

Industrial Organization
Case Studies
Michaelmas Term

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1 Week 3 - Dupont Case

1.1 Introduction of DuPont Case

- DuPont is in the Titanium Dioxide (TiO_2) business and a new technology comes along that is more efficient than previous methods. The standard technology involved Rutile in production but the technology involves an Ore called Ilmenite. This new technology would give DuPont a cost advantage over the rest of the market. So Dupont is faced with a decision. Grow quickly in the TiO_2 business and hopefully discourage other competitors to do the same (a preemption strategy). Or maintain current expansion plans and remaining on or around their current market share.
- 3 effects will determine DuPont's cost advantage in TiO_2 production: Scale (Total Capacity / Number of Plants), cumulative production, and Capacity Utilization (Total output / Total capacity). This is because with the new technology comes massive returns to scale and a learning by doing advantage. The original cost differential is just 2 cents (22.6 versus 24.6) but these numbers need to be reduced by the appropriate measures which will come out of the regression coefficients.
- We will also look at the profit stream from Dupont which is dependent on demand growth in the economy.

2 Week 4 - Dupont Case

2.1 Discussion and Conclusions

- Regression Results:

$$\ln(\text{Costs}) = 6.49 - 0.23(\ln \text{ Scale}) - 0.33(\ln \text{ Cumulative}) - 0.31(\ln \text{ Cap Util}).$$

Note that one of the independent variables in the regression is not significant. However removing it might introduce omitted variable bias so it is best to just leave it in because the other coefficients are unbiased but just less efficient.

- Cost Differential:

Dupont,

$$22.6 * 2^{-0.23} * 2^{-0.33} * 0.77^{-.31} = 16.58.$$

Rivals,

$$24.6 * 2^0 * 2^0 * 0.87^{-.31} = 25.69.$$

Differential,

$$25.69 - 16.58 = 9.11.$$

Which would seem to justify an expansionary growth path.

- Discount rates: The rate at which we must discount the NPVs of the profit streams to equalize them under the growth versus maintain strategies.

$$2 \text{ percent demand growth} \implies 7.2\%.$$

$$3 \text{ percent demand growth} \implies 10.4\%.$$

$$4 \text{ percent demand growth} \implies 15.2\%.$$

- Graphically, it is clear that initially under the growth strategy Dupont will suffer because of low capacity utilization, but after about 1979, their profit differential (between the two strategies) becomes positive. Initially the price in the market is expected to be low because Dupont is adding all this supply but the demand in the market is still low. Eventually, as DuPont's market share rises, as does demand, prices begin to rise and DuPont actually has some monopoly power over this price.
- In regards to the demand forecast, if it was wrong, we would have to consider the elasticity of demand to determine the effect this would have on prices. For instance if output in 1975 was 700 instead of 798, under a price elasticity of -0.3 , instead of the price being 37.5 as expected, it would be,

$$p = p_0 \left(\frac{Q}{Q_0} \right)^{\frac{1}{\eta}} = 37.5 \left(\frac{798}{700} \right)^{-\frac{1}{0.3}} = 24.$$

2.2 New Information

- In the end DuPont did approve the growth strategy. After a few years however, several firms approached DuPont and asked them to license the technology to them for a royalty fee. At the same time, several firms decided to up the price of their TiO_2 because of tight demand/supply conditions. The question for this week is if DuPont should licence the technology and what DuPont should do in response to the price hike.

3 Week 5 - Dupont Case

3.1 Discussion and Conclusions

- If DuPont simply licensed the technology for a fixed lump sum fee, the results would definitely not be in DuPont's favor in the long run. This would simply shift the rivals long run costs down to DuPont's level and they would no longer have the large cost advantage. Price would fall all the way down to DuPont's marginal cost.
- [G-5.1] DuPont could however make the royalty in the form of a per unit fee. Thereby keeping the costs of the rivals well above DuPonts, but maintaining market prices at the rivals costs, above DuPonts. This however also has the disadvantage in the long run as it undermines DuPont's strategy of preemption. The rivals would gain the knowledge of learning by doing and this would encourage those firms to expand their plants as well with the new more efficient technology.
- Should DuPont follow the price hike? If DuPont keeps its price low: they will be able to increase output but since they are already near full capacity, the lower price would result in just a little more output. Alternatively, they could cut back on output a little and get the high price and profits. So the key here is capacity utilization. Since DuPont's was already high, they have no incentive to undercut so the price will eventually end up at the new higher price. Supply and Demand really made the lower price unsustainable.

3.2 New Information

- So DuPont decided not to license its technology to domestic competitors but did to foreign companies as DuPont felt that they only competed domestically and the foreign market was only profitable in selling the license for a royalty.
- DuPont raised their price in line with the rivals.
- Demand in this market continued to be very strong. In order to keep DuPont's preemption growth strategy in tact, they had a signalling problem. They wanted to signal that they were spending all this money building new plants while they were really just using existing plant and capital.
- Additional demand growth is forecasted at around 50 – 70,000 tons. Kerr-McGee issues a press release to build a new 50,000 ton plant. DuPont was alright with this because the new plant will simply supply the excess demand in the market and not affect prices. However, if any other firm decided to follow Kerr-McGee, DuPont might be in trouble.
- So DuPont issues a phoney press release that is basically just a lie saying that they are in the detailed planning stages of building a new plant. They want to make the rivals afraid of the new supply. (More preemption strategy).

- In 1975, it was clear that demand would be 20 – 25% below forecasted data. This implied only 75% capacity utilization. This, of course, raises DuPonts production costs. Kerr-McGee announces a 5 cent price increase. They do this because costs are increasing and they want to increase the profit margin. However, this time things are different from the last time when Kerr-McGee tried to raise prices. DuPont did not follow suit this time knowing that they did have the capacity to supply the market if they kept their prices lower. So prices in the market eventually collapsed to Dupont's price.
- Again, demand growth was low, DuPont is now having cash flow problems and they now face another decision: Grow or Maintain. DuPont decides again on the Growth strategy. Do we agree or disagree? Demand forecasts again are the crucial focus. What are the planners saying about the future of demand growth?

4 Week 6 - Dupont and ReaLemon Cases

4.1 Discussion and Conclusions

- First note that the cost differential between DuPont and its rivals is only around 3 to 4 cents while they were expecting it to be closer to 8 or 9 cents. This is still positive but just not as good as they would have liked. Thus scale and learning by doing effects were not as large as they were hoping that they would be.
- As far as demand projections, DuPont was reasoning that even though demand was far short of expectations in 1975, they expected a large rebound by 1982 back to their original estimates. This would require about 7% annual growth over these years which seems high. However, DuPont was reasoning that because of business cycles, their long term projections should still be accurate. [G-6.2] The first couple of years happen to be a down turn in the economy but they would expect that if the long term numbers are correct, then a boom should be expected to even out the growth rates. Thus, the 7% is an unrevised estimate of where DuPont expected to end up. While it is reasonable to expect that growth rates should be a little higher than average over the coming period, they should also make use of the information given thus far and revise estimates.
- Thus, DuPont also faces the possibility of losing their investment costs (under Maintain) to the new plant at Delisle. Economically, it appears that if these demand growth numbers are at all inaccurate, there is a quite a risk of Dupont really suffering. So possibly taking the investment costs as sunk and continuing with a maintain strategy might be in their best interest. However, the optimistic analysts in the pigment department told a story that is very attractive to DuPont. Thus, they decided to grow.
- In April 1978, the Federal Trade Commission went to DuPont and charged them with attempted monopolization, predation, and unfair competition. They based most of their evidence on a diagram of consumer surplus showing positive surpluses from the early 70's up through the early 80's and then huge negative consumer surpluses following all the way up through 1992. [G-6.3] This figure were based on DuPont's actual numbers. However, the accusations took place in a period when consumer surplus was actually positive (Due to DuPont's increased capacity under the growth strategy). So DuPont really wasn't doing anything but having the intention to monopolize. But intention is not prosecutable.
- Also, there are other considerations which make the FTC's case very weak. 1) The Consumer loss graph assumes that DuPont is actually successful in gaining monopoly power, driving competitors out of the industry, and driving up the price ... this point is weak because it is speculative. 2) The FTC is making some assumptions about DuPont's goal market share. Will it be enough for it to have monopoly power over its competitors? If the market share is not large enough, DuPont cannot raise prices above the marginal costs of its competitors. (This wouldn't be monopolistic behavior). 3)

The FTC's conclusions were based on a 14 year forecast which is hard to hold up in court.

- The biggest weakness however is that DuPont is not an inefficient firm that is trying to take over a market. They simply had a better production process that was cheaper to use and therefore had cost advantages. This should not be labelled as monopolistic behavior. If it was, the innovative process would be stifled. The fact that process / product innovation leads to higher market shares and more profits should not be misconstrued as monopolistic behavior.
- Thus, in the end, the case again DuPont fell apart. DuPont continued to pursue its growth strategy and demand did grow quickly in the 1980's and DuPont made huge profits. End of story.

4.2 New Information on the ReaLemon Case

- Predatory Pricing Case. In these types of cases our first aim is to determine a way to diagnose predation and the second is to apply the rule, or in this case, to apply the Areeda - Turner Rule.
- Under both predation and competition, prices fall when entrance occurs. The difficulty comes in determining which is which. The one thing we do know is that in the case of competition, (Monopoly to Duopoly or just the entrance of an additional firm), prices should never fall below marginal cost. Assume that $MC = AVC = \text{Constant}$. Average Variable Cost is just the cost of labor and raw materials.
- In determining a rule to distinguish predation from competition, we want to make it rather conservative in order to avoid prosecuting innocent competitors. Thus the Areeda-Turner Rule: If $\text{Price} < \text{Average Variable Cost}$, conclude predation.
- Consider the Borden owned ReaLemon Case. ReaLemon produces lemon juice by the pure process of squeezing and bottling. Not preservatives added. They dominated the market in the 1960's having somewhere around a 90% market share. In comes a new entrant in California called Golden Crown.
- Suddenly ReaLemon starts cutting prices in the local areas where it was competing with Golden Crown.
- Questions for Discussion: 1) Did ReaLemon violate the Areeda - Turner Rule? 2) Was ReaLemon's price cutting predation? Was this a pricing policy that only existed to increase the probability that Golden Crown exited the industry?

5 Week 7

5.1 Discussion and Conclusions

- We found that ReaLemon did not violate the Areeda Turner rule because their lowest price was \$4.05 which was above all cost estimates ranging from 3.75 up to 4.05. These estimates however are probably only accurate to around ± 1 to 3 percent.
- To answer the question of if it was predation even without Areeda-Turner, we considered several characteristics of the problem. First the market definition should surely be the narrow definition of reconstituted lemon juice. This is because on the demand side, consumers definitely view ReaLemon's (RL) product as very different from actual lemons. Thus RL's market share under this market definition was around 90% initially, before Golden Crown (GC) entered.
- Geographically, RL's costs should be lower in those areas close to their supply plants. Since both Philly and Buffalo are close to their production facilities, their costs in those cities should be well below their national average of 4.05. Even though supposedly RL did not have the cost numbers from the region, they would have expected them to be well below their price of 4.05 which supports RL's claim of NOT predating.
- The grocer's role in this market is key to survival since they are only willing to carry one higher priced premium product due to shelf space and sales issues. Because of RL's premium brand name, the product that RL and GC are producing is highly differentiated. Since the Grocer required a mark up of about 15 cents on GC product, this would mean that they would have to sell it to the grocer for about 4 percent less than RL. This clearly puts GC below their *AVC* so it looks like predation from their side though it is the grocer that is requiring the low price and not the competition from RL.
- We also considered a new legal rule so that prices can never go below the entrant's *AVC*. This wouldn't be advisable unless we had equally efficient competitors. Since, due to the RL name, GC was at a comparative disadvantage and therefore, less efficient, this rule would not work for this case.
- Could there be a model that we have studied which could be applied here? The Long Purse argument would fail because 7up comes in and buys GC which adds a purse to the GC product. The reputation game doesn't work either because the only documents were from lower management which would never hold up in court. (Easily discounted as crazy salemen trying to impress their superiors.)
- What was happening in the other areas where RL was not competing with GC: prices were rising. This is probably because RL was trying to cover their reduced profits in those regions they were competing with GC by raising prices elsewhere and getting short run profits. But this story implies that eventually RL thought that they would regain their profits back in the competitive areas (Philly and Buffalo), which is a clear sign of Predation.

- So once 7up has come and in purchased GC, what should they do? They have the money to advertise and gain market share, but it would cost a huge amount to overcome the well established RL name. 7up should really just remain as the secondary competitor and not incur the large investment costs of gaining market share.
- Judge's Ruling: RL found guilty of predation. The penalty was for Borden to license the RL name to anyone who asked for a period of 10 years for some reasonable royalty fee. This penalty is rather draconian because it undermines all R&D that RL has ever done. Probably the harshest punishment possible. So on appeal, for reasons unclear, the ruling was over-ruled and Borden was cleared of all predation charges.

5.2 New Information on Lucas Case

- Product: Ignition Coils for cars. The battery charges the coil which is attached to the starter of the car. There are two makers of ignition coils. Lucas (the incumbent) and AC Delco (the entrant). This time however, AC Delco has the advantage. AC designs a new coil which is equally effective and is produced at lower marginal cost. When AC enters, Lucas cuts price. Does this violate Arreda Turner? Is it predation?
- Notes: The coil is part of an integrated electrical system of components in the car. There are only a small number of buyers (car makers) in the market. Coil will be in the car for several years.

6 Week 8

6.1 Notes for Class on the Lucas Case

- **Did Lucas violate Areeda Turner?** Again, we have two answers to this one. If you define the market as class 2 products or some sort of bundle that is sold to the car makers, then for sure they did not violate. The profit curves that are plotted on the graph only go negative in one year for the initial equipment (IE) segment of the market. These profits are surely calculated using total average costs which include average fixed costs, something which Lucas probably had a lot of following their expansion into the oil based ignition coil. Thus, the average variable costs were surely much lower and therefore price probably never went below AVC so they would not have violated Areeda Turner. (And definitely did not do so persistently as is shown in the graph).
- If the market is just for ignition coils however, just one part of class 2 products, the answer to the question is less certain. It said in the paper that Lucas experienced losses on ignition sales in 1954 thru 1957 of -3.8 , -13.8 , -26.8 , and -5.8 percent respectively (Percent of Home Sales?). Again, this measure is probably based on average total costs and if average fixed costs are taken out, then even though the profit deficits would be less extreme, it is unlikely that price would be greater than AVC for ignition coils only. (Sign of Predation) However, this is dependent on the cost of the new facilities to build the new coils, so without those numbers, we could never legally convict Lucas unless we had that data. However, if all the production facilities were built by 1954, the year when Lucas started to experience losses, we wouldn't expect profits to fall any further than it did in 1954 since we assume that the fixed investment costs are spread out equally over some period of time (say 10 years). So the fact that profits on Coils fell to -26 percent (of home sales) by 1956 is highly suspicious of predation.
- However, we also had difficulty even applying Areeda Turner to this case. Lucas is basically selling its product to car manufacturers but they are surely selling the coils along with some other bundle of electronic goods. Lucas and the car manufacturers surely prefer a setup like this as it is more cost effective. So Lucas is really competing in the market for the bundle of components that they are selling, while AC Delco (AC) as making a case about predation in the coil market alone. Lucas is really pricing their bundle and not just the coil component.
- **Was it predation?** We basically concluded that the answer to this question was “no” based on several different aspects of the case. First of all the market dynamics. You've got car manufacturers buying several different components from one company and do to the possibility of having to replace these components in the future, they would prefer to stick to one supplier to keep their customers happy when something goes wrong with their car. Lucas stated in the article that they really just didn't want to lose their present contracts and didn't mind if AC was in the market. AC's primary customer was Vauxhall (both owned by GMC) so surely Lucas assumed they would lose Vauxhall's business to AC. So, in the companies board minutes, when Lucas says: “the loss on coils was due to the low selling prices agreed as a policy in order to keep

AC out of the field.” The “field” we felt was Lucas’s present contracts and possibly not the entire Coil / electric component market.

- But still, Lucas cut their price on their old coils when Delco entered the market which caused Delco to only secure the Vauxhall contract and not to gain further market share. Was this predation? We reasoned that it wasn’t because first of all, Lucas was just trying to hold on to present contracts while they updated their product and was not trying to exclude AC from other buyers. Yes, there were few buyers and assume that Lucas was supplying all but one (Vauxhall) so you could still make an argument for predation. However, consider the situation if Lucas did not lower its price on its old coils. AC would come in, having a superior product (Coils) but also selling assumed equal quality distributors, windscreen wiper motors, and horns. Depending on which of these or other components were in the bundles that manufacturers were previously buying from Lucas, the car makers might choose to buy from AC instead of Lucas. But then two years down the road, Lucas has updated its product but the car manufacturers are hesitant to switch again because of the secondary replacement market that was mentioned earlier. So Lucas might be forced out of the market completely.
- There was also the issue of Lucas’s business practices. They have developed relationships over the years with the car makers and when someone comes up with a better product, almost as a courtesy to their buyers, they extend to them the lower price even though they’ll make losses until they update their product. Office supply stores often advertise that they will beat and competitor’s price if you bring in an ad from the other firm displaying the lower price. The one difference is that the product is different in this case: Lucas’s is less efficient than AC’s. However, given the possibility that Lucas might lose the market completely given the nature of the secondary replacement market, we still deemed Lucas’s behavior as Competitive and not Predatory.
- Lastly, it says in the paper: “AC would normally supply to Vauxhall first and then, subject to available capacity, seek initial equipment business from other vehicle manufacturers.” Thus it seems that AC wasn’t even trying to compete with Lucas’s contracts and Lucas wasn’t interested in Vauxhall. Lucas preferred to maintain a sort of “you stay out of my business and I’ll stay out of yours” behavior in terms of competition with other firms. We have difficulty calling this predation by any of the definitions available so far.

6.2 Class Discussion on Lucas versus AC Delco

- As far as Areeda Turner is concerned, though legally, there isn’t enough information for a judge to find Lucas guilty, they do say straight out that marginally they were making loses on every coil sold, so we would have to assume as economists that Lucas did go below AVC for some period of time and did indeed violate Areeda Turner.
- Was it predation? Should we rule predation just to protect R and D incentives, No. Is it enough for a firm to want to limit the market share of another firm to be predation? No. Also AC Delco’s setup did not fit the reputation of either predation model. They

are backed up by GMC so they have very deep pockets. And in the future, AC and Lucas would be competing at the same costs and prices with AC maintaining their guaranteed contract with Vauxhall so there is really no threat to having AC forced to exit the market.

- So consider the usual perfect competition story. [G-8.1] When AC enters with the superior and lower cost product, Lucas's sales go down to zero because AC can supply the market at a much lower price (ignoring capacity limitations). When Lucas eventually starts producing the lower cost coils, their sales will rebound and both firms will be splitting the market. But this ISN'T a likely story here due to switching costs. The costs are too high for car makers to jump around between suppliers (especially due to the secondary resale market for coils). If AC did come in and supply the whole market with their lower cost coil and Lucas comes back after a couple years with the same product and equal cost, car makers will be hesitant to switch back again unless not only does Lucas beat AC's price, but also cover the switching costs. Unlikely they could do this, so Lucas would lose entire market.
- Thus the normal competitive response is to match price as they did and then when costs come down, return to making profits. If it wasn't for Vauxhall, AC may not have been able to enter at all for the same reason (high switching costs). They also may have come in via a replacement market if they were able to make their cheaper coils so they could replace old coils already in the cars.
- Thus the results of this case are opposite that in the Borden case. Lucas did violate Areeda Turner but was actually not predating, while ReaLemon did not violate Areeda Turner but economically, was predating. It all has to do with the particular market setups. The Predation cases are difficult especially to convict legally because of the subtle differences between fixed and variable costs.

7 Week 9

7.1 Air Products and Chemicals Case: Background

- No discussion this week. Watched Laker Airline Video.
- Air Products (AP) sells industrial gases such as Nitrogen and Oxygen.
- The transport costs are very large. Thus the possibility of modelling this using the hotelling model.
- The industry is very stable because once the firms are set up, there is no room for any new firms to enter. Firms build plants all around the country to minimize transport costs. Once in a while there is a shock to the industry which dramatically changes market shares of those already in it.
- The entrance of AP was one of those shocks. AP entered and got a huge market share.
- They claimed that they were so successful because they were very good at “learning by doing.” What was the secret of their success? How did they destabilize such a stable industry. Did the rivals reply in a good way? Could they have done better?
- Background information on industry: 3 types of supply techniques. They could either build the O_2 plant right on the user’s site (mostly for very large scale clients such as US and Bethlehem Steel). They could also transport the O_2 via a pipe line for mid sized users or transport it by truck at the highest cost for small users.
- The CEO of AP comes up the idea to move into the chemical (TDA) industry with a very large scale plant but there are vertical linkages. What would be the optimal reply from the CEOs of the other firms?

8 Week 10

8.1 Notes on the Air Products Case

- Question 1. Why was Air Products so successful? How did they destabilize the industry?
 - We reasoned that AP entered the market by successfully providing the gases at a lower cost by building directly on site. Firms already in the market had their pipelines set up for the mid sized and larger customers and would not be able to compete with the much lower price that AP was able to charge given that they had much smaller delivery costs.
 - The use of “take or pay” contracts was also essential in their success. By locking their customers into long term contracts and guaranteeing themselves a certain revenue stream for some set period of time, they were able to debt finance their plants. Banks were very willing to loan them the investment funds given the contract.
 - AP was also more successful because they were a young firm willing to take more risks than the established firms. For instance, building the capacity to supply NASA even before they secured the contract. Led by Poole, AP also seemed to have a relatively strong management team so their learning by doing might have been faster than other firms.
 - The wars (Korea and Vietnam) and the growth of the steel industry also helped spur the demand for industrial gases and AP was able to capitalize on these contracts.
 - Once the wars ended, AP had established itself and then turned to the concept of “Piggy backing.” By purposefully building the capacity at their on-site plants larger than what they needed for the customer, they could use the plant to sell to the local, smaller, retail markets either by pipeline or truck. They would have the advantage of being closer to the retail markets so they could then charge a lower price.
- Question 2. Did the rivals respond optimally?
 - Clearly the rivals had their pipelines all set up with existing clients so it would have been fairly costly to change the supply method from pipelines to on-site. However, since these costs are SUNK! we reasoned that they should not enter the decision of the rivals.
 - If AP had a technological advantage, it might not have been possible for the rivals to build the on-site plants and save transport costs.
 - Considering a new prospective customer, if there are no barriers to building the on-site plants, it seems that the rivals could have successfully built the on-site plants and competed at the lower prices (based on lower costs). If the rivals were

taking the sunk costs of the current infrastructure into account, they may have reasoned that it would be unprofitable to supply with on-site plants.

- The key that AP used to enter the market was a combination of the debt-financing and piggy backing. They could build the large plants because they secured long term contracts. By supplying the small retail market, they were able to make huge profit margins on those customers because their transport costs would have been lower. If the rivals would have realized this, they also would have followed this strategy. Thus their reply was NOT optimal.
- Question 3) TDA Market. Should AP follow the same strategy of building a large, low cost, plant in the TDA market?
 - Based on very little information, we figured that AP should not pursue this investment, at least not based on the same reasons they were successful in the O_2 market. They lack the experience, raw materials are in short supply, and firms are already producing TDA and using it to produce TDI. The market for TDI is supposed to grow quickly over the next 10 years, but we have no reason to suppose that the firms already producing the TDA (and resulting TDI) won't expand their own facilities. The magnitude of the new plant is also crazy. A plant size of 200 million pounds of TDA per year is about 63% of current capacity of the other largest 7 firms in the industry. It sounds terribly risky.

8.2 Class Discussion of Air Products Case

- How was AP able to infiltrate the market? They had developed a way to build smaller plants during the war when they were making plants for the military to put on ships and submarines. Thus the other incumbent firms were not able to build plants on site because they had to build them so large that the fixed costs of setting them up were too high. Thus AP figured out a way to build a plant half the size at half the cost.
- So what was the rival to do? They couldn't build a plant right next to AP's plant because the fierce price competition would drive down both of their prices and no one would make a profit. Thus the real competition comes in choosing where to position their plants. The incumbents could have predated and stopped AP from further entering the market by building a large plant on a new client's site for example. However, this plant would have been too big and they would have to make losses. Thus every incumbent was hoping that the other guy would build and stop AP, but of course, in the end, no one is willing to take the losses and AP takes over the market.
- The only good strategy for the incumbent firms would be to imitate AP's technology of building the smaller plants, but it took them some time to realize this. In this time, AP made quick advances in securing their market share.
- So what happens when the demand for Industrial gases goes up in a stable hotelling model? For the incumbents, building plants between their current plants is really like

stealing customers from your existing plants. Thus an entrant has the advantage of building in between two plants and stealing others customers. In this situation, the entrant can destabilize the market. The incumbent can only continually invest and hope to keep up with the new technologies.

- The second question was concerning the chemical industry and if AP could do the same thing here that they did in the industrial gases industry. And answer is no because if they built this huge plant, they would be a monopolist in the middle of a supply chain of the other firms. The other firms would choose not to buy their TDA from AP because AP could charge monopoly prices and the other firms wouldn't make any profit. The other firms do not want to be reliant on AP for their TDA when demand for TDI is high. Thus, they don't accept AP's offer for TDA contracts. AP does not enter the chemical TDA market and they remain a powerful player in the industrial gases market.