



MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Economics of Marine Transportation Industries
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Assignment 1

Aquaculture Investment Proposition

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Introduction

The Aquaculture Industry has been through great changes over the past thirty years. There used to be a large chain of retailers between producers and consumers consisting of wholesalers, fish mongers, various fish markets and restaurants etc. Today, the market has effectively turned into an oligopsony, following the emergence of a few large supermarkets worldwide that buy directly from producers and sell directly to consumers. These supermarkets collectively buy approximately 70% of the product compared to 10% or 15% up until 20 years ago, but this trend has not been followed on the production side. Supermarkets therefore have a great power over the many small producers. This has effectively pushed prices down and has consequently led consumers to use hormones and other methods that decrease quality in order to compete for supermarket buying prices. The oxymoron is that although demand currently exceeds supply for the product, some small firms are being forced to shut down. Mergers between small producers, which have already begun will counteract the power of supermarkets, thus driving prices higher and hopefully achieve quality improvements.

Future Price and Quantity Determinants

There are a number of factors determining the market price and quantity. A change in market price will lead to a change in the quantity demanded and that supplied depending on the shape of the respective curves. Theoretically, demand and supply intersect at an equilibrium point (Fig 1) resulting to optimum allocation of resources (assuming externalities are accounted for). In practice however, the dynamic nature of the industry and the imperfect flow of information lead to a continuous change of this equilibrium point and it is thus never perfectly achieved for substantial periods of time.

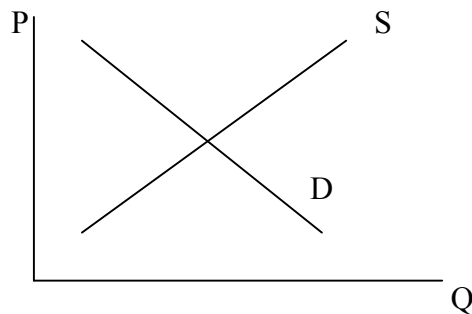


Fig. 1: Simplified (straight line) Supply and Demand Diagram

Demand Curve Shape

As most products (except Giffen and Veblen goods) fish products have a downward sloping demand curve (Fig 1). This is explained by the substitution effect (people switch to substitutes following an increase in price) and the income effect (the percentage of disposable income spent on the product increases with product price).

The curve is relatively elastic meaning that a change in price leads to a relatively larger change in the quantity demanded. This has to do with the point at which you operate on the demand curve but also on its slope at that point (greater slope corresponds to lower elasticity). Factors contributing to the demand elasticity for fish products include the fact that it is a luxury good and not a necessity; the large number and closeness of ready substitutes which increases the more narrowly you define the product (i.e. a brand of salmon as oppose to salmon or any fish or just food); the small number and small degree of complementary goods (refrigeration, fish tailored cooking materials etc.), the large portion of disposable income spent on it in many countries; the large market size that keeps increasing with globalization and free trade; collective diminishing returns in consumption to some extent etc. It should be noted that in the long run, the demand curve is more elastic as people can adapt to changes.

Supply Curve Shape

The supply curve is upwards sloping, as producers will be willing to produce more at a higher price. Both S and D have been simplified in Fig 1 and shown as straight lines. Again elasticity is defined as the percentage change in quantity (this time supplied) over the percentage change in price, and depends on the point of operation on the slope and the local slope gradient. There are several factors affecting it including the elasticity of input products such as corn or soybean, transportation, aquaculture equipment, land, labor, storage equipment and even more importantly, the time scale.

In the short run, supply is relatively inelastic compared to the long run as time allows for more adjustments in production (new fish farm units as oppose to just increasing the production of existing ones); and in the very short run (momentarily) supply can be considered as fixed (perfectly inelastic). A right shift in demand therefore

would cause an increase in price along the initial supply curve for some time until it adjusts.

Curve Shifts

Due to the downward sloping demand curve and the upward sloping supply curve (Fig 1), a right-hand shift in demand or a left-hand shift in supply cause a price increase and vice versa. Right shifts of both supply and demand cause the market quantity to increase. The shapes of the demand and supply curves (elasticities), which have just been examined, and the point of operation on the slopes, define the extent to which price and quantity will change in response to curve shifts (either concurrently or one along the another). It is important to distinguish between a movement along a curve as a result of an increase in price, and a shift of the curve as a result of changes in the industry. What remains therefore in order to analyze possible changes in the price and quantity of fish in the future is to examine the factors, which would result in demand, and supply shifts. These have been summarized in Appendix A and B respectively.

Proposal Assessment and Assumption Evaluation

The business plan makes the following assumptions for the next 5 - 10 years.

- 1. 10% annual growth rate in global seafood consumption*
- 2. 20% to 30% annual growth rate in global aquaculture production*
- 3. 5% annual increase in average seafood unit prices*

The first assumption implies a growth rate of global seafood consumption significantly higher than that of the world's population, which is approximately 1.5% [U.S. Census Bureau 2006, UNPIN 2004]. This could only be possible if there is an increased preference for fish by the current population or that entering the market by 2015; if the price of substitutes increases; or if the real price of fish drops in the future which contradicts with the third assumption (assuming the 5% price increase is inflation adjusted). The factors leading to a rightward shift in demand are summarized in

Appendix A. As there is no evidence in the information provided suggesting any of the above, the first assumption does not seem very well substantiated.

According to the business plan, production from global fish catches has stagnated since 1989 at a value of 100Mt annually and cannot increase beyond that as new sources have been exhausted. A further 30Mt are currently supplied annually by aquaculture production. The 10% annual increase suggested in the first assumption implies that in ten years, annual consumption will be 337Mt so according to the above information, 237Mt will have to be supplied by aquaculture production. This corresponds to an annual increase of 22.97% over the next 10 years in aquaculture production, which leads onto the second assumption. Given the information provided therefore, the second assumption is only valid if the first assumption is correct.

The 2002 UN estimates provided suggest that a further 20Mt annually (from 2002 production) will be required by 2015. The first assumption implies that global production in 2015 (9 years from now) will be approximately 307Mt so unless production in 2002 was around 287Mt which is highly unlikely, one of the two will have to be discarded. [FAO 2006] indicates that given projected population growth, an additional 40Mt will be required annually to maintain consumption at current levels by 2030, which is closer to the UN figures. Furthermore, annual growth in global aquaculture production since the year 2000 has been around 6.8% [FAO 2006]. Though in most projections supply cannot keep up with demand [FAO 2006, Delgado et al 2003], indicated figures are much lower than those suggested by the business plan. On this account therefore, both the first two suggestions seem unrealistic.

Moving onto the third assumption, a 5% annual increase in average seafood unit prices in conjunction with a 10% annual increase in consumption (first assumption) could only result if there is a great rightwards shift in demand (unless the 5% is not inflation adjusted). Judging by the presented data and information, it seems more likely that wild fish prices will increase in the future because their supply is limited. Having said this, according to [FAO 2006], consumption trends are driving an increase in demand and price is expected to increase by 15% by 2020 from 1997 prices (much lower than the suggested 5% annually). As discussed in the introduction, in order for prices to increase significantly, mergers between producers will be required in order for their negotiating

power to increase over supermarkets that are currently controlling prices, keeping them at a low level.

Would I Invest?

As indicated in the previous section, the figures suggested by the business plan are unrealistic. It may however be worth investing if a number of factors are first investigated. The issues which I would need to know more about in my decision to invest in Global Marine 2K, are summarized in Appendix C. Out of these factors, what I personally value above all in a business plan, even more than the idea or the opportunity itself, is the management team. So judging by the first predictions, I would be disinclined to invest unless presented with a very impressive opportunity. It should be realized that predictions over the next 10 years or so are very difficult to make and often inaccurate so conservativeness would be highly valued.

Appendix A - Demand Shifts

1. Population

- a. Population growth essentially shifts the demand curve to the right as it increases market size.
- b. Changes in tastes and preferences of the existing population or due to population entering the market shifts the demand curve.
- c. The emergence of new diseases and the trend towards an ageing population in several countries leads to an increase in demand for nutrition with low cholesterol (fish). Demand thus shifts to the right.

2. Substitutes and Complementary Goods

- a. As previously explained, the number and closeness of substitutes depends on how narrowly you define the product. Changes in the availability and price of these substitutes will cause shifts in the demand curve. Increased competition from livestock is expected for example (left shift), whereas demand for poultry decreases worldwide (right shift) pushing fish prices up [Harvey, D.J. 2006].
- b. Complementary goods (freezer, specialized fish cooking appliances) though not very close in the aquaculture industry, have exactly the opposite effect of substitutes regarding both demand shift and elasticity.
- c. Illnesses or epidemics in competing industries such as the Bird Flu or Mad Cow Disease could cause sudden right shifts in demand for fish as they have in the past.

3. Wealth

- a. Economic growth will increase restaurant sales (right shift in Demand) and demand for fish in general. Global GDP growth rate is currently around 4% with higher figures in developing countries such as China with 10%.
- b. An economic recession or war would cause demand to shift to the left.
- c. Factors such as wages and income, indirect tax, employment, wealth distribution and inflation could affect the % of disposable income spent on the product. This may not only shift the demand curve but also affect its

elasticity. An increase in wealth will shift the demand to the right (luxury good) and a decrease in % of disposable income will make demand more inelastic.

4. *Promotion*

- a. Promotion and advertising the product regarding its health advantages over meat especially at locations remote from the sea has a great potential to increase demand (right shift).
- b. A “Healthy Fish” announcement by doctors, scientists and the media would have a similar effect for aquaculture products as long as it is not a healthy “wild” fish announcement though it is difficult to distinguish wild from farmed fish.
- c. Traditionally, consumers haven’t trusted farm products due to the use of antibiotics, hormones, the products used to feed the fish, the toxins released in the bodies of fish as a result of the stress because of them being too many in confined spaces etc. Promotion is thus required to make up for bad publicity.
- d. Consumers are increasingly becoming more quality conscious. Educating consumers regarding fish farming will also shift demand to the right.

Appendix B - Supply Shifts

1. Technology

- a. Technological improvements will reduce production costs shifting supply to the right
- b. Research and development will lead to the ability to farm more fish types leading to a rightwards shift in supply
- c. Improvements in refrigeration can improve the cost of storage allowing for buffer stocks and the ability to regulate supply.
- d. Improvements in the reefer shipping industry as well as better logistics (very important as fish have to be delivered fresh) will result in lower transportation and distribution costs causing supply to shift to the right.

2. The Industry and Foreign Trade

- a. Mergers between the many small producers could result in bigger firms with more market power, which could possibly shift the supply curve to the left. Economies of scale that will result however are also likely to cause supply to shift supply to the right.
- b. Globalization and free trade causes supply to shift to the right. This is achieved as long as transportation (reefer ship charter rates) costs are low.
- c. Barriers to entry or international trade barriers such as tariffs and quotas or other means of protectionism by government policy to improve international competitiveness, causes supply to shift to the left. This is important as the US currently imports \$11bn worth of seafood products annually [FAO 2006]. The biggest producer internationally is China accounting for 51.2% of global fish production followed by Japan with 6.0% [FAO 2006]
- d. Mutual agreements on production limits to regulate prices also cause the supply curve to shift to the left.
- e. Government subsidies shift supply to the right and taxes on fish products shift supply to the left.

- f. The currency exchange rates have an effect on how competitive imports are. The currently weak dollar makes imports expensive and thus leads to a decrease in supply. If US were an exporter rather than an importer of fish, this would also result to an increase in demand.

3. *Input prices*

- a. A decrease in input costs causes the supply curve to shift to the right. These include production costs (food, medicine, equipment, wages etc.), transportation costs (reefer ships and trucks) and storage costs (refrigeration). Factors affecting those industries therefore (e.g. the weather for corn) indirectly affect the supply curve. Corn price is expected to increase and high protein soybean to decrease in the near future [Harvey, D.J. 2006]
- b. Socially and environmentally acceptable practices, safety, certification and traceability are becoming increasingly important. These represent additional input costs and therefore shift the supply curve to the left.

4. *Weather & Epidemics*

- a. Bad weather or hurricanes could reduce local (eg Chinese) supply from fishing or aquaculture. This would cause supply to shift to the left.
- b. Undesired weather conditions could also have the same affect. Cod for example requires cold steady temperature.
- c. Unpredictable illnesses or epidemics in the industry, analogous to the bird flue or mad cow disease, would cause a sudden left shift in supply.

Appendix C – Issues Regarding Investment

1. About Global Marine 2K
 - a. The team and why they are competent
 - b. If the product or service (e.g. delivery) provided is differentiated in any way and more about promotion
 - c. Marketing strategy and future plans such as merging with other firms (both vertical or horizontal integration), entering the stock market etc.
 - d. Pricing
 - e. How adaptable they are to changes in the market
 - f. Company specific Risks
2. About the Business Plan
 - a. Finance and financial figures
 - b. Equity Break-Even time – when will operation at a loss stop and when will invested money be paid back
 - c. How much investment is required
 - d. Estimated rate of return
 - e. Estimated time of return and with what certainty
 - f. How much of the return will be reinvested
3. About the Market and Industry
 - a. More detailed and substantiated projections of global and regional supply and demand along with trends over the past several years for aquaculture products
 - b. The same for complementary assets (refrigeration, cooking materials etc.) and substitute (meat, poultry etc.) markets.
 - c. The same for input markets (reefer ship freight rates, fish food, medicine, aquaculture equipment, wages etc.)
 - d. A separate analysis for fresh and frozen seafood products
 - e. A separate analysis of farmed and wild seafood products
 - f. Barriers to entry to other firms
 - g. Market risks – Consumer or competition related

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