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MARKETING AGENCIES AND THE ECONOMICS OF MARKET SEGMENTATION*

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Increasing importance is being attached to market segmentation strategies as a means of increasing producer returns. In this paper, a generalised model of price discrimination without supply control is developed to analyse the implications of optimal segmentation strategies for non-homogeneous products. It is shown that the magnitude of producer returns is dependent on demand and supply conditions, with increases in returns falling as price elasticities of demand and supply increase. The model is applied to the New Zealand sheep meats industry to reveal that returns to producers from market segmentation strategies could be quite low in the long run.

The literature on price formation and imperfect competition in international agricultural markets covers a wide range of topics. McCalla and Josling (1981) review much of this material. However, many of the studies have been based, at least notionally, on 'world' grain markets with assumptions of storability and product homogeneity.

Homogeneous product models have been used to show how marketing institutions and government policies are able to influence producer returns and other aspects of economic performance. Some authors have studied the impacts of supply control by either an individual exporter, cartel or oligopolistic organisation (McCalla 1966; Alaouze, Watson and Sturgess 1978; Schmitz and McCalla 1981). Other authors have analysed the situation where an exporting agency diverts the product between domestic and international markets (Banks and Mauldon 1966), within a voluntary quota scheme (Freebairn and Gruen 1977; Reeves and Longmire 1982), or to alternative uses (Rae 1978).

With the assumption of homogeneous products in world trade, opportunities for gains from this type of price discrimination are limited by the possibility of product transfer between consumers or competition from alternative suppliers. Therefore the success of price discrimination depends on factors such as trade policy, commercial practices which restrain arbitrage, product storage and product transformation.

In international markets for meat and horticultural products, conditions can differ considerably. While the policy and trade restriction environment may be similar, the products may be less storable and less homogeneous. For example, much of the international trade in meat is in the form of frozen product which does not compete directly with local fresh supplies, and many horticultural products are supplied at times of the year when there is little competition from local products. Promotional programs to identify products from individual countries can result in consumers viewing products from different countries as less than perfect substitutes. Under these circumstances,

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the opportunities for increasing producer returns may be greater, although more difficult to measure.

In this paper, a general model of price discrimination is used to evaluate the extent of the marketing power available to an agency whose concern is the allocation of a non-storable product between markets or market segments. The term market segmentation is used to describe this activity because it is dependent upon an ability to identify and exploit individual groups within traditionally defined markets. For example, an agency with tight control over product flows, packaging and prices may be able to distinguish between an institutional and a consumer demand for a particular product within a specified region.

The New Zealand Dairy Board has long been an example of an exporting agency which has extensive control over product transformation and flows but no control over aggregate production. Other agencies have been created in the sheep meat and horticultural sectors with similar objectives. One of the major arguments used to justify the development of these agencies is their ability to increase producer returns through the use of marketing programs which would allow differential pricing in individual market segments and, thus, the payment of higher pooled prices to producers. The extent of these benefits is influenced by the degree of homogeneity of the product and the general price responsiveness of its producers and consumers.

In the following section of the paper a model of the optimal allocation of a fixed quantity of product between multiple markets is developed. In the subsequent section the impact of product supply response and its implications for producer welfare are incorporated. In the final section an empirical example of New Zealand sheep meat exports is presented along with a discussion of the implications of product heterogeneity for the likely welfare and revenue changes.

The Model

A linear model is developed to isolate the welfare and revenue impacts of price discrimination, assuming that the total demand for a product can be segmented into n independent markets. Demand in the i-th market is represented by a linear, price-dependent demand curve:

$$(1) \quad P_i = a_i - b_i Q_i \qquad a_i, b_i > 0$$

where P_i and Q_i are the price and quantity in market segment i. The aggregate inverse demand curve which represents the quantity demanded at a common price in all markets can be represented as:

$$(2) \quad P_a = A_a - B_a Q_a$$

where P_a is the common price, Q_a is the total quantity demanded,

$$A_a = \frac{\sum_{i=1}^{n} a_i/b_i}{\sum_{i=1}^{n} 1/b_i}$$

and

$$B_a = \frac{1}{\sum_{i=1}^{n} 1/b_i}$$

For a given level of production, Q_a, the competitive equilibrium price can be determined from (2), but it is possible that at this price some individual demand curves would not be operational. If markets are ranked such that $a_1 > a_2 > \ldots > a_i > \ldots > a_m$, then only markets with $a_i > MR_a$ remain functional after price discrimination, where MR_a is the marginal revenue associated with the aggregate demand curve. Let n represent the number of operational markets after price discrimination. Then equation (2) represents the segment of the linear aggregate demand curve for the n operational markets.

Total revenue from all markets is maximised by allocating Q_a to the n market segments such that marginal revenues are equal in all markets. This requires allocating Q_{id} to market i, where:

$$\text{(3)} \quad Q_{id} = \frac{2b_a Q_a + a_i - A_a}{2b_i}$$

and charging a price P_{id} where:

$$\text{(4)} \quad P_{id} = 0 \cdot 5(a_i + A_a) - B_a Q_a$$

The average revenue, P_{ad}, is the weighted sum of the price in each market segment. That is:

$$\text{(5a)} \quad P_{ad} = \frac{\sum_{i=1}^{n} P_{id} Q_{id}}{\sum_{i=1}^{n} Q_{id}}$$

By substituting (3) and (4) into (5a), an expression determining the relationship between a given level of output, Q_a, and the return from price discrimination, P_{ad}, is derived:

$$\text{(5b)} \quad P_{ad} = A_a - B_a Q_a + K/Q_a$$

$$\text{and} \quad K = \sum_{i=1}^{n} \left[\frac{(a_i - A_a)^2}{4b_i} \right] > 0$$

The model is illustrated in Figure 1. Equations (2) and (5b) are represented by D and D', respectively. The vertical difference between D' and D, which is K/Q_a, represents the revenue gain from price discrimination per unit of output. Therefore, for a particular level of output, Q_a, total revenue gains from price discrimination are represented by $(K/Q_a)Q_a$, which equals K. Note that these total gains from price discrimination are constant with respect to the level of output. This condition arises from the linear demand characteristics of the model and will not necessarily be preserved when demand curves in market segments are non-linear (Robinson 1933; Schmalensee 1981).

It is also interesting to note the impact of changing supply levels on the pooled price which is received after price discrimination. It can be

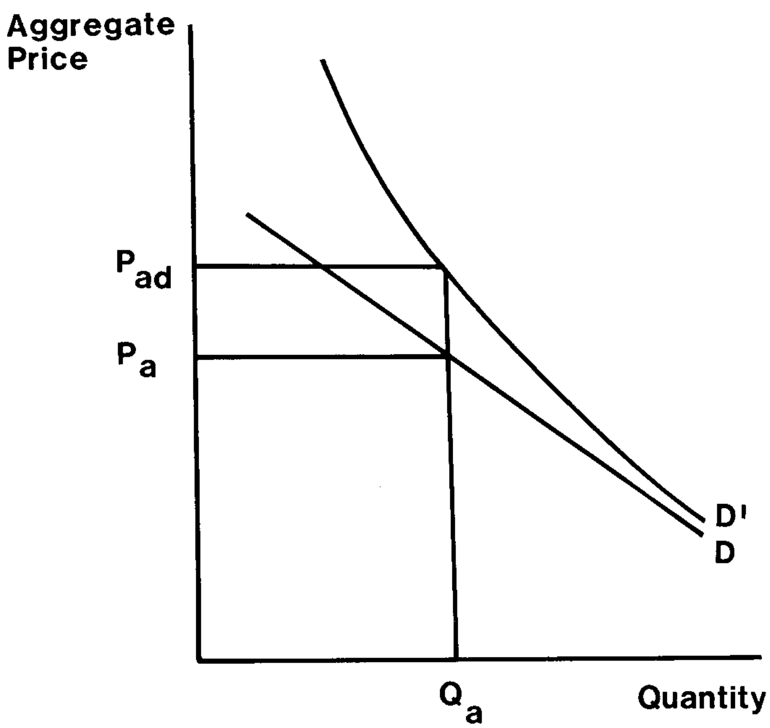

FIGURE 1—Returns from Price Discrimination.

seen that the average revenue curve under discrimination is an inverse function of the quantity produced and is asymptotic to the aggregate demand curve. Thus, a given change in production would result in a greater change in producer price under price discrimination than it would with non-discriminatory pricing. That is, discriminatory pricing will lead to higher but less stable prices than a competitive pricing system. Myers and Piggott (1981) and Alston and Freebairn (1986) reached similar conclusions about the effect of supply variability on producer prices under two-price schemes.

The algebraic results derived thus far can be transformed to variables of more obvious economic significance, such as the price elasticities of demand and market shares ruling at the competitive equilibrium. In this case, the total revenue gains from price discrimination are given by:

$$(6)\quad K = 0{\cdot}25 P_a Q_a \sum_{i=1}^{n} \left[n_i S_i \left(\frac{1}{n_i} - \frac{1}{n_a} \right)^2 \right]$$

where n_a is the price elasticity of demand (absolute value) facing suppliers for their product in the aggregate market at (P_a, Q_a);

n_i is the price elasticity of demand (absolute value) facing suppliers for their product in the i-th market segment at (P_a, Q_{ia}); and

$S_i = (Q_{ia}/Q_a)$ is the market share in the i-th market at P_a.

The optimal market share in the i-th segment after price discrimination, S_{id}, is:

$$(7)\quad S_{id}=0\cdot 5S_i\left(\frac{n_i}{n_a}+1\right)$$

and the optimal price in each market segment is:

$$(8)\quad P_{id}=P_a+0\cdot 5P_a\left(\frac{1}{n_i}-\frac{1}{n_a}\right)$$

The model presented above reflects the simple case where a fixed quantity of production is allocated in a profit-maximising manner across n operational markets. Such a model ignores supply costs and might be used to measure the return in the short run to an industry with a perfectly inelastic supply.

Alternative models which incorporate supply costs could include monopolistic production control, or a competitive supply response to the pooled price. The former is the case of a discriminating monopolist which was originally considered by Pigou (1920) and Robinson (1933), and is discussed by Phlips (1983). The focus in this paper is on the latter case where it is presumed that the returns associated with segmentation are pooled and paid to all producers on an annual or a production period basis. This is the situation that would be faced by a co-operative marketing agency, or an exporting agency with control over the destination and pricing of products, but not production. In the following section the effects of this competitive supply response are incorporated into the model.

Supply Response to Gains from Market Segmentation

The influence of a production response to increasing returns from price discrimination is depicted in Figure 2. The equilibrium (P_{ad}', Q_a'), which equates the supply cost with average producer returns from discrimination, defines a new level of producer welfare and total revenue to the industry.

It can be seen from Figure 2 that the revenue gains in moving from a simple competitive equilibrium (P_a, Q_a), to a discriminating equilibrium, (P_{ad}', Q_a'), will lead to an increase in producer revenue. This increase can be broken into two components. The first, $(P_{ad}'-P_a')Q_a'$, is equivalent to the revenue gains, K, from discriminating with a given supply, Q_a', and has already been defined. The second is equivalent to the revenue change associated with the movement down the non-discriminating aggregate demand curve $(P_a'Q_a'-P_aQ_a)$, and may be positive or negative, depending on the elasticity of this aggregate demand curve in this region.

$$(9)\quad \Delta TR=P_{ad}'Q_a'-P_aQ_a$$

$$(10)\quad\quad =K+(P_a'Q_a'-P_aQ_a)$$

By utilising equations (2) and (5b), and an assumed linear supply function of the inverse form,

$$(11)\quad P_s=c+dQ_a \qquad c,\ d>0$$

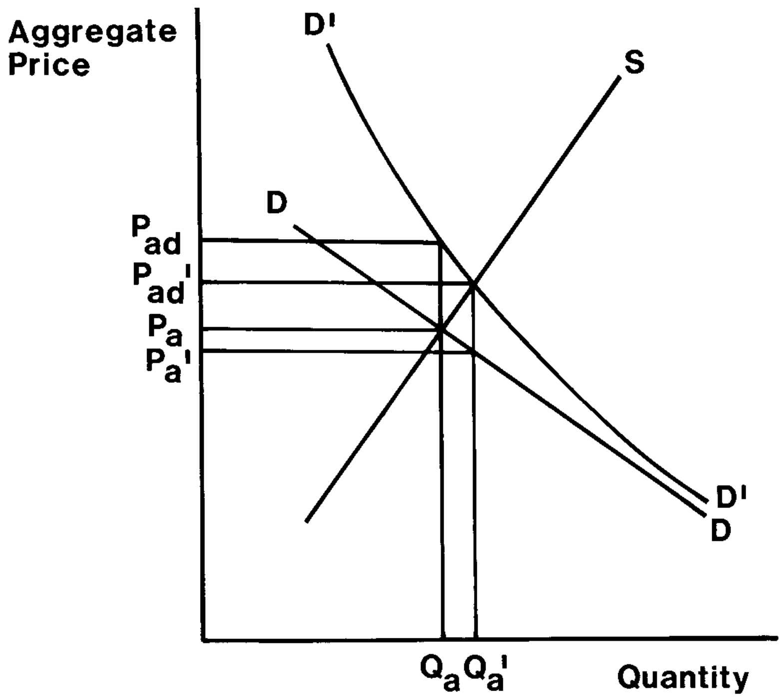

FIGURE 2—Returns from Price Discrimination with Supply Response.

where P_s is the producer price of the product; and
Q_a is the aggregate supply,

an algebraic expression can be derived to measure this revenue effect:

$$(12)\quad \Delta TR = K + \left[\frac{P_a^2 Q_a^2}{4} + P_a Q_a\, K\left(\frac{n_a e}{n_a + e}\right)\right]^{0\cdot 5} - \frac{P_a Q_a}{2} - K\left(\frac{e}{n_a + e}\right)$$

where K is the gain in revenue from discrimination with a given level of supply;
n_a is the price elasticity of demand at (P_a, Q_a); and
e is the price elasticity of supply at (P_a, Q_a).

It can be seen from equation (12) that in the case where the supply elasticity tends to zero, the change in total revenue will tend to K, the static or short-run gains. In the long-term situation when the supply curve is more elastic, the revenue gains may be greater or less than K depending on the magnitude of the demand elasticity, n_a. In this case:

$$(13)\quad \Delta TR = \left[\frac{P_a^2 Q_a^2}{4} + P_a Q_a K n_a\right]^{0\cdot 5} - \frac{P_a Q_a}{2} \qquad e \to \infty$$

A similar measure can be derived to estimate the changes in producer welfare utilising equations (2), (5b) and (11). From Figure 2, it would be expected that with inelastic supply conditions, the gain in producer welfare would approach K, and with elastic supply conditions it would tend to zero.

The specific measure of the change in producer surplus (ΔPS) associated with the use of market segmentation can be shown to be:

$$(14)\quad \Delta PS=\frac{1}{4e}\left\{\left[P_a^2Q_a^2+4P_aQ_a\,K\left(\frac{n_ae}{n_a+e}\right)\right]^{0\cdot 5}-P_aQ_a+2K\left(\frac{n_ae}{n_a+e}\right)\right\}$$

The change in producer surplus approaches zero as e increases, but it is not obvious that it approaches K as e decreases. In addition, it is not immediately apparent from (14) how the change in producer surplus varies with changes in the aggregate demand elasticity, n_a. Such questions can best be handled with a numerical example. This is shown in Table 1, where the impact of changing the aggregate demand and supply elasticities is outlined for a simple two-market segment example with specific characteristics. In interpreting such data, it may be useful to consider a low supply elasticity as a short-run situation and a higher supply elasticity to represent the long run.

Consider the influence of changing aggregate demand elasticities. Given a constant divergence between demand elasticities in individual market segments, the initial price discrimination gains, K, decrease as the aggregate demand elasticity, n_a, increases. As a result of this effect, total revenue gains also decrease as n_a increases. However, it can be seen that when the aggregate demand elasticity is less than one in absolute terms, the total revenue change, ΔTR, is less than the initial revenue change, K. Conversely, for an aggregate demand elasticity greater than one, the total revenue change is greater than the initial revenue change. For producer surplus gains, the situation is more straightforward, with these gains decreasing as n_a increases, with an apparent upper bound of the initial revenue gains, K.

The influence of changing supply elasticities is less complex. In this case, the static revenue gains, K, which are not influenced by the supply elasticity, remain unchanged. However, total revenue gains, ΔTR, decrease as e increases, though not markedly so. However, producer surplus gains show a relatively sharper decrease as the supply elasticity increases.

From the standpoint of an export marketing agency, it can be seen that there will always be gains in revenue and producer welfare from following a market segmentation strategy, but the actual magnitude of these gains is highly dependent on market conditions. Increases in producer welfare will decrease as supply responds, even though total export revenue may increase. A further consideration is the manner in which demand elasticities may change in the short and long term. If it is assumed that there are competitive suppliers in the individual markets who will respond to changing prices, then it may be argued that the effective demand elasticities facing the export agency will increase in the long term. While the influence of alternative market conditions is highlighted in the simple example given above, the restrictive assumptions mean that these other points cannot be considered, and therefore, little indication is provided of the actual magnitude of gains which an industry operating in a non-homogeneous product market might expect to receive.

TABLE 1

Implications for Producer Gains of Changing Aggregate Elasticities[a]

Influence of varying n_a				Influence of varying e			
n_a	K (\$m)[b]	ΔTR (\$m)	ΔPS (\$m)	e	K (\$m)	ΔTR (\$m)	ΔPS (\$m)
0·26	2946·0	289·0	466·0	0·26	4·167	4·164	3·301
1·00	4·167	4·150	2·075	1·00	4·167	4·150	2·075
10·00	0·004	0·007	0·003	10·00	4·167	4·111	0·376

[a] Assumptions: P_a = \$1000/t; Q_a = 250 000 t; $S_1 = S_2 = 0{\cdot}5$; $e = 1{\cdot}0$ when n_a varies; $n_a = 1{\cdot}0$ when e varies; and $n_2 - n_1 = 0{\cdot}5$.
[b] All monetary amounts are expressed in NZ dollars.

An Application — New Zealand Sheep Meat Exports

A hypothetical reallocation of New Zealand sheep meat exports was considered for the 1979–80 season. This particular year was chosen for a number of reasons. In the first instance, voluntary export restraints had not yet been exercised by the European Community and empirical evidence suggests that there was minimal effective policy intervention in the global sheep meat market at that time (Blyth 1983). Also at that time there was considerable producer pressure for the New Zealand Meat Producers' Board to exercise its statutory authority to control the marketing of New Zealand sheep meat exports. In fact, the benefits from price discrimination activities were seen to be one of the major justifications for the control over export marketing which was later exercised by the Board. New Zealand export data (New Zealand Meat Producers' Board 1980) and world trade data (US Department of Agriculture 1982) were used to derive a set of trade flows between New Zealand and other exporters, and the major importing countries. A recent model of the world sheep meat market (Blyth 1983) provided estimates of the necessary demand and price transmission elasticities. This data set is presented in Appendix Tables A.1 and A.2.

Implementation of the model requires estimates of demand elasticities for the product of concern in each potential market segment. It is obvious that this elasticity can vary markedly from the aggregate elasticities which would normally be estimated in a competitive trade model. An approximation of the relationship between these elasticities can be derived, however, using a technique normally associated with estimating the aggregate demand for a country's exports (Bredahl, Myers and Collins 1979; Cronin 1979). By adapting Cronin's formula, it can be shown that the elasticity of demand facing exporter j in market i (n_{ij}) is:

$$(15) \quad n_{ij} = \sigma_{ij}\left(n_{ii}\, C_i/I_{ij} - e_{ii}\, S_i/I_{ij} - \sum_k \varepsilon_{ik}\, I_{ik}/I_{ij} \right)$$

where σ_{ij} is the elasticity of price transmission between the imported product price and the domestic product price in market i;

n_{ii} and e_{ii} are domestic demand and supply elasticities, respectively;

ε_{ik} is the elasticity of imports from other suppliers with respect to changes in the local price in market i;

C_i and Y_i are consumption and local supply in market i, respectively; and

I_{ij} and I_{ik} are imports into market i from exporter j and all other exporters, respectively.

Relationships of this form are normally associated with trade in homogeneous products, and the price transmission elasticities which reflect the relationship between the world price and the domestic price of this homogeneous product tend to be used as a measure of trade barriers. In this case, the price transmission elasticity is assumed to reflect the relationship between the price of the imported product and all other sheep meat prices in that market. Because there was relatively little policy intervention in these markets at that time, it can be assumed that these relationships reflected the degree of product heterogeneity. In fact, the elasticity estimates used in this analysis are based on the world price (cif Smithfield) of New Zealand lamb, and the individual domestic prices for most of the countries concerned. However, the use of these data in equation (15) provides some approximation of the expected relationships in a heterogeneous product market. It can be seen that the effective demand is a positive function of the price transmission elasticity, implying that the less homogeneous the product the lower the effective demand elasticity.

The elasticity is also influenced by the relative share and size of the market concerned while the effect of competition from other suppliers is incorporated indirectly through their response to changing domestic prices. Such a response may occur relatively quickly when competitors arbitrage in their product or more slowly as their production responds. In the absence of any specific data on these elasticities, the results are presented initially assuming no response from competitors, and then with an assumed unitary elasticity. The comparison reflects not only varying degrees of product homogeneity but also short-run and long-run effects which would be associated with production and arbitraging lags from competitors. It is apparent that more direct estimates of these responses would improve the accuracy of measuring the benefits of adopting a segmentation strategy. At this stage, however, there are few theoretical models available for estimating such responses and none exist for sheep meats. An interesting exception is a recent beef industry model developed by Goddard (1985). In that study estimates of the substitution and cross-price elasticities between products from alternative sources are derived from a modified market share model.

The price elasticity of demand facing an exporter in any particular market segment also varies directly with the price elasticity of demand for the product from all sources in that market. Blyth (1983) acknowledges that her demand estimates may be somewhat low, which would induce an upward bias in potential market segmentation gains. In addition to this, it must be noted that transport costs or those costs associated with monitoring and enforcing a commercial strategy aimed at restricting arbitrage in New Zealand product are not considered in the model. Therefore, the results which follow must be regarded in each case as an upper bound to gains which could be realised.

Results

In the empirical analysis, three alternative scenarios are developed to highlight the source of potential benefits. The first case is a representation of the short-run situation where it is assumed that the existing level of exports is reallocated among the eight markets and that there is no response from other exporters. The demand elasticities in the individual markets are derived from the first term in equation (15) and are presented in Table 2 along with the share of New Zealand sheep meat exports which were observed during 1979–80. The optimal market shares and market prices under price discrimination are also shown. As would be expected, prices increase in markets with low demand elasticities, while the converse occurs in markets with high demand elasticities. The average revenue is increased by 26 per cent to $NZ3280, representing a gain to the industry of $NZ307m which, in the absence of supply response, would represent an upper bound to the initial gain in producer welfare.

A prevalent commercial practice used to control product flows to overseas markets is to penalise exporters who originally handle product which finds its way to unintended markets through arbitrage. However, even when such behaviour can be contained, these short-run gains may soon be eroded by the response to discriminatory pricing from the supplying country itself or from its competitors.

To show how supply response in the supplying country would affect these gains, alternative levels of supply response in New Zealand were simulated. Under each supply condition the optimal allocation and

TABLE 2

Market Segmentation in the Sheep Meat Market: Short Run

Region	Regional elasticity (n_i)	Existing market share[a] (S_i)	Optimal market share[a] (S_{id})	Optimal prices[b] ($'000/t) ($P_{id}$)
Canada	1·88	0·022	0·023	2·53
United States	2·31	0·024	0·028	2·40
European Community (8)	3·78	0·030	0·048	2·18
United Kingdom	0·32	0·410	0·243	5·90
Iran	1·78	0·144	0·147	2·57
Japan	5·46	0·060	0·126	2·07
USSR	4·63	0·138	0·250	2·12
Rest of world	0·85	0·173	0·129	3·36

Aggregate Market: Short Run

Variable	Existing situation	Optimal solution
Elasticity (n_a)	1·71	[c]
Price/average revenue ($'000/t)	2·60	3·28
Total revenue ($m)	1170	1478
Quantity ('000 t)	450	[d]

[a] Does not add to 1·00 due to rounding.
[b] All monetary amounts are expressed in NZ dollars.
[c] Not calculated.
[d] No quantity adjustment in the short run.

returns were estimated using the analytical model. Assuming initially that demand conditions are to remain stable in the future, these results are indicative of types of changes which might be expected in a competitive industry over time. The extent of the long-term response depends, of course, on the cost structure and other factors which influence entry into an industry. From the results in Table 3, it can be seen that as the supply response increases, average revenue from the segmentation policy would fall but production would increase. Total revenue, which in this case also represents foreign exchange earnings, would increase but at a decreasing rate. The gain in total revenue is limited by the quantity which would be consumed when the average revenue approaches the original competitive price. This ignores the possibility of a decreasing cost industry which would allow average revenue to fall even further. As has already been noted, the change in producer surplus approaches zero as the supply response increases, but it must be realised that, in the long-run situation, the number of producers will change and this must be considered in interpreting returns to the industry. The results are consistent with outcomes in a competitive industry where freedom of entry and exit ensures that, in the long run, returns to individual producers are normal. It is interesting to consider that existing producers are likely to benefit the most from such a strategy in the short term, while the growth in output and revenue would be a long-term benefit for the economy as a whole. This would not be the case in an industry where the aggregate demand elasticity is less than one. Total revenue would then be at a maximum when supply is inelastic, which might only occur in the short run.

The other major influence on long-term gains from a segmentation strategy is the competitive reaction within the consumer market. It has been suggested that this response would increase the effective demand elasticity in each market. The data presented in Table 4 show how the demand elasticity in each market would increase when it is assumed that the domestic production response in each market (e_{ii}) and the competitors' response elasticities (ε_{ik}) are unity. It is also assumed that the supply response in New Zealand has unitary elasticity. The demand elasticity has increased in all markets and the relative elasticities have also changed between markets, which affects the optimal market shares

TABLE 3

Impact of Alternative Levels of Supply Response in New Zealand on Gains from Market Segmentation[a]

Supply elasticity (e)	Total supply ('000 t) (Q_{ad}')	Average revenue ($'000/t) ($P_{ad}'$)	Change in: Total revenue ($m) ($\Delta TR$)	Change in: Producer surplus ($m) ($\Delta PS$)
0·0	450	3·28	307	307
0·5	492	3·08	347	228
1·0	515	2·97	363	182
5·0	569	2·73	388	70
10·0	583	2·68	391	40

[a] All monetary amounts are expressed in NZ dollars.

and relative prices. It is important to note that the range of optimal prices over the markets has lessened as the demands have become more elastic, and optimal average revenue is less than in the short-run case (Table 2). It is estimated that in this particular environment, the average revenue has increased only by 3·5 per cent, and total supply has increased by a similar amount. Thus, total revenue would be about 7 per cent higher than it is in the existing situation, and producer surplus would increase by only $NZ42m. While these results are dependent on the assumptions which have had to be made about the degree of the own and competitive response, they are useful for gauging the sensitivity of the outcomes to changing market conditions.

The time span over which the potential short-term increases in producer welfare are eroded will depend on the nature of the competitive response. If it is largely an arbitraging reaction, then the initial gains will be fleeting. However, if producers respond by increasing output, then the length of the production cycle will determine how long it takes to erode market segmentation gains.

Conclusions and Implications for Marketing Agencies

A framework for evaluating the impact of pursuing a market segmentation strategy in an agricultural industry has been presented. It has been argued that such a strategy is possible where products in a market are non-homogeneous and a marketing agency exists to implement an allocation and pricing policy. The benefits associated with such a scheme are influenced by the presence of a competitive

TABLE 4

Market Segmentation in the Sheep Meat Market: Long Run

Region	Regional elasticity (n_i)	Existing market share[a] (S_i)	Optimal market share[a] (S_{id})	Optimal prices[b] ($'000/t) ($P_{id}$)
Canada	2·78	0·022	0·017	2·80
United States	11·81	0·024	0·050	2·42
European Community (8)	37·48	0·030	0·124	2·37
United Kingdom	1·82	0·410	0·276	3·03
Iran	7·16	0·144	0·172	2·51
Japan	10·27	0·060	0·090	2·46
USSR	6·16	0·138	0·151	2·54
Rest of world	1·09	0·173	0·120	2·97

Aggregate Market: Long Run

Variable	Existing situation	Optimal solution
Elasticity (n_a)	5·14	[c]
Price/average revenue ($'000/t)	2·60	2·69
Total revenue ($m)	1170	1253
Quantity ('000 t)	450	466
Change in total revenue ($m)		83
Change in producer surplus ($m)		42

[a] Does not add to 1·00 due to rounding.
[b] All monetary amounts are expressed in NZ dollars.
[c] Not calculated.

supply sector, and it has been shown that the distribution of benefits over time is also affected by the aggregate demand elasticities and long-run supply conditions in the market.

The reaction of competitive suppliers is difficult to measure but has also been shown to be a major factor. It may be argued that promotional effort and product developments, such as improved grading, might be used to minimise this effect by creating a less homogeneous product. However, the costs associated with such activities must be offset against the benefits described here. The extent of the marketing power associated with particular marketing institutions is an empirical question, and based on the preliminary results presented here for New Zealand's sheep meat exports, the returns could possibly be low, especially in the long run. However, before the accuracy of these estimates could be improved it would be necessary to develop alternative models of international trade which focus on the heterogeneous nature of the products concerned and the degree of substitution between these products. While such models will provide challenges in model specification and data collection, they are an essential part of understanding the trading and marketing behaviour of some agencies.

APPENDIX

Data Used in Sheep Meat Market Analysis: 1979–80

TABLE A.1
Quantities

Market	Production (Y_i) '000 t	Consumption (C_i) '000 t	Imports: NZ (I_{ij}) '000 t	Imports: Total ($I_{ij}+I_{ik}$) '000 t
Canada	5	19	10	14
United States	144	159	11	15
European Community (8)	350	410	13	102
United Kingdom	278	432	184	191
Iran	350	415	65	65
Japan	0	157	27	157
USSR	na	na	62	157
Rest of world	na	na	78	165
Total			450	866

na — Not available.

Sources: New Zealand Meat Producers' Board (1980) and US Department of Agriculture (1982).

TABLE A.2
Elasticities[a]

Market	Demand (n_{ii})	Price transmission (σ_{ij})
Canada	−0·99	1·00
United States	−0·16	0·81
European Community (8)	−0·12	0·94
United Kingdom	−0·14	0·94
Iran	−0·28	0·56
Japan	−0·94	0·64
USSR	−1·83	1·24
Rest of world	−0·40	1·00

[a] The competitive price for all markets is $NZ2600/t.
Source: Blyth (1983).

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