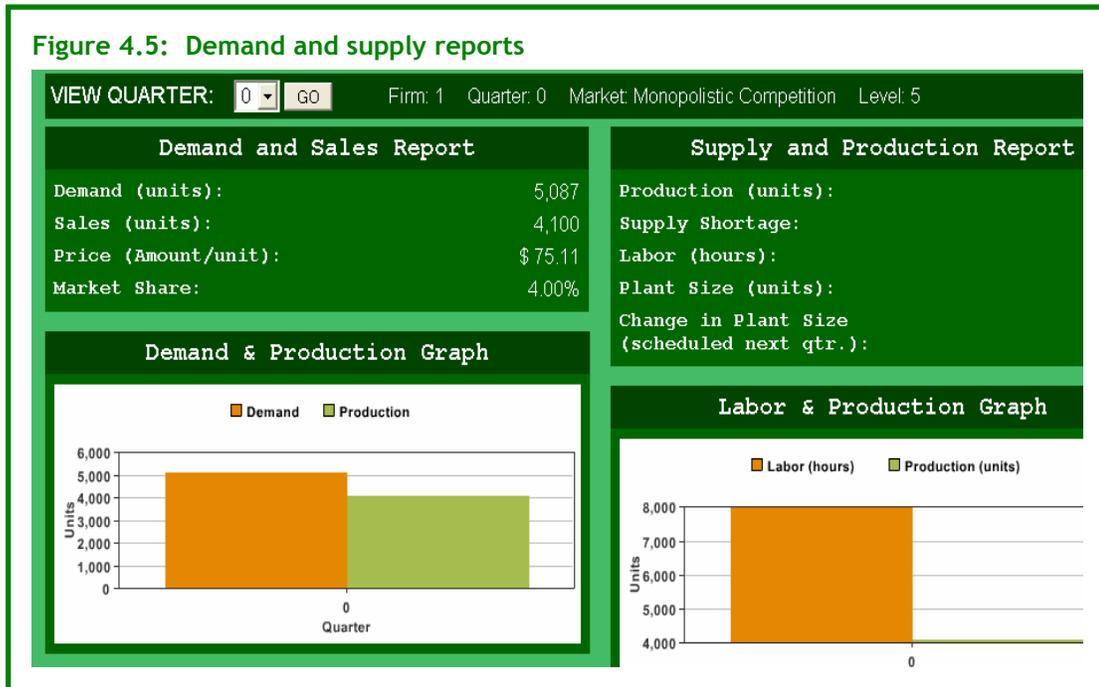
Demand

The quantity your customers are willing and able to buy at your specified price is the demand. In this example, in quarter 0 your demand is 5,087 units, given the price of \$75.11.

Units demanded depend on numerous factors relating to the economy, the market structure, the customer, and the competition. Of course your own decisions regarding price, advertising, product development, and e-commerce are also very important. Random economic events may affect your demand (such as the change in the price of a substitute good). These types of events are given to you in the Market Research Report (Fig. 4.6).

Sales (units)

Sales are the quantity sold in units for the quarter (Fig. 4.5). You can sell up to your demand, assuming you produced enough goods. In quarter 0, the quantity demanded (5,087) exceeded the quantity produced (4,100), so the quantity sold equaled the quantity produced.



If production would have exceeded demand, then the excess production over demand would not have been sold. This is very costly because there is no inventory in the game. The product is assumed to be perishable or a time-sensitive product with no value in future quarters. The loss to the firm of producing a good that is not sold would equal the variable costs of production. In quarter zero, total variable costs were \$105,548 to produce 4,100 units. As an extreme example of the loss to the firm, if the firm did not sell any goods in quarter zero, the firm would have lost all it spent on production, i.e. \$105,548 (Fig. 4.1, 4.2).

Market Share (%)

The market share is the firm's percent of the total market sales (Fig. 4.5). It is calculated by dividing the firm's units sold by the total sales in units in the market. In quarter 0, the market share is 4% if the monopolistic competition market structure is selected. This is because there are 25 firms in the market, and initially each firm is selling the same number of goods and has an equal share of the market. So the market share is 1 divided by 25. The market share varies based on the market structure. For example, in monopoly it is always 100% because there is only one firm selling to the entire market.

Production (units)

This is a controllable decision you make in the game (Fig. 4.5). Section 3 discusses the impacts of the production decision.



Supply Shortage

If quantity demanded exceeds quantity supplied then there is a shortage of supply (Fig. 4.5). In this example in quarter 0 the supply shortage was 987 units because the quantity demand was 5,087 and the quantity produced was only 4,100. There is an opportunity cost of a shortage equal to the lost profits that could have been realized if adequate production were scheduled to meet demand. An Excess Supply is reported if production exceeds demand. There is a direct cost in this case because you are producing a perishable or time-sensitive product with no sales potential in future quarters. Clearly, studying demand and supply in the game is critical to your success.

Labor (hours)

Labor hours required to meet the production scheduled for the quarter are reported (Fig. 4.5). The labor hours depend on the amount scheduled for production given the firm's plant size. It took 7,982 labor hours (rounded to the nearest whole number) to produce 4,100 goods.

The information on labor hours is useful to track the efficiency of your operation. A common measure of efficiency is the average product of labor, which is production divided by labor hours. In quarter 0, the average product of labor is 0.514 units produced per labor hour. It is recommended that you check to see if there are increasing or diminishing returns to labor as you schedule more production for a given plant size. As you increase plant size it is also insightful to note the impact on the average product. Try to determine if there are increasing or decreasing returns to scale (i.e. plant size). Returns to scale exist if efficiency improves with increases in plant size.

Plant Size (units)

The plant size is a measure of the production capability (or scale) of the firm. In quarter 0, the plant size is reported to be 6. A plant of size 6 was designed to produce 3,000 units in the long-run but can produce up to 6,000 units if demand is high enough. However, beware of diminishing returns to labor productivity (measured by the average product of labor) as you increase production to its maximum level. Lower productivity means higher costs of production.

Plant size is a controllable decision of the firm. There are 20 different plant sizes in the game. The relationship between plant size and production capabilities is explained in Section 3.

Change in Plant Size (units)

In quarter 0 there is no change forthcoming because a value of zero is reported for the Change in Plant Size (Fig. 4.5).

If the "Change in Plant Size" were reported to be 1, then starting next quarter your plant size would be 7. If this were the case, you need to realize that your plant size will be 7 when you make decisions for the next quarter.

If a value of negative one (-1) were reported in quarter 0 for the "Change in Plant Size" then next quarter your plant size would be reduced by one unit from 6 to 5.



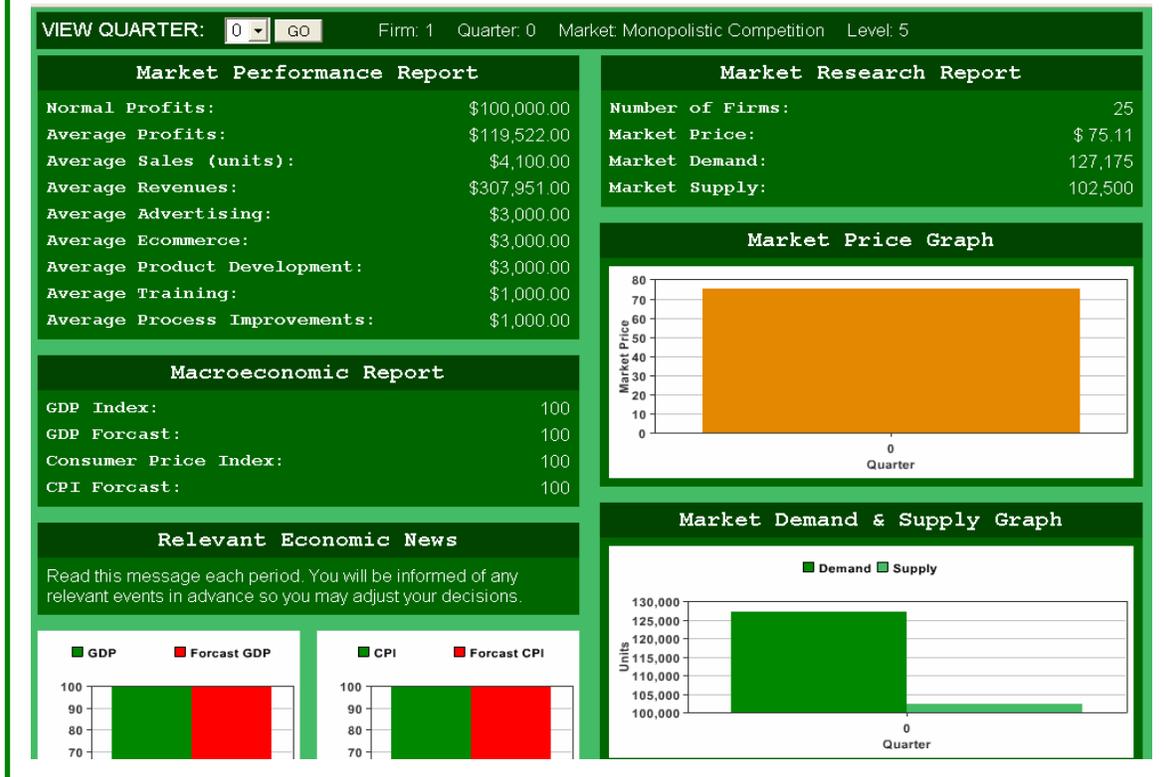
Remember the level of your fixed costs change with plant size. Variable costs should change as well with plant size. If there are economies of scale, average variable costs should decline as plant size increases. If diseconomies of scale occur then average variable costs will increase with plant size.

Market Research Report

Market Research is important to understand the overall market and the likely macroeconomic changes. Your decisions concerning price, production, plant size, and others, should be modified based on your assessment of the market conditions. The Market Research Report includes a Demand and Supply Report for the market, Market Performance characteristics, Relevant Economic News, and a Macroeconomic Report. The quarter 0 results are displayed (Fig. 4.6) and each line item is explained.

The **Number of Firms** in the market is 25 in this particular game. The number of firms changes with the market structure. For example, there is only 1 firm in the market in the monopoly game. The **Market Price** is the average price of all firms in the market and is currently \$75.11. Market demand (127,175) exceeds market supply (102,500) in quarter 0. The **Market Demand** is the sum of all customers in the market and the **Market Supply** is the sum of all 25 firms in the market. The excess demand is likely to cause the computer managed firms to increase supply and raise prices.

Figure 4.6: Market research report



Market Performance

Numerous measures of market performance are given (Fig. 4.6). All the variables are averages of all firms in the market. These measures should help you gauge your performance in the game and the impacts of your decisions. For example, if your profits are above the **Average Profits** in the market this is commendable. If your sales and revenues are below the **Average Sales Units** and **Average Revenues** this might be due to your firm's advertising, e-commerce and product development decisions compared to the **Average Advertising**, **Average Ecommerce**, and **Average Product Development** in the market. You need to compare your firm to the market to understand your own performance.

Average Profits are also a signal for market entry or exit of firms in certain market structures, such as Perfect Competition or Monopolistic Competition. If average profits in the market exceed normal levels, then firms will enter the market in perfect competitive and monopolistic competition. If average profits are below normal levels then firms will exit these markets. The entry and exit of firms will influence market price. The issue of market entry and exit of firms will be discussed more thoroughly in Sections 5 and 7, which give examples of perfect competition and monopolistic competition games.



Relevant Economic News

Any important economic events that will influence the market will be told to you in advance in Relevant Economic News (Fig. 4.6). This way you can modify your decisions based on your assessment of the direction of the market in the next quarter.

Macroeconomic Report

The **GDP INDEX** (Fig. 4.6) measures the level of the Gross Domestic Product compared to the base quarter (Quarter 0). GDP is a measure of total production of goods and services in the economy. If GDP increases from 100 to 104, then the economy has grown by 4%. This should increase consumer demand for goods and services. The **GDP FORECAST** (Fig. 4.6) is an estimate of GDP for next quarter. The estimate is accurate within plus or minus 1 point.

The **CONSUMER PRICE INDEX** (CPI) measures the average price of consumer goods and services compared to the base quarter 0 (Fig. 4.6). If the CPI increases from 100 to 102, then prices in the economy have increased by 2%, which is a measure of inflation. Inflation will increase the costs of doing business as wage rates, material prices, and other resource prices rise. Purchasing power of consumers will also be reduced with inflation. The **CPI FORECAST** (Fig. 4.6) is an estimate of the CPI for next quarter. The estimate is accurate within plus or minus 1 point.

It is up to you, as executive, to decide how to respond to the information and "forecasts" provided. Just as in the real world, judgment must be used.

Competitive Analysis Report

The Competitive Analysis Report lists the decisions and profit performance of each firm in the game. The firms are ranked by cumulative profit. The challenge is to see whether you can do better than the other firms in the game that face the same costs and demand function as you. To "*beat the market*" you should be ranked at the top of the list. In quarter 0, all profits are the same, so the firms are just ranked in numerical order. The competitive analysis report is critical to assess your performance and to try to understand the strategies of the other firms in the game and to "*beat the market*".



SECTION 5: FREQUENTLY ASKED QUESTIONS

Common questions students have asked about playing the game are provided in this section with answers. This information may help you to *beat the market!*

1. How do I begin to make a decision?

- Understand that the objective is to maximize profits.
- Study the reports in the game including: Market Research, Demand & Supply, Net Profit, and Competitive Analysis.
- Review the suggestions of the automated “CONSULTANT” that are on the Summary page of the game.
- Click on the information buttons next to each decision and read the suggested process.

2. What are the “key” factors that affect profits in the game?

There are three “major factors” in the game:

- Set production as close as possible to firm demand.
- Set marginal revenue close to marginal cost
- If plant size is a decision, select the plant size that will be most cost effective, given the projected level of demand. Information how costs change by plant size is found on the Decision page by clicking the Info button.

3. The CONSULTANT tells me to set production closer to firm demand, how do I do this?

- Look at the past reports and use the GRAPH option to study the sensitivity of demand to changes in your firm’s price, your rival’s price and the market price (if not a monopoly). Once you learn about price elasticity, this information is very helpful and may be found on the Decision page by clicking the Info button for price.
- If advertising, product development, and e-commerce are decisions, then look at the marginal impact of these decisions. This information is found on the Decision page by clicking the Info button.
- If there are random economic events occurring in the game, check out this information on the Market Research Report.
- If the economy is changing, check out the GDP forecast in the Market Research Report. As a rule of thumb, a 10 unit change in the index, would increase market demand by 5%.

4. Why is my firm demand increasing when my price has gone up? Doesn’t this violate the law of demand?

There are a few reasons why this might happen in the game.

- The market price is rising more rapidly than the firm’s price. The market price is reported in the Market Research Report.



- b. If advertising is a decision, then the firm's advertising may have increased along with the firm's price. This would cause the firm's demand to shift to the right, and may cause quantity demanded to increase even though price is rising.
- c. If product development or e-commerce are decisions, the same phenomenon as in "b" above is occurring.
- d. If economic shocks are permitted in the game, the market demand may be increasing (shifting) due to this event. Economic shocks are reported in the Market Research Report.
- e. If the economy is set to growth or business cycles, then market demand could be shifting from quarter to quarter. The growth in the economy is measure by a GDP index that is reported in the Market Research Report.

5. The CONSULTANT tells me my average costs are much higher than the average of other firm in the market, why is this?

- a. Costs rise rapidly as production gets close to maximum capacity. The maximum production capacity is found on the Decision page by clicking the Info button for production.
- b. If plant size is a decision, average costs depend also on plant size. The impact of plant size on average costs is found on the Decision page by clicking the Info button for plant size.
- c. If training or process improvements are decisions, then your rivals may be spending more on these decisions than you. The impact of these decisions on costs or productivity may be found on the Decision page by clicking the Info button.
- d. Selling or overhead costs include advertising, product development, e-commerce, training, and process improvements. If these are decisions in the game, the student may be overspending on these factors.

6. The CONSULTANT tells me to set MR closer to MC, how do I do this?

- a. Changing price is the most important factor affecting MR. MR will change positively with price. As price is increased, MR will rise and become closer to the price level but will always be less than price; and as price is decreased, MR will decline at a faster rate and the gap between MR and price will widen.
- b. Changing "production" will alter MC. As production gets closer to the maximum production capacity of the firm, then MC will rise rapidly.
- c. If you can change plant size, then this will also change MC. The impact of plant size on MC may be found on the Decision page by clicking the Info button.

7. How do I decide on the level of advertising, product development, and e-commerce?

- a. If advertising is a decision, be competitive and raise advertising as long as the marginal revenues from increased advertising exceed the marginal costs of production. But be careful there are diminishing returns to advertising. (Information on the marginal impact of advertising is available by clicking the Info button on the decision page for advertising and for production).
- b. If product development is a decision, be competitive and raise product development as long as the marginal revenues from increased product development exceed the marginal costs of production. But be careful there are diminishing returns to product development. (Information on the marginal impact



of product development is available by clicking the Info button on the decision page for product development and for production).

- c. If e-commerce is a decision, be competitive and raise e-commerce as long as the marginal revenues from increased e-commerce exceed the marginal costs of production. But be careful there are diminishing returns to e-commerce. (Information on the marginal impact of e-commerce is available by clicking the Info button on the decision page for e-commerce and for production).