

The Competitive Strategy Game -- Version 3.10

The competitive strategy game is a simulation of the strategic interaction between eight companies that compete with one another in any or all of four different markets. The firms have different strengths in each market; for instance, one firm may be the most efficient manufacturer in market A, but may face the highest costs of entering market B. Each of the markets differs in the size and growth rate of demand, the capital intensity of production, and the substitutability of brands in the market. One market may be hospitable to many of the companies at once while another may offer a profitable opportunity to just one company in the game.

Each team of students will control one firm in the game. In doing so, they decide which market or markets to enter and when, how much investment to make in production facilities for each market and when to make that investment, when to exit a market, what quantities to produce and what prices to charge. The game is complex, so it is very important to study it thoroughly before it begins.

The game is divided into periods. Firm strategies for each period must be submitted by email before a preannounced deadline. After the first period or two, there will generally be two periods per week. The outcome of the market process will be handed out in class after each period.

An important aspect of the strategy game is the role of information. Some data are public information, such as all firms' prices and production capacities, the degree of substitutability across brands within each market, and some basic information about demand. Other variables are publicly known only with some noise. For instance, each firm knows its own sales in each market, but the total sales in each market is known publicly only with a degree of error. Similarly, no firm knows the production costs of its competitors with certainty, but it does have an idea of the range of possible costs of other firms.

**PRODUCTION AND COSTS:** In order to produce goods and sell them in a market, a company must (1) enter the market, (2) build production capacity for that market, and (3) produce goods. Each step in the process is costly. Costs for each step in each market differ across firms. Each firm's company profile, which contains private information, includes a table, similar to table 1 (on next page) that indicates each cost the company would have in each market. These costs do not change over the course of the game.

Table 1: Operating Costs for Company X

Market	A	B	C	D
Entry Cost	10,000	20,000	100,000	3,000
Capacity Cost Per Unit	200	600	10	30
Marginal Cost	5	15	8	31

**MARKET ENTRY COSTS:** In order to enter each market a firm must pay a one-time entry fee or setup cost. This cost is sunk once paid; it cannot be refunded or salvaged. It is assessed automatically when the firm builds its first unit of capacity in the market. (The entry fee is assessed again if a firm reenters a market in which it has retained no production capacity.) A firm can enter no more than one market each period.

From the market profiles (see Attachment A for an example), which are public information, you will learn the range of possible entry costs that your competitors might have for each market. For instance, the market profile for market A might indicate that the entry costs for this market are drawn from a distribution with a mean of \$8,000 and a standard deviation of \$2,000. (All distributions in this game are normal.) With this information, you would realize that your \$10,000 cost of entering market A is probably higher than most of your competitors', but you would not be certain.

**COSTS OF CAPACITY:** A firm's production cost in each market is determined in part by its capacity in that market. (Each of the four markets involve completely different goods, so there is no way to use capacity in one market for production in another market.) Before a company can produce from capacity, it must take one period to build the capacity. If, for instance, you decided after period 2 that you want more production capacity in market D, you would announce a capacity increase as part of your strategy for period 3. You could not actually produce from that capacity, however, until period 4. Capacity changes become public information during the period in which they are announced, before they can be used for production. The decision to enter a market and the announcement of building capacity in that market occur simultaneously.

In the company profile, you will learn your firm-specific cost of building capacity in each market. There are no scale economies in building capacity; building 10 units of capacity costs exactly 10 times as much as building one unit of capacity. As with entry costs, the market profiles indicate the distribution of capacity costs for each market from which each firm's individual capacity cost is drawn. Capacity can be increased at any time in the game.

A unit of capacity lasts until one of three things occurs: (1) the capacity exhausts its useful life (shown in the market profile), (2) the firm decides to eliminate units of capacity before they have exhausted their useful lives, or (3) the game ends. Unlike the entry costs, capacity costs are partially recoverable. In the period after a unit of capacity is installed, it declines in value by a certain percentage of its building costs, which is shown in the market profile. After that, the value drops by a (generally smaller) constant percentage each period. This percentage (of the

contemporaneous value not of the original building cost) is also shown in the market profile. Shutting down capacity for its depreciated value can be done in increments as small as one unit, so for instance you could reduce your capacity in an industry from 50 to 49 and receive the depreciated value of the unit. (Consistent with the timing of building and using capacity, a company that is liquidating capacity can produce from that capacity during the same period that it is liquidated. The liquidation occurs after production in that period.) If a unit of capacity is used until it exhausts its useful life, then the capacity is automatically removed from the firm and the firm receives the scrap value of exhausted capacity (shown in the market profile). If a firm requests a reduction in capacity, the game will eliminate the youngest capacity (with the highest depreciated value) first. (This can be overridden. See me if you want to specify capacity units other than the youngest for salvaging.) At the time that the game ends, all remaining capacity is cashed in for its depreciated value (any other request by the firm to add or reduce capacity is ignored).

**MARGINAL COSTS:** Once you have installed capacity for a market, you can produce and sell units at some marginal cost. If production is less than or equal to available capacity, then marginal cost of each unit is the marginal cost given in the company profile. The market profiles show the distribution of marginal production costs for each market from which each firm's individual marginal cost is drawn.

Production can also exceed available capacity, but the marginal cost of producing units beyond capacity increases as production increases beyond capacity. The elasticity of marginal cost with respect to the increase of production beyond capacity is common for all firms in a market and is shown in the market profile.

For instance, assume in a given market that a firm has 100 units of available capacity in market A and its company profile indicates a marginal cost of 20. Assume also that the market profile for A indicates that the elasticity of MC with respect to production is 0.5 for quantity beyond capacity. Every unit up to 100 would then cost the company 20 to produce. Unit 101 would be 1% above capacity and would therefore cost 0.5% more than the basic MC or 20.10. Unit 102 would be 2% above capacity and would therefore cost 1.0% more than the basic MC: \$20.20. Producing 102 units would thus involve variable costs of  $20 \times 100 + 20.10 + 20.20 = 2040.30$ . (Only available capacity is considered in determining costs. As explained above, capacity is not available until the period after it is produced. Note that producing in a market without capacity would involve exceeding capacity by an infinite amount and would therefore be infinitely costly.)

**PRODUCTION, SALES, AND INVENTORY:** Each period, a firm's strategy will include its decision on quantity to produce and price to charge. If there is sufficient demand, a firm may sell all of its production in that period plus any stock it has inventoried going in to the period. If the firm sells less than it produces, due to insufficient demand or a strategic choice, then in markets the excess may be stored for future periods if storage in that market is possible (markets A, B, and C). The cost of storing one unit for one period is common to all firms in a market and is

shown in the market profile. Production in market D cannot be stored and therefore is wasted if not sold. Besides price, production quantity, and any adjustments to capacity, a firm's strategy in each period may include a maximum allowed number of units to be sold. If no maximum is included, then the maximum is the quantity produced plus the inventory quantity going in to the period. That is, the default is to sell all production and inventory if there is sufficient demand at the announced price.

For instance, assume that in the first period a firm in a given market chooses to produce 100 units. When demand is revealed, assume that it sells only 96 units at the price it has announced. It then carries 4 units into the following period, paying a cost of 4 times the per-unit storage cost. Assume that in the following period, the firm decides to produce 90 units. It may then sell up to 94 units, because it has four units in inventory. (Units do not deteriorate in inventory.) If it sells less than 94 units, then it will carry the difference into the following period as inventory. The firm may choose to restrict sales to less than 94 units, by setting a maximum sales of, say, 87 units. In that case, if demand is greater than or equal to 87, it will still sell 87 units and carry the 7 excess units into the following period. If demand is less than 87, the firm will carry 94 minus actual quantity demanded into the following period.

**COST OF FINANCING:** Each firm begins the game with \$1,000,000 in a bank account. All financing of the business comes from this account, but the balance can be negative or positive. If the balance is positive, you earn 2% interest per period on the balance. If it is negative, you pay 5% interest per period on the loan. Since there is no inflation in the game, these are real as well as nominal interest rates. Money spent is withdrawn from the account and revenues earned are deposited to the account at the end of each period.

**MARKET DEMANDS:** As in the real world, you do not know the demand function in any market. At the beginning of the game, you are given a bit of information: the quantities that would have been sold in period 1 at different prices and with different numbers of firms. At any point in time, the quantity sold will depend on the prices charged by each firm and -- because consumers have heterogeneous tastes -- the number of brands in the market. (Each firm may have at most one brand in each market.)

The sensitivity of total quantity sold to the number of brands in the market -- holding price constant -- will depend on the degree of heterogeneity among brands, i.e., the extent to which consumers consider different brands good substitutes. If consumers think that different brands are nearly identical, then adding brands to a market will have almost no direct effect on total quantity. If consumers think that different brands have very different attributes, then adding brands to a market will expand the size of the market to a greater extent. As the number of brands increases, the additional market-expanding effect of an additional brand in a market will decline. These effects are demonstrated in the first table of the market profile (attachment A).

Qualitative evaluations of the degree of brand substitutability in each market are given in the market profiles. This factor is independent of which firms introduce brands and cannot be affected by a student's strategic choices. Some quantitative information on brand substitution is

given in the second table of the market profile.

Though brands are differentiated, no brand has a perceived or actual overall quality advantage over others. If all brands in a market were to charge the same price, then all brands would be expected to get approximately equal market shares (provided each had sufficient production plus inventory to meet that demand). This would be true regardless of market shares in previous periods.

Total demand in a market changes over time. Each period the number of possible consumers in a market changes by some proportion, called the market growth rate. The market growth rate follows a random walk. The market profiles tell you the growth rate observed in period 1. In each market, the growth rate changes from the previous period by a random amount, but the average change in the growth rate is zero. Thus, if the growth rate was 7% last period, it will be 7% this period plus or minus the random change. If it increases by 2 percentage points to 9% this period, then you would expect it to be 9% plus or minus a random change next period. Besides the period 1 growth rate, the market profiles also gives you information on the amount by which the growth rate could change each period. Once the market growth rate changes from its original level, there is no tendency for it to return to that level. Each period it changes by some random factor from its level in the previous period.

After the initial market profiles, the only additional information you receive about the size of each market is from observing prices and quantities sold in the market. The market update (see Attachment B for an example) distributed by email each period will tell you the production capacity of each firm in each market and the price charged by each firm in each market. It will also give an approximate market quantity sold during the previous period. All information in the market update is public.

**STRATEGIES AND MARKET OUTCOMES:** Each period, every team will submit a strategy, which consists of

- (1) the price it will charge in each market in which it has production capacity.**
- (2) the quantity it will produce in each market.**
- (3) any changes in production capacity it will make.**
- (4) a maximum allowed level of sales in each market (less than or equal to production in the period plus inventory from the previous period).**

A company cannot enter, i.e., raise capacity from zero, more than one market each period. In addition, a strategy may include a public statement, which will be reported in the market update. Public statements may be no more than 20 words. Public statements that violate U.S. antitrust laws will not be printed and the company will be fined \$100,000. I am available for consultation about the legality of a proposed public statement.

Once all strategies are received, the markets operate for that period. In each market, every firm sells to any consumer that wishes to buy its brand, up to the point that the firm's sales are equal to its maximum allowed. If demand for a brand exceeds the maximum allowed sales for that

brand, then the maximum allowed is sold and the output is distributed randomly among consumer trying to purchase from that firm. Consumers who do not obtain the brand they want due to this rationing may purchase another brand or may not buy in the market.

At the beginning of each period, you will receive two sheets of information. The first is the market update sheet. It contains the prices charged by each company in each market, the changes to capacity of each company in each market, approximate total sales in each market, and approximate cash positions of each firm. It also contains any public statements made by each company. Private communication about the game between members of different teams is not permitted. If discovered, this will be treated as harshly as sharing information during an exam. The second sheet is the company update (see Attachment C for an example), which contains private information on the quantity that the firm sold in each market that period as well as summary information on the costs, revenues, and financial status.

**EVALUATING PERFORMANCE:** The basic measure of performance is the value of the firm at the end of the game. The value of the firm is its cash holdings plus the salvage value of all capacity at the end of the game. For grading purposes, remember that 15% of your course grade is based on the strategy game. Of this 15%,

**1/3 is based on a strategy memo due , WEDNESDAY, APRIL 20 (max 500 words).**

**1/3 is based on a strategy memo due WEDNESDAY, JUNE 1 (max 750 words).**

**1/3 is based on the financial performance of your firm in the game (taking into account the cost structure of the firm and other environmental effects).**

**GAME ENDING:** The game will end on the last day of class.

**LOGISTICS:** The method of submitting strategies is through a submission page on my web page at:

<http://darkwing.uoregon.edu/~bruceb/iosubmit.html>

In your submission, you must indicate your team's password or the strategy will not be valid. It is vitally important that you do not reveal your password to members of other teams, so that they are not able to submit bogus strategies. If your team's strategy does not make the deadline I will submit a random strategy for your team, so don't forget!

## ATTACHMENT A: EXAMPLE OF A MARKET PROFILE

**MARKET DESCRIPTION:** Market X is a large market, but shows very little growth prospect. Consumers consider different brands to be usable substitutes if prices are sufficiently different, but they do have favorite brands, which they will buy if prices are close to one another. Entry costs for market X are moderate, and vary substantially across firms. Production is very capital intensive and there is significant variation across firms in the efficiency of production.

**PRODUCTION COST INFORMATION:**

Mean Entry Cost:	\$50000	Standard Deviation:	\$3000
Mean Cost of one unit of Capacity:	\$2000	Standard Deviation:	\$400
Mean Marginal Cost:	\$40	Standard Deviation:	\$5

Percentage Depreciation of Capital in Period After Construction: 30%  
 Percentage Depreciation of Capital in Following Periods: 10%  
 Maximum Useful Life of Capacity: 8 periods  
 Scrap Value As a Percentage of Original Capacity Cost: 35%  
 Inventory Cost: 10 per unit per period.  
 Elasticity of MC with respect to output for output > available capacity: 10

**DEMAND INFORMATION:** The following demand information is for period 0. Growth or decline of the market in subsequent periods would affect aggregate quantities. For the tables below, it is assumed that each firm has production plus inventory to supply the demand for its product at the indicated prices:

Information on Market Demand and the Effect of Brand Proliferation: If there had been the indicated number of firms each charging the same indicated price, the cell shows the approximate market output that would have resulted:

Number of Firms in Market	1	2	3	4
Price				
200	3059	3660	3831	4176
300	1439	1681	1915	2169
400	512	711	861	1059

Information on Brand Substitution: With two firms in the market, if firm 1 charges the price shown in the lefthand column and firm 2's price differs by the amount shown in the top row, then the cell indicates the approximate market share of firm 1.

Price Differential of Firm 2	-20%	-15%	-10%	-5%
Price of Firm 1				
200	22%	28%	36%	43%
300	16%	22%	31%	40%
400	13%	21%	28%	39%

Market Growth Rate in Period 1: 1%.  
 Standard Deviation of Change in Growth Rate: 0.5 percentage points.

## ATTACHMENT B: EXAMPLE OF A MARKET UPDATE

### UC MARKET UPDATE AFTER PERIOD 9

PRICES CHARGED: (\*\*\*\*\* indicates no capacity for production this period)

COMPANY	ABC	IBM	RJR	TCI	NBC	UAL	CHV	DEC
MARKET								
A	200.	200.	250.	220.	*****	*****	330.	*****
B	400.	*****	*****	*****	380.	*****	430.	380.
C	*****	200.	*****	*****	*****	150.	250.	*****
D	*****	*****	400.	*****	*****	425.	450.	*****

CAPACITY AT END OF PERIOD:

COMPANY	ABC	IBM	RJR	TCI	NBC	UAL	CHV	DEC
MARKET								
A	400.	400.	400.	400.	0.	0.	100.	0.
B	400.	0.	0.	0.	800.	0.	100.	5000.
C	0.	105.	0.	0.	0.	200.	100.	0.
D	0.	0.	400.	0.	0.	50.	100.	0.

APPROXIMATE MARKET SALES: (plus or minus 10%)

MARKET	A	B	C	D
APPROXIMATE OUTPUT	1676.	5172.	383.	575.

RECENT PUBLIC STATEMENTS:

ABC: "We plan to open a new plant in market A expanding our total production capacity to 900 units."

TCI: "We will soon diversify by beginning production in market D."

## ATTACHMENT C: EXAMPLE OF A COMPANY UPDATE

Company IBM (UC#2) Update After Period 5

MARKET	A	B	C	D
Beginning Inventory	0.	0.	0.	0.
Production	100.	0.	55.	0.
Quantity Sold	100.	0.	55.	0.
Ending Inventory	0.	0.	0.	0.
Price	300.	0.	300.	0.
Capacity at Start of Period	100.	0.	45.	0.
Capacity At End of Period	170.	0.	37.	0.
Inventory Costs	0.	0.	0.	0.
Variable Costs	5400.	0.	2787.	0.
Capacity Costs	207800.	0.	-16275.	0.
Entry Costs	0.	0.	0.	0.
Revenue	30000.	0.	16500.	0.
Net Revenue	-183200.	0.	29988.	0.
Cash At the End of Period 4:	613739.			
Interest Earned (Expense) :	12275.			
Total Net Revenues :	-			
	153212.			
Cash At the End of Period 5:	472802.			

Age Structure of Capacity at End of Period 5 (\*\*\*\*\* = beyond life of capacity)

MARKET	A	B	C	D
Maximum Capacity Life	3	10	10	5
New Capacity	70	0	0	0
1-Period Old Capacity	100	0	0	0
2-Period Old Capacity	0	0	0	0
3-Period Old Capacity	*****	0	19	0
4-Period Old Capacity	*****	0	18	0
5-Period Old Capacity	*****	0	0	*****
6-Period Old Capacity	*****	0	0	*****
7-Period Old Capacity	*****	0	0	*****
8-Period Old Capacity	*****	0	0	*****
9-Period Old Capacity	*****	0	0	*****
10-Period Old Capacity	*****	*****	*****	*****