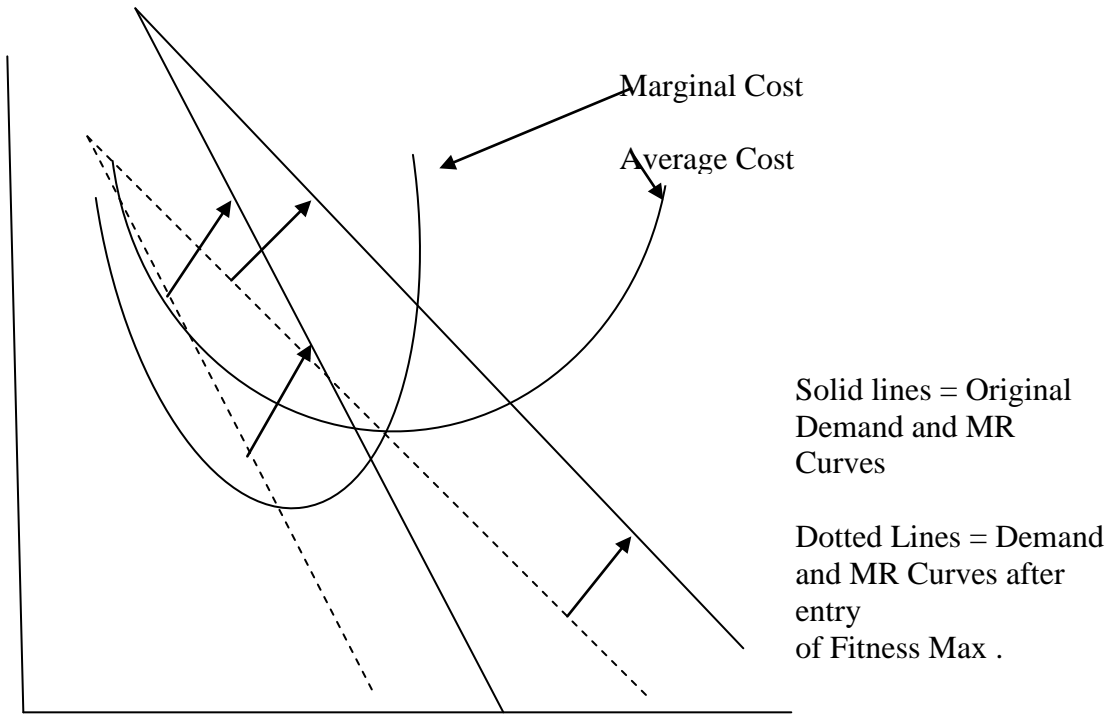Answers to Problem Set 6

1) In the early 1990s, there was a sales boomlet in an exercise device called an "abs machine," a small frame of steel tubing with padding that you put on the floor that helped you to do sit-ups, crunches, and other exercises to tighten your abdominal muscles thereby reducing dreaded. Suppose that the abs machine industry had the following history:
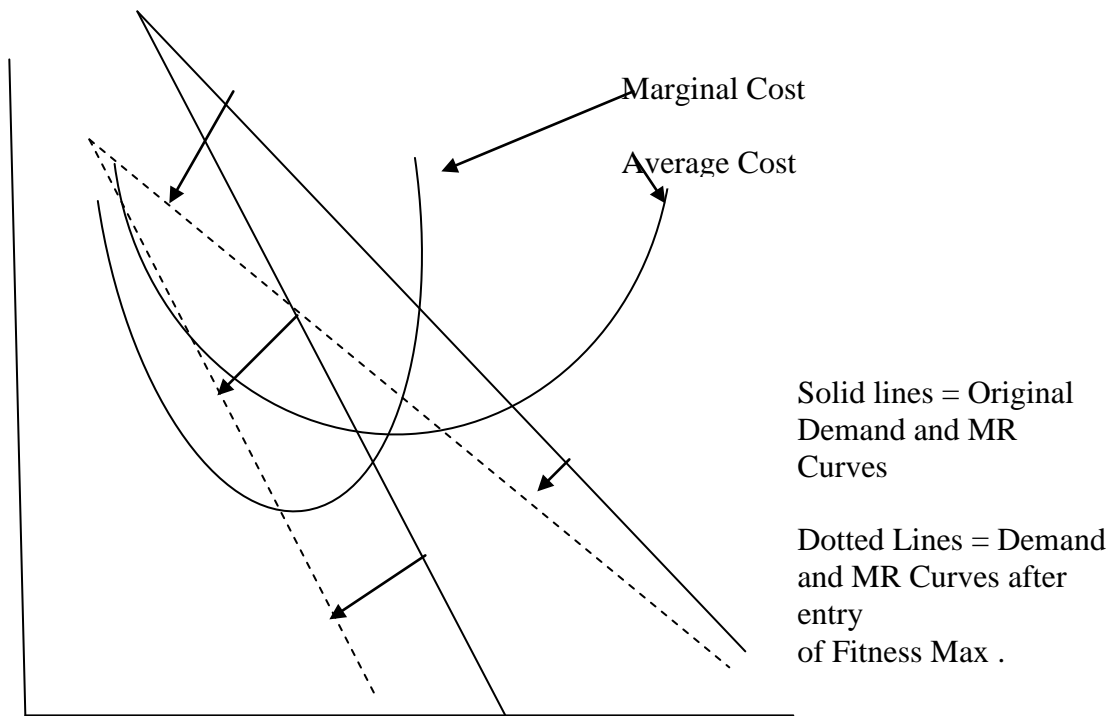
- In December 1992, nobody in the United States has heard of an abs machine.

- In January 1993, Venture Aerobic Productions introduces the "Abs Roller." It becomes an immediate market success.

- In July 1993, Fitness Max Corporation introduces the "Abs-of-Steel Machine" which is very similar to the "Abs Roller" except for slightly different padding on the steel tubes, etc.

- By December 1993, seven other companies have introduced their own abs machines - "Flat Stomach Express," the "Looking Good Machine," and so on. The machines differ from each other slightly - in color, in exact shape - but they basically do the same thing.

- In March 1994, Venture Aerobic Productions introduces the "Abs Roller Plus," a slightly fancier version of their original "Abs Roller." It is the first abs machine to include a fifteen minute video cassette which shows how to do exercises on an abs machine and it was also the first to include a built-in digital timer on the machine itself.

a) Using several diagrams, compare the demand curve faced by Venture Aerobic Productions, the first firm in the industry, in January 1993, May 1993, August 1993, and January 1994. In your diagrams, show what happens to both the position of the demand curve and its elasticity. Accompany your diagrams with a verbal explanation.

Answer: When you first look at this problem, you should think it is an example of either monopolistic competition or oligopoly (i.e. you know it is **not** perfect competition or monopoly or duopoly). One characteristic of oligopoly –e.g. automobiles or laundry detergents – is that it is fairly difficult for new firms to enter the market. The problem says that eight other firms have entered this market in a year and – a related fact – common sense says this exercise machine does not take millions of dollars of equipment to make even one unit. Together, these factors point to monopolistic competition rather than oligopoly.

Marginal Cost

Average Cost

Solid lines = Original
Demand and MR
Curves

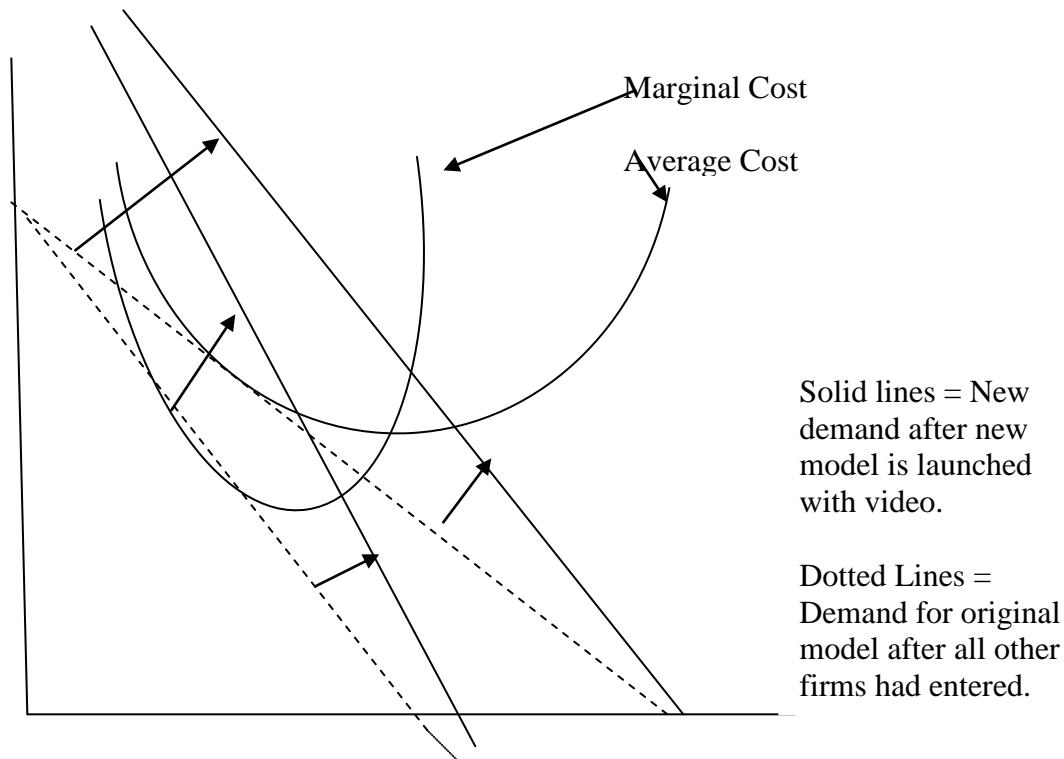Dotted Lines = Demand
and MR Curves after
entry
of Fitness Max .

January 1993 - May 1993: Here we would expect the demand curve to shift out as more people discover the Abs Roller through advertising, etc.

Marginal Cost

Average Cost

Solid lines = Original
Demand and MR
Curves

Dotted Lines = Demand
and MR Curves after
entry
of Fitness Max .

January 1994 - August 1993: Fitness Max's entry will definitely cause Venture Aerobics' demand to become more elastic because the Abs Roller now has one close substitute. The entry will likely also cause Venture Aerobics' demand to shift inward because two firms now divide the market. The only reason demand might not shift in is that the market keeps expanding rapidly as people hear about this kind of exercise machine - i.e. expanding rapidly enough that it keeps Venture Aerobics' demand curve from shifting inward.

Marginal Cost

Average Cost

Venture Aerobic's
demand and MR
after multiple firms
have entered.

Demand

MR
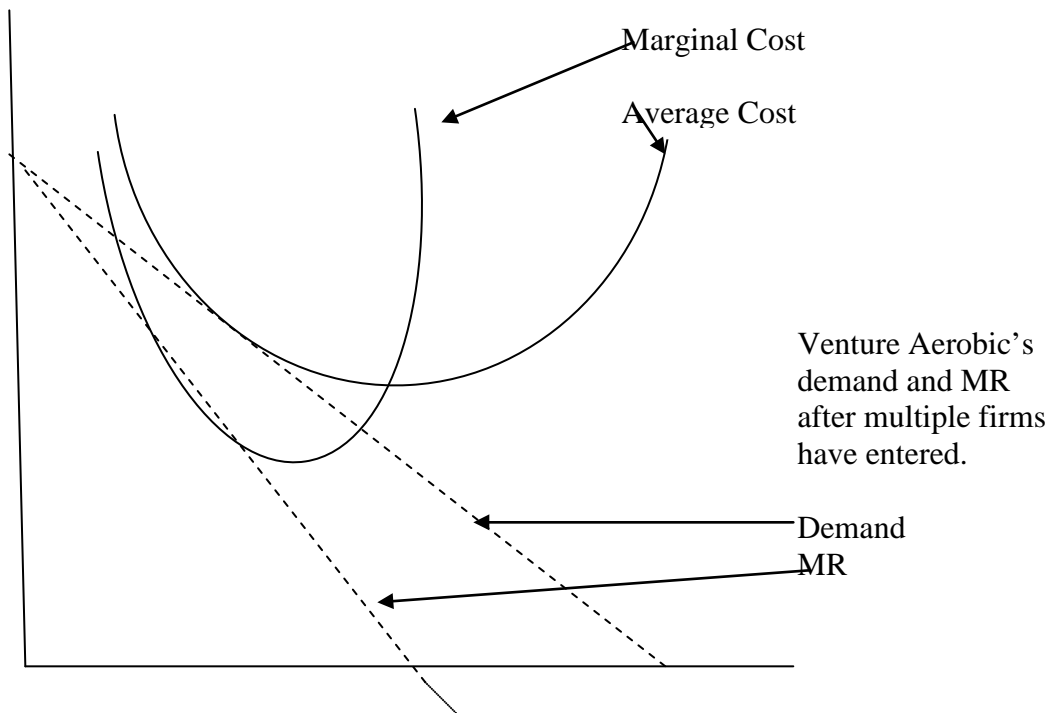
January 1994. Venture Aerobics' demand in December 1993 might look something like this – i.e. the entry of all the other firms drives Venture Aerobics into a break-even situation (the equilibrium of a monopolistic competition situation – the firm produces the quantity where MR = MC and the firm is just breaking even at that point (P = AC).

Marginal Cost

Average Cost

Solid lines = New demand after new model is launched with video.

Dotted Lines = Demand for original model after all other firms had entered.

Bonus Diagram - April 1994 With the introduction of the Abs Roller Plus and the training video, Venture Aerobics' demand curve might shift out again because it is now producing a product that is somewhat different than the other exercise machines (see Part C below)

b) Over the same four periods, discuss as well as you can what happens to the percentage markup between the price Venture Aerobics charges for the Abs Roller and Venture's marginal cost of production. Illustrate your argument using any relevant formulae.

Answer: From January 1993 (when the product was introduced) through December 1993, we expect Venture Aerobics' markup to shrink for two reasons. First, new entrants into the market were causing the demand curve to shift inward. Second, more substitute products were causing demand to become more elastic and applying what we called the Lerner Index, a more elastic demand leads to a smaller percentage mark-up (i.e. recall that in that formula, the percentage mark-up of price over marginal cost = -1/e

c) Using words, explain in a general way why Venture introduced the "Abs Roller Plus" in March 1994 rather than just continuing to produce the original "Abs Roller."

Answer: We described how one way that monopolistic firms compete is by adding "features" to their product – i.e. making an MP3 player that is thinner than existing brands or making a smart phone with a larger screen. In other words, each firm in the industry tries to reduce the extent to which competitors' products are seen as close substitutes of their own product. The fewer the substitutes, the less elastic their demand and, applying Lerner's Index, a less elastic demand translates into a larger percentage mark-up of price over marginal cost.

2) In 1965, Congress passed a law banning cigarette advertising on television. From a game theory perspective, we can think of an established cigarette maker – call it Company A - using advertising for either or both of two purposes.

- One purpose is to increase sales by convincing current smokers of other brands to switch to Company A's cigarettes.

- A second purpose is to expand the size of the market by encouraging current non-smokers to start smoking Company A cigarettes.

a) It is plausible that Congress wouldn't have passed the television advertising ban if established cigarette markers had violently opposed it. Focus on the first reason above and construct a prisoners' dilemma game that explains why the major cigarette makers might have been willing to go along with the television advertising ban. To keep the exercise simple, structure the game as Company A versus Company B where Company B represents all other established cigarette firms who, we assume, act in the same way.

Answer: An answer would begin with two ideas:

- Television advertising is expensive
- Company A and Company B have concluded that advertising has little effect in expanding the total market. Advertising's main effect is to take away the other company's smokers, but when both companies advertise, the effects largely cancel each other out. (This is sometimes called an economic arms race – you have to do it because the other person is doing it. The hiring of lawyers often looks like this as well.)

The result might be a prisoner's dilemma game like this:

	Company B	
	Advertise on TV	Don't Advertise
Ad. On TV	(-3/-3)	(-5/+6)
Don't Advertise	(+6/-5)	(-1/-1)

Company A

(The first number in each pair refers to the payoff for Company B)

When both companies advertise, the main effect is the lost expenditure on advertising since neither gains many of the other companies' smokers and each firm gets only a small number of new smokers. When A advertises and B doesn't, A loses the cost of the advertising but it has a big gain in smokers who switch from Company B, etc. When neither A nor B advertise, they each lose a little from not attracting a few new smokers.

As with the original prisoner's dilemma, the cooperative equilibrium (-1,-1) looks most attractive. Both firms would like to be there but it is not a Nash equilibrium since if B says it is not going to advertise, A will want to advertise, etc. The Congressional advertising ban turns this situation into a cooperative game by guaranteeing that nobody can advertise and it allows both companies to save the advertising expenditures without fear of the other firm cheating on the agreement.

b) Unlike Company A and the other established companies, Company X is a start-up company that is trying to introduce a new brand of cigarette to the market. Describe what you think their position be on the television advertising ban. What effect, if any would its situation have on Company A and B's positions on the ban?

Answer: If Company X is a start-up, we can assume that many people don't know they exist. As a result, they are more dependent on advertising and so they would be less in favor of the Congressional ban. The existence of Company X would reinforce A and B's desire for the ban because it the ban reduces the competition Company X could create.

3) Black Hills is a town of 20,000 persons in an isolated part of Wyoming - it is a drive of over 150 miles to reach another town of any size. Until five years ago, if you wanted to buy blue jeans in Black Hills - men's or women's - there was only one store you went to: Suzanne's Pants on 4'th Street. Suzanne had a large selection of jeans and she gave good customer service. She would let you try on jeans in the store to see if they fit, etc.

Suzanne's marginal cost for a pair of jeans was a constant $25.00 and, like every other clothing store in Wyoming, she had to pay a $5.00 "jeans tax" to the Wyoming state government on every pair of jeans she sold. Suzanne estimated that the demand curve for jeans in Black Hills had the form:

$$P = \$75 - .05Q \quad \text{where Q = pairs of jeans sold in Black Hills/month.}$$

Five years ago, the residents of Black Hills received their first mail order catalog from Jeans-R-Us, a large firm in Wisconsin that sold jeans by mail throughout the nation. Initially, buying jeans from Jeans-R-Us involved filling out an order form, mailing it with a check to Wisconsin, etc. But over time, Jeans-R-Us introduced a toll free telephone number so you could order over the phone with your credit card. Next, they began using the two-day Federal Express option to get the jeans to you fairly quickly, and so on. Jeans-R-Us has the same marginal cost as Suzanne for the jeans. But because they are located in Wisconsin, they are not required to collect the Wyoming "jeans tax" even on jeans shipped to persons in Wyoming.

a) Today, Suzanne believes the best she can do is to divide the market with Jeans-R-Us in a Cournot/Nash equilibrium. If she succeeds in doing this, how many pairs of jeans per month will Suzanne sell and how many will Jeans-R-Us sell?

Answer: This, of course is a Cournot duopoly problem with a twist: In class, we said that both producers faced the same MC. Here, the Wyoming tax means that the two producers have different MC's with Suzanne's being $5.00 higher. Nonetheless, we solve this the same way we solved the problem in class. We begin by deriving each firm's reaction function which we get by setting up MR = MC for each firm.

As the problem says Suzanne's MC = $30 while Jeans-R-Us MC = $25.00 because JRU doesn't have to pay the Wyoming Jean's tax

For Suzanne, Revenue = Q_S*($75 - .05*(Qs + expected Qjru)) ("*" here is the multiplication sign)

You can set up Jeans-R-Us revenue in a symmetrical fashion:

Revenue = Qjru*($75 - ..05*(Qjru + expected Qs))

It follows that Marginal Rev for Suzanne = 75 - .10xQs - .05*expected Qjru:

And so, setting MR = MC

   75 - . l0*Qs - .05*expected Qjru = 30   or Qs = 450 - ,5*expected Qjru

The reaction function for Jeans-R-Us is calculated in the same way and it gives us:

Qjru = 500 - .5*expected Qs

(jru's reaction function differs a little from Suzanne's because Jeans-R-Us doesn't pay the $5.00 per pair and so has a lower MC.)

Equilibrium is reached when the actual amount and expected amount are equal for each quantity. This means we can write:

Qs*450- .5*(500 - .5Qs) or .75 Qs = 200 or Qs = 266

Solving the similar equation for Qjru = 366

b) Recently, Suzanne called the Black Hills representative in the state legislature to complain about the $5.00 Wyoming jeans tax". "It really hurts me," she said. Because my store is in Wyoming, I pay the tax on my sales. But when Wyoming residents purchase jeans from Jeans-R-US, Jeans-R-Us doesn't have to pay the tax and so they face lower costs than I do."

Is Suzanne exaggerating? Suppose she didn't have to pay the $5.00 tax. Would her monthly sales in the Cournot-Nash equilibrium look much different? Explain.

Answer: If you run through the problem with Suzanne having a $25.00 Marginal Cost it becomes:

Qs = 500 - .5*(500 - .5Qs) or .75*Qs = 250 or Qs = 333. So without the tax, she would sell more pairs of jeans and she does have a legitimate beef

c) Suppose Jeans-R-Us didn't have a web site or toll free number and any Jeans had to be ordered by mailing them a check. Do you think a Cournot model would still be appropriate to examine this market? Briefly explain your reasoning.

Answer: Not appropriate. The Counot Model assumes the two producers have identical products (though, as we have seen, not necessarily identical costs). Without the web site and toll free number doing business with Jeans-R-Us would be much less convenient – in economic language, it would involve higher transaction costs - and so the two firms would not be identical.

4) Within economic policy, there is an ongoing debate over when, if ever, it is appropriate for the

government to subsidize specific industries. The normal argument against subsidies is that they arise from inappropriate politics – e.g. political contributions from the industry being helped – and they only serve to freeze out more efficient foreign producers. Potentially, however, there are other cases. Several years ago, Paul Krugman created this example:

Consider the civilian aircraft industry where there are now two large competitors in Europe/America – Boeing and Airbus. Developing a new airliner involves large initial costs and so each company needs, say, 300 new orders over the first three years to break even. The problem is that the world market is likely to generate only 400 orders over the next three years.

Suppose Boeing and Airbus are each considering developing a new passenger airliner. Given the nature of the market, the pay off matrix for profit looks like this (Boeing's profit is the first in each pair).

<table>
<tr><td></td><td></td><td colspan="2" align="center">Airbus</td></tr>
<tr><td></td><td></td><td align="center">Develop</td><td align="center">Do not Develop</td></tr>
<tr><td></td><td>Develop</td><td align="center">(-7, -7)</td><td align="center">(25, 0)</td></tr>
<tr><td>Boeing</td><td></td><td></td><td></td></tr>
<tr><td></td><td>Do Not Develop</td><td align="center">(0, 25)</td><td align="center">(0,0)</td></tr>
</table>

a) Does this competition have a Nash equilibrium? Explain.

Answer: The right way to check for a Nash equilibrium is to examine the game through what-if questions: What if Boeing was planning to develop the aircraft and discovered that Airbus was also planning to develop, would Boeing change its plans? Etc.

Using these questions, we can see that (-7, -7) is **not** a Nash equilibrium – if either player thought their opponent was going to develop the aircraft, they would decide not to develop the aircraft. Similarly (0,0) is not a Nash equilibrium – if either player thought their opponent would not develop, they would choose to develop. .

But, by the same logic (0,25) and (25,0) are each a Nash equilibrium. In both cases, if a firm thought they were going to end up there, they could not improve their position by changing their strategy.

b) Suppose that while the two companies are examining their positions, the U.S. government announces that it will give Boeing a subsidy of 9 units to develop the airplane – i.e. a payment that would not have to be returned as long as Boeing developed the plane and brought it to market. How might that influence how the game evolves.

Answer: It influences the game a lot. Without the government subsidy, each firm is trying to determine whether the other firm will undertake development. Under the subsidy program, as long as Boeing develops the airplane, it makes a profit regardless of what Airbus does. Airbus knows this and so knows that Boeing is definitely going to develop. Since Boeing is going to develop, Airbus knows it can only lose by developing and so it drops out.

5) As you walk down the aisles of a supermarket, you will see that many firms engage in "product proliferation". Nine-Lives Cat Food produces about a dozen different flavors of cat food – Seafood Delight, Tuna in Sauce, several meat-flavored cat foods that cannot be mentioned here. Tide laundry detergent produces five or six different varieties of Tide - Tide Original, Tide with Fresh

Scent, Tide with Bleach Substitute, liquid Tide etc.

Typically, these varieties all sell for about the same price so they are not a way of achieving price discrimination. Rather, as the kinked demand curve suggest, product proliferation is a form of non-price competitive strategy. One part of the strategy involves appealing to various consumer tastes. In the context of a supermarket, what other strategic reason might these manufacturers have for producing so many similar products?

Answer: The strategy begins with the fact that shelf-space in a supermarket is limited. If you can fill up the shelves with your products, you can crowd competitors' products off the shelves so that consumers cannot easily buy them. Product proliferation is an attempt to create a "reason" why your firm needs more shelf space – to display all the different varieties of your product. In the end, a smart supermarket will keep experimenting to see which particular products sell and allocate its space accordingly.

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