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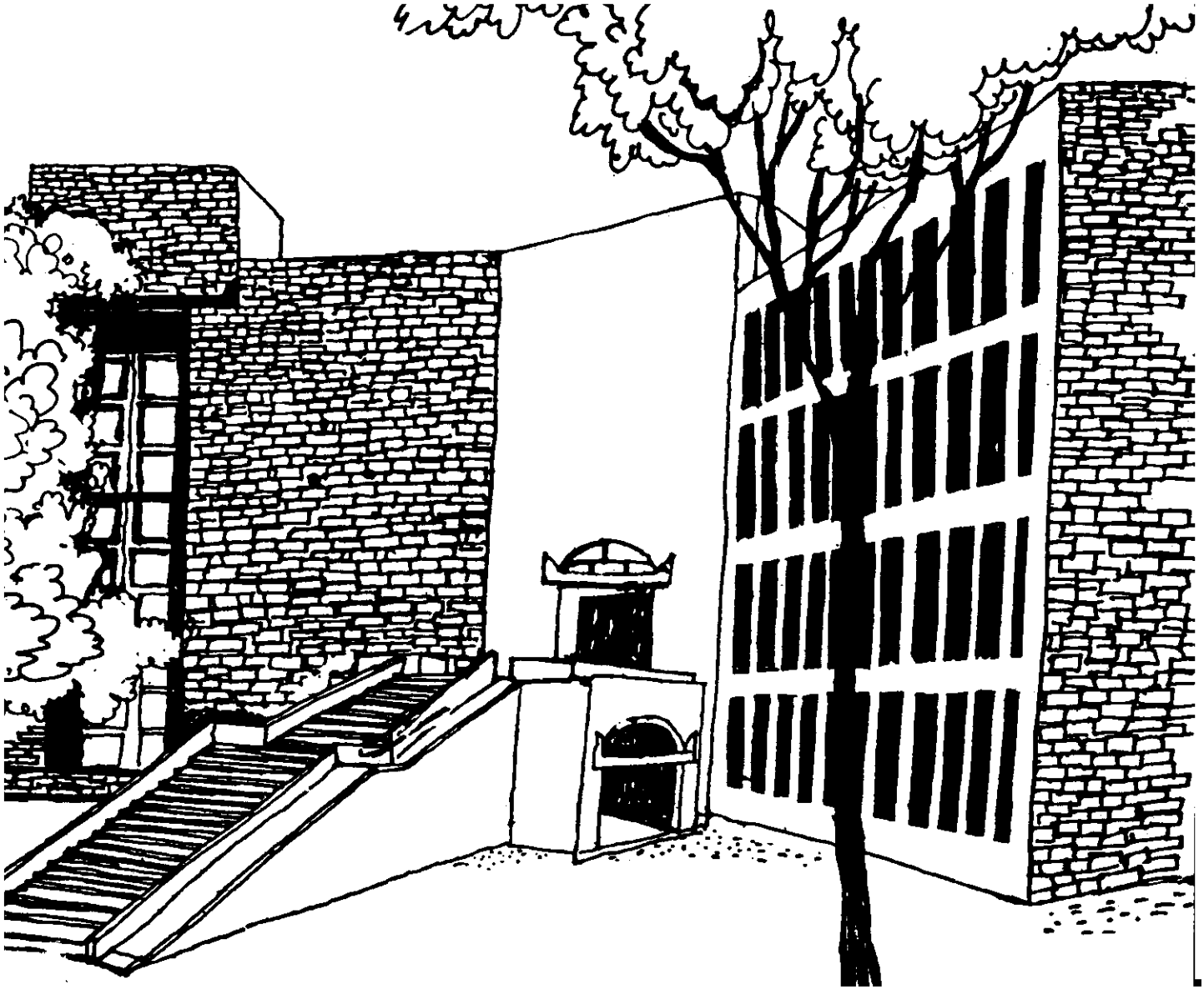

A Market Share Approach to Pricing Commodity Exports

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Abstract

In this paper a market share model is developed for formulating appropriate export strategies for commodities by exporting countries. Assuming individual consumer in an importing country makes discrete choice regarding the source of a commodity or product depending on his/her perception of quality of the commodity or product from each sources and their prices, the aggregate demand of the importing country for each source is obtained. Based on this a market share model is developed assuming logistic distribution for the utilites. This market share model can be used by an exporting country to examine whether there is a premium or discount for its product/commodity and its magnitude which will help in determining (i) the relationship between relative prices and market share (ii) the level of price at which the country can earn maximum foreign exchange. This would help in formulating appropriate policies to influence freight-on-board (fob) prices thereby aligning with the changing international trade scene so as to effectively compete in the preferred markets to retain or increase market share which would maximize export earnings. The applicability of the model is illustrated using fennel seed export from India as an example.

A Market Share Approach to Pricing Commodity Exports

Gopal Naik and V. N. Asopa[1]

Introduction

Exporters have to constantly evolve strategies towards either increasing or at least maintaining their shares especially in markets which have political and economic stability, relatively free access, large size and high growth potential. Export strategies are formulated by either individual exporters, producers associations and parastatal agencies involved in exports or by the government depending on the nature of the product and the structure of the industry. In the developed countries the exporters themselves are able to devise strategies to effectively compete in the international markets because of the large size of their operations, organisational strength and generally fewer competitors for the products. In contrast, presence of a large number producers and relatively small size of individual exporters in the developing countries especially in the case of agricultural commodities requires government or parastatal agencies to take greater responsibility to formulate export strategy. The intervention of the government is also aimed at achieving greater stability in the domestic market and improving the foreign exchange earnings.

Exporting countries often use pricing policies as effective export strategies. An important consideration that needs to be taken care of while formulating these pricing policies is that there are differences in qualities of commodities supplied by various sources. In the case of agricultural commodities these quality differences could be due to inherent differences in varietal or climatic conditions of producing countries. The consumer in the importing country would be willing to pay a premium if product/commodity from a particular origin is perceived to be of better quality than products/commodities from any other sources. In such a case the amount of premium or discount would depend on the consumer's perception of the superiority of the quality of the product from a particular source over the others. Therefore, while formulating pricing policies, it is essential to understand (i) how the relative prices affect market shares in an importing country? (ii) does there exists a premium for its product? (iii) if it exists, at what level of premium it would benefit the exporter the most in terms of export earnings?

In this paper a market share model is developed which could be used to estimate the premium or discount for quality differences of products/commodities, the market shares at different levels of relative prices and the market share at which the export earnings would be highest for the exporter. This model has more attractive theoretical base than other market share models (Sirhan and Johnson,

[1] Authors are grateful to Nitin R. Patel for clarifying certain theoretical issues.

1971) used for examining commodity exports.

Theoretical Background

We begin with the choice problems of consumers of a product/commodity in an importing country. We assume individual consumer is utility maximizer. Accordingly, given the products/commodities from alternative sources (countries) consumer prefer the product/commodity with better quality and lower price. If the quality of the product from different sources are uniform, the obvious choice would be for a source which offers the product at the lowest price. The amount of premium or discount that a consumer is willing to pay would depend on the consumer's perception of the superiority of the quality of the product from a particular source over the others.

With these assumptions individual demand for products from different sources is derived, considering quality differences, by maximizing utility in a discrete choice framework. Then the aggregate demand of the importing country for product/commodity from each source is obtained. From the aggregate demand market share model for an exporter is developed assuming logistic distribution for the utilities.

Consider consumer i having budget B_i to purchase a unit of product X.[2] Assume that there are two sources for X, x_1 and x_2 which are qualitatively different, with prices P_1 and P_2, respectively. For convenience, further assume that $P_2 \geq P_1$ and $B_i = P_2$.[3]

Since consumer i has the option of purchasing a unit of either x_1 or x_2 his/her utility function can be represented as [4]

$$U_i(B_i) = y.u_{i1} + (1-y).u_{i2} + y.g_i(P_2-P_1)$$

where $y \in (0,1)$, u_{i1} and u_{i2} are the utilities derived by consumer i from consuming one unit of x_1 and x_2, respectively and $g_i(P_2-P_1)$ is the opportunity utilities derived by the consumer for the amount (P_2-P_1).[5]

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[2] We can think of B_i as an approximate amount consumer i allocates to purchase commodity X from his total budget.

[3] $P_2 \geq P_1$ means the quality of x_2 is perceived to be superior or same as that of x_1. The result is not constrained by this assumption.

[4] Though consumer could be choosing from both sources at some proportions this situation is not considered here.

[5] Opportunity utilities can be defined as the utilities derived from consuming next best good by spending the difference in amount $(P_2 - P_1)$. Here we can see that the assumption $P_2 \geq P_1$ is not binding, because if $P_1 > P_2$ and $P_2 = B_i$ then the consumer would borrow from his total budget if it is worthwhile to do so.

Consumer i chooses either of these brands by maximising $U_i(B_i)$ subject to the budget constraint [6]

$B_i = y.P_1 + (1-y).P_2 + y.(P_2-P_1)$

i.e. $\text{Max } L_i = \text{Max } \{y.u_{i1}+(1-y).u_{i2} + y.g_i(P_2-P_1)$

$+ \lambda_i[B_i - y.P_1 - (1-y).P_2 - y.(P_2-P_1)]\}$

$= \text{Max } \{[u_{i1} + g_i(P_2-P_1) + \lambda_i B_i - \lambda_i P_2], [u_{i2} + \lambda_i B_i - \lambda_i P_2]\}$

Therefore, he/she chooses

x_1 if $u_{i1} + g_i (P_2 - P_1) > u_{i2}$

and x_2 if $u_{i2} > u_{i1} + g_i (P_2-P_1)$

or x_2 if $u_{i2} - u_{i1} > g_i (P_2-P_1)$

To generate market demand from the individual demand curves assume $g_i(P_2-P_1) = g^*(P_2-P_1)$ $\forall i$. Then the market demand for x_2 is

$$X_2 = \int_{g^*(P_2-P_1)}^{\infty} f(u_i)du_i = 1 - F[g^*(P_2-P_1)]$$

where X_2 is the market share, $u_i = u_{i2} - u_{i1}$, f(.) is the probability density function and F(.) is the cumulative distribution function.

Specific functional forms for X_2 could be obtained depending on the assumption made on the distribution for u_i. Assuming normality

$$F(g^*(P_2 - P_1)) = \int_{-\infty}^{g^*(P_2-P_1)} f(z)dz \qquad z \sim N(0,1)$$

Therefore, the probit model is (see Judge et al for details)

$$V = F^{-1}(X_2) = g^*(P_2 - P_1).$$

Assuming logistic distribution we get

[6] Note that this budget constraint is same as $B_i=P_2$.

$$F(g^*(P_2 - P_1)) = \frac{e^{g^*(P_2-P_1)}}{1 + e^{g^*(P_2-P_1)}}$$

Therefore,

$$X_2 = \frac{1}{1 + e^{-g^*(P_2-P_1)}}$$

Logistic type of model is used because of its close approximation to the normal cumulative distribution function and its numerical simplicity (Judge 1985, pp.762). The model developed here is similar to other market share models such as Multiplicative Competitive Interaction (MCI) Model or Attraction Model.

Since $g^*(P_2-P_1)$ represents utility for only the difference in prices it will take small value compared to the total budget. Therefore, we can locally express it in a linear form as

$$g^*(P_2-P_1) = \beta_o + \beta_1(P_2-P_1)$$

where, $\beta_1 > 0$ and $\beta_o \geq 0$ depending on the location of the utility function at which (P_2-P_1) falls.

Optimal Pricing

Since (P_2-P_1) determines the share (X_2) of source x_2 in the market, there must exist a P_2^* for a given level of P_1 such that $X_2.P_2$ is maximum. $X_2.P_2$ is an index of revenue earned by a country. The primary objective of any exporting country is to attain a share at which the foreign exchange earning is maximum. That is,

$$\text{Max } X_2 \cdot P_2 = \text{Max } P_2 [1 - F(g^*(P_2-P_1))] .$$

Once the level of P_2 is determined for a given P_1, the exporting country has to keep this price level either by supply (stock) management or through export taxes or subsidies.

This model can be extended to include more than one competing countries. Also, export share elasticities can easily obtained form the model.

An Application

We illustrate the use of the above model with the help of an example of fennel export from India. Fennel is an important seed spice exported from India (Asopa and Naik, 1990). US is a major importer. India and Egypt are the two major sources of US import of fennel seed. Hence Egypt is the main competitor for India in the U.S. market. Therefore, if India wants to increase its share in the US market through an appropriate price policy it is important to know how its share in the US market changes with the changes in its price relative to changes in Egyptian price. The specific questions that needs to be answered are: 1) how the relative prices of Indian and Egyptian fennel affects India's share? 2) Is there a premium for Indian fennel? 3) If yes, at what premium India can benefit most? Answers to these questions would help to design strategies to maintain certain market share during unfavourable years or increase share during favourable years by introducing appropriate incentive schemes.

From the model derived above it is apparent that the relative price affects the market share. That is,

$$S = f(RP) \qquad [1]$$

where, S is the share of Indian exports in U.S. imports of fennel from both India and Egypt, and RP is the relative price - the ratio of Indian fennel price to Egyptian fennel price.[7] We expect that an increase in relative price (RP) decreases India's share in U.S. imports.

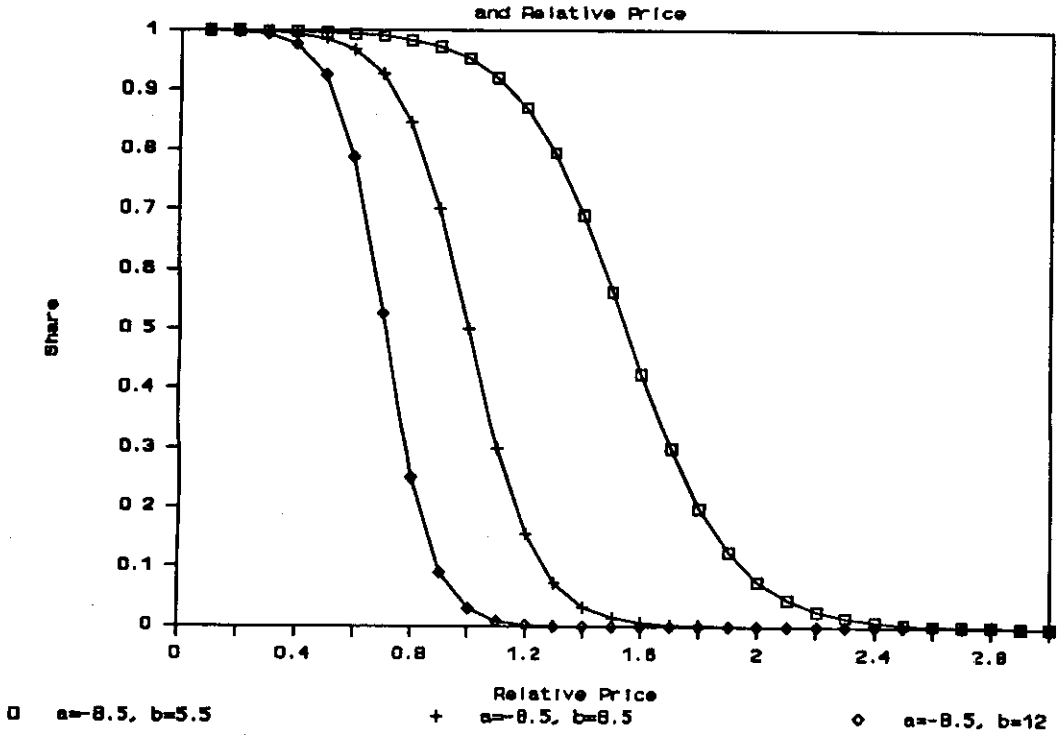
It is reported that the quality of Indian fennel is perceived as better than the Egyptian. Naturally, we expect that the Indian fennel to command a premium in the US market. Therefore, theoretically one would expect a very high share when RP is less than one, and when RP > 1 the share would decline depending on the size of the premium the Indian fennel commands in the U.S. market. At some level of RP greater than 1 (when premium is exhausted), the share would decline very fast. The share would decline faster if there is no premium and vice versa. As discussed earlier logistic type functional form is often used for such analysis. That is

$$S = \frac{1}{1 + e^{a+b.RP}}. \qquad [2]$$

The magnitude of the coefficients 'a' and 'b' determines the exact shape of the relationship. This shape indicates whether we can obtain premium or have to sell the commodity at discount and the

[7] We used the price ratio instead of price difference to take care of the price increases over time.

Fig.1 Relationship Between Share and Relative Price



corresponding market shares. This can been seen from figure 1. For example, when a=-8.5 and b=5.5 at a relative price ratio equal to one the market share is less than even 10 per cent. Therefore, if our aim is to maintain higher market share then the commodity/product has to be sold at discount compared with the price of competitors product. When a=-8.5 and b=8.5 at a relative price of 1 the market share is 50 per cent. That is, pricing at the competitors level would fetch 50 per cent of the market share. This situation is same for a=-2.76 and b=2.76 (in fact for that matter for any a=-b). However, when a= -8.5 and b=12 pricing at the competitors level would fetch more than 70 per cent

of the market share. In other words, 50 per cent share can be maintained by pricing at a higher level than the competitors price. That means there exists a premium for the product sold by this country.

However, the question arises at what level of market share of relative price level the country would earn highest return. This can be done by computing the product of share and relative price which is an index of returns, and identifying the maximum level. The functional form that is chosen does not lend to explicit solution for RP. Therefore, it is necessary to compute the product for various values of RP using the estimated coefficients. For example, in the following figure we show the optimum level for the situation when a=-8.5 and b=5.5 the optimum RP is 1.2 and corresponding share is 87% (see figure 2).

We estimated the coefficients for US fennel seed market using data from 1977 to 1987. The estimated coefficients for the relationship [2] are

a = - 5.27 b = 3.26

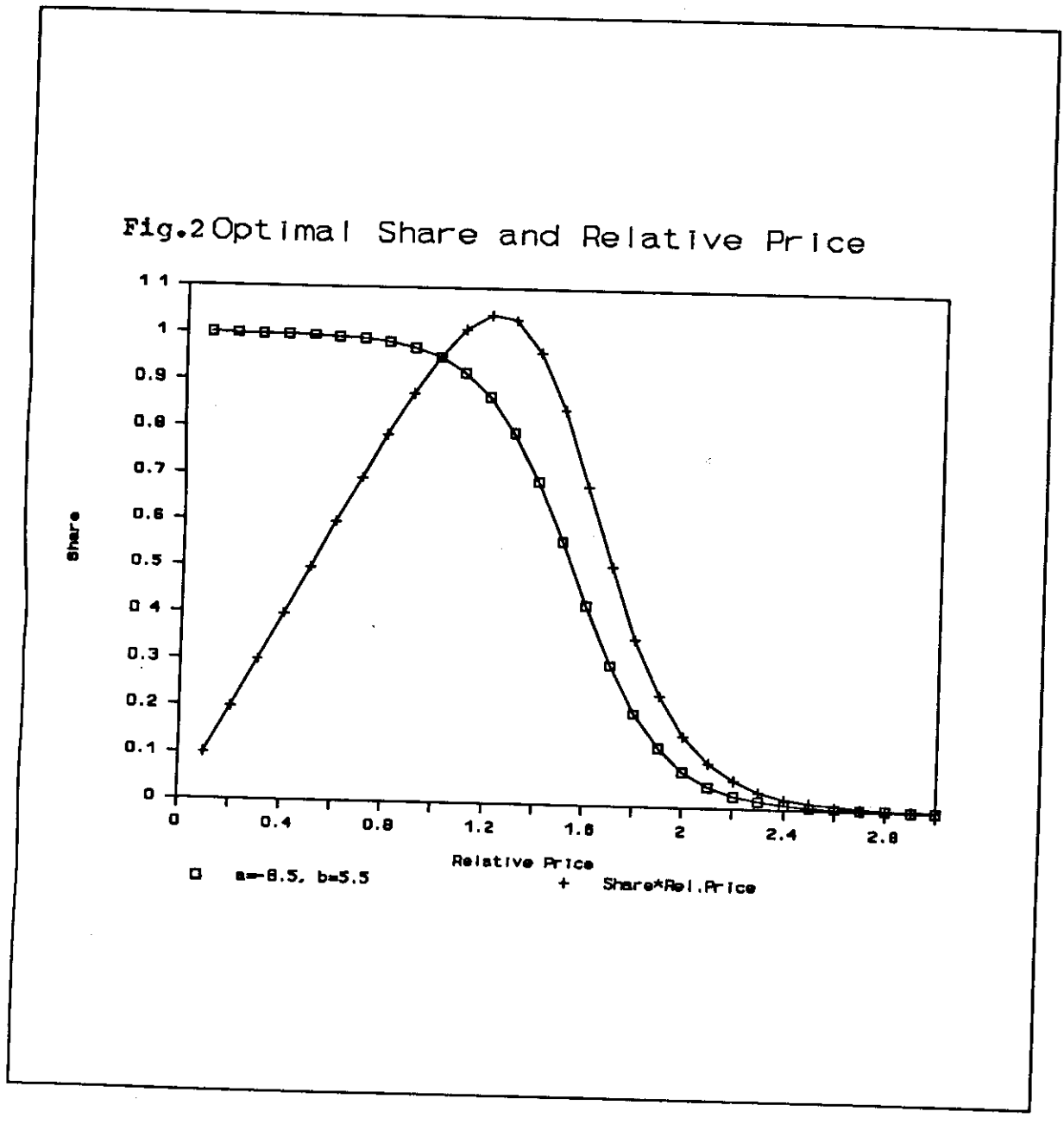
(- 6.60) (6.63).

Figures in parantheses are t-statistics. Since there were two outliers, we adjusted for these outliers by substituting the predicted values from the estimated equation, and then reestimated the coefficients. They are as follows:

a = - 5.24 b = 3.37

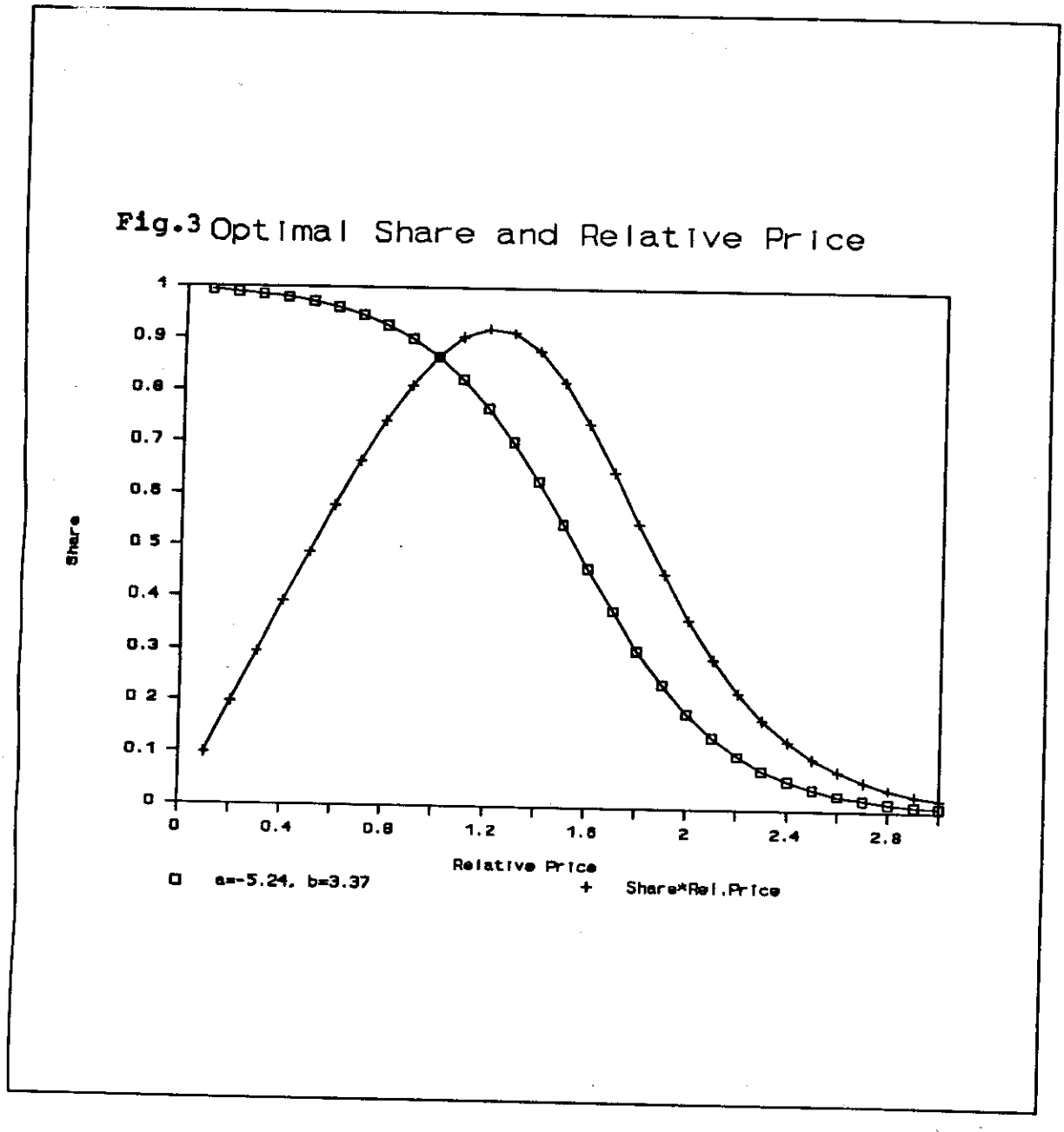
(- 6.32) (6.60)

We can see from t-Statistics that the coefficients are significant at 1 per cent level. Using these coefficients the level of RP at which the benefit from exports is maximum is examined. This turns out to be at 1.22 (see figure 3). That is, when the Egyptian fennel fetches Rs.1/unit, then by charging Rs.1.22/unit would give India maximum benefit. This shows that there exists a premium for Indian fennel and is 22 per cent (maximum benefit premium). The corresponding share is .8. This indicates that India should try to maintain a share of 80 per cent by keeping the relative price ratio at 1.22.



This can be done through various incentive schemes. The extent of incentives would vary from year to year. In fact in some years there could be no incentives or even a small tax (i.e., when domestic prices in India are lower than the Egyptian prices) so that India gets an appropriate premium. In shortage years there has to be incentives.

The model could yield more accurate results if larger number of shorter duration observations such as weekly or fortnightly, are used for estimation.



Conclusions

In this paper a market share model is developed for formulating appropriate export strategies for commodities by exporting countries. This market share model can be used by an exporting country to examine whether there is a premium or discount for its product/commodity and its magnitude which will help in determining (i) the relationship between relative prices and market share (ii) the level of price at which the country can earn maximum foreign exchange. Also the elasticities of its share with

respect to its own price and price of other countries can be obtained.

Once the level of price is known the exporting country can formulate appropriate policies to influence freight-on-board (fob) prices thereby aligning with the changing international trade scene so as to effectively compete in the preferred markets to retain or increase market share which would maximize export earnings. Operationally, this would mean maintaining the price level through export duties or incentives and subsidies in one or the other form. Though global export subsidies are considered as welfare reducing, Abbott et al (1987) have shown that a small targeted subsidy can increase the welfare of the subsidizing country. Moreover, maintaining such share would also help in stabilizing international trade.

We illustrate the use of the above model with the help of an example of fennel export. Fennel is an important seed spice exported from India. For this spice the US is the major customer and Egypt is the major competitor. Using the model described above and the import data of US for the period 1977 to 1987 we found that Indian fennel fetches a premium in the US market. The maximum export earning level yields a share of 80 percent and a premium of 22 percent over Egyptian fennel. Since the Spices Board, a promotional body with monitoring responsibility constituted by the government of India, is in charge of export policy formulation, a suitable restriction or subsidy could be levied from time to time depending on the price of Egyptian fennel so as to keep the premium at 22 percent level.

References

Abbott, P. C., P. L. Paarlberg, and J. A. Sharples, "Targeted Agricultural Export Subsidies and Social Welfare, American Journal of Agricultural Economics, 69 (1987):723-732.

Asopa, V. N. and G. Naik, "Exports of Minor Spices: Performance and Growth Strategies," Report, Indian Institute of Management, Ahmedabad, India, 1990.

Judge, G. G., R. C. Hill, W. E. Griffiths, H. Lutkepohl and T.C. Lee, The Theory and Practice of Econometrics, John Wiley and Sons Inc. New York, 1985.

Sirhan, G. and P. R. Johnson, "A Market-Share Approach to the Foreign Demand for U.S. Cotton, American Journal of Agricultural Economics, 53(1971):593-99.