OPTIMAL PRICING AND PROMOTION FOR AGRICULTURAL MARKETING AGENCIES

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PREFACE

Marketing agencies which operate in international markets are faced with pricing and promotion decisions in individual markets. Economic theory can assist in these tasks by providing a framework for evaluating specific commercial strategies in particular products.

Therefore, the Agricultural Economics Research Unit has an interest in theoretical research which widens our understanding of optimal decision-making by agencies operating in agricultural markets.

Mrs S.K. Martin has been considering aspects of the economics of market segmentation by agricultural marketing institutions as part of her doctoral dissertation under the supervision of Professor A.C. Zwart. This Research Report outlines one aspect of this research. It was undertaken in collaboration with Professor L. Young from the University of Texas, Austin, Texas, USA. Professor Young derived the solutions to the problem established in Chapter 3.

R.G. Lattimore
Director

CHAPTER 1

INTRODUCTION

In recent years, marketing institutions operating in New Zealand's agricultural export sector have placed increasing emphasis on market segmentation strategies as an economic instrument. Indications that marketing institutions have moved towards this type of policy are evident in attempts to diversify markets, and to gear promotion activities and product development to specific market segments. The change in policy emphasis by these agencies reflects the increasing influence of the prescriptions of marketing management in agricultural marketing.

When the general term 'market segmentation' is used in the marketing management context, it tends to refer to the practices of segmenting a market, targeting specific market segments, and positioning products within these segments. Product positioning requires the development of a marketing mix for each target segment using a particular blend of controllable marketing variables (Kotler, 1984).

In attempting to apply these principles in the markets for agricultural products, agencies are faced with the problem of how much product to allocate to individual market segments, and what pricing and promotion strategies to adopt in each of these segments. The prescriptions of economic theory can assist in these tasks, by indicating optimal strategies for a particular marketing agency objective. In the literature, attention has been directed towards this problem of determining optimal marketing mixes (Lambin, 1976). However, much of it uses extensions to the theory of monopolistic or oligopolistic markets, but in typical

agricultural industries these market conditions do not apply.

In this Report, the development of economic models of marketing behaviour are discussed, and the analysis is extended to consider the specific environment faced by an agricultural marketing agency. The major feature of such analysis is the incorporation of a competitive supply response in a model which determines the optimal pricing and promotion strategies in more than one market segment.

The following Chapter describes the development of such models, while Chapter 3 focusses on their extension. The final Chapter compares the alternative model prescriptions for pricing and promotion.

CHAPTER 2

ALTERNATIVE MODELS AND THEIR OPTIMAL MARKETING STRATEGIES

Since a great deal of attention in the literature has been directed towards the marketing behaviour of a monopolistic firm (Lambin, 1976), a generalised version of this problem will be discussed, and variants and extensions of this general model will be subsequently examined.

Consider a monopolist who operates in a number of predetermined market segments, and provides a product of identical quality to each of these segments. In this case, demand in the ith market segment, Q_i, can be written as

$$(1) \qquad Q_i = Q_i(P_i, A_i)$$

where P_i and A_i are price and advertising, respectively, in that segment. Aggregate demand, Q, is then given by

$$(2) \qquad Q = \sum_i Q_i(P_i, A_i)$$

If the firm maximises profit net of advertising costs, then its profit function, $\prod$, is

$$(3) \qquad \prod = \sum_i P_i Q_i(P_i, A_i) - C(Q) - \sum_i A_i$$

where C(Q) is the total cost of producing output Q. To develop appropriate decision rules for marketing mix optimisation, this objective function, $\prod$, would be maximised.

Variants of this generalised problem have been examined in the literature. For example, Dorfman and Steiner (1954) considered marketing mix optimisation by a monopolist in one (aggregate) market, where the decision variables available to the firm are price or output, and advertising. In this case, demand, Q, is given by

$$Q = Q(P,A) \tag{4}$$

and the profit function, $\prod$, by

$$\prod = PQ(P,A) - C(Q) - A \tag{5}$$

where P and A are price and advertising.

When this profit function is maximised, it yields the optimal advertising decision rule

$$\theta = \beta\left[\frac{P - MC}{P}\right] \tag{6}$$

where θ is the advertising to sales ratio, A/(PQ), β is the advertising elasticity of demand, and MC is marginal cost. The corresponding product-price decision rule is given by

$$\left[\frac{P - MC}{P}\right] = 1/\eta \tag{7}$$

where η is the price elasticity of demand (absolute value). This is the familiar profit-maximising rule where marginal cost equals marginal revenue.

These optimal product-price and advertising decision rules can be expressed in a single relationship which encapsulates both rules as follows.

$$\theta = \beta/\eta \tag{8}$$

Equation (8) has become known as the Dorfman-Steiner theorem, and is appropriate for a monopolist operating in a single market, which includes a marketing agency concerned with aggregate demand and with the ability to control output. This theorem of optimal advertising by a monopolist has been extended to include oligopolistic market structures (Lambin, 1976), and from its static formulation to include the dynamics of the sales response to advertising (Nerlove and Arrow, 1962).

Although the Dorfman-Steiner model considers price, product and promotion as elements in its marketing mix, it abstracts from the fourth variable of place, or market segments. An alternative model which does this, but which abstracts from promotion, is the familiar model of monopolistic price discrimination. In this case, demand, Q, is given by

$$(9) \qquad Q = \sum_i Q_i(P_i)$$

and the profit function, $\prod$ by

$$(10) \qquad \prod = \sum_i P_i Q_i(P_i) - C(Q)$$

Maximisation of this profit function gives the familiar output and pricing rules for a price discriminating monopolist. That is,

$$(11) \qquad MR_1 = MR_2 = \ldots = MR_i = \ldots = MC$$

where MR_i is marginal revenue in the ith market and MC is the marginal cost of production.

The decision rules derived from these models give partial indicators as to how a profit-maximising monopolist might optimally choose a marketing mix or mixes in specific

circumstances. However, such prescriptions are not appropriate for a marketing agency operating in a typically structured agricultural industry. When operating collectively on behalf of producers, such institutions may be able to exert monopoly power in their markets. However, in New Zealand, they do not have the power to restrict output by producers. Therefore, when producers receive higher returns, in the form of a pool price, which results from demand management strategies in individual market segments, they may respond by increasing output accordingly. Unlike the monopoly case, where output is a decision variable which can be optimised, output is determined competitively.

Nerlove and Waugh (1961) recognised these supply-side differences between a monopolist and a typical agricultural marketing agency. Assuming the above agricultural supply conditions, they considered the optimal advertising decision for such agencies operating in one (aggregate) market. In their model, demand, Q, is given by

$$Q = Q(P,A) \tag{12}$$

and supply can be represented by

$$S = S(P) \tag{13}$$

where S is the output supplied at price P. The profit function to be maximised then becomes

$$\prod = PQ(P,A) - C(S(P)) - A \tag{14}$$

where C(S), the aggregate cost of production, is the area under the supply curve to the left of S. However, this profit function must be maximised subject to the constraint that excess supply is zero. That is,

$$Q(P,A) = S(P) \tag{15}$$

The solution to the Nerlove-Waugh model yields the following advertising decision rule

$$(16) \qquad \theta = \frac{\beta}{\eta + \varepsilon}$$

where ε is the price elasticity of supply and other variables are as defined for the Dorfman-Steiner model.

In the Nerlove-Waugh case, the optimal promotion decision can be determined by the marketing agency, whereas the product-price decision is determined by the market. However, like its counterpart, the Dorfman-Steiner theorem, this model abstracts from the marketing mix variable, place, since it does not consider pricing and promotion strategies in individual market segments.

An attempt was made by De Boer (1977) to examine the direction of advertising effort to individual market segments under discriminatory pricing between these segments. However, his prescriptions for agricultural marketing agencies are not necessarily valid, since he assumes monopolistic supply features. In fact, the theory of advertising under competitive agricultural supply conditions has advanced little since the Nerlove-Waugh theorem (Strak, 1985).

An obvious extension to the Nerlove-Waugh theorem would be to consider the allocation of optimal advertising effort among a number of market segments, where price in each of these segments is determined by aggregate (total) demand and supply conditions. This has been done by Martin (1985).

In this case, demand in market segment i is given by

$$(17) \qquad Q_i = Q_i(P, A_i)$$

and aggregate demand by

$$(18) \qquad Q = \sum_i Q_i(P, A_i)$$

Supply is represented by

$$(19) \qquad S = S(P)$$

The profit function to be maximised is given by

$$(20) \qquad \Pi = P\sum_i Q_i(P, A_i) - C(S(P)) - \sum_i A_i$$

subject to the constraint that

$$(21) \qquad \sum_i Q_i(P, A_i) = S(P)$$

In this case, optimal advertising effort in market segment i, is given by

$$(22) \qquad \theta_i = \frac{\beta_i}{\eta + \varepsilon}$$

where $\theta_i = \frac{A_i}{PQ_i}$ and β_i is the advertising elasticity of demand in market segment i, with all other variables being defined as for the Nerlove-Waugh model.

In a two market segment case, the relative direction of advertising effort can be given by the following ratio.

$$(23) \qquad \frac{A_1/Q_1}{A_2/Q_2} = \frac{\beta_1}{\beta_2}$$

That is, the ratio of advertising per unit sales in one market segment to that in the other market segment is equal to the ratio of the corresponding advertising elasticities.

Although the above model extends the Nerlove-Waugh theorem to consider a number of market segments, it abstracts from optimal pricing policies which such an institution might pursue when it has the power to control the allocation of industry output among alternative market segments. Consequently, the next Chapter develops a marketing mix optimisation model which yields decision rules for optimal pricing and promotion in individual market segments, and which takes account of typical agricultural supply features.

In such a case, demand is represented by

$$(24) \qquad Q = \sum_i Q_i(P_i, A_i)$$

and supply by

$$(25) \qquad S = S(R)$$

where R is the return per unit of output, or pool price, received by the producer. This return is given by

$$(26) \qquad R \equiv \frac{\sum_i P_i Q_i(P_i, A_i)}{\sum_i Q_i (P_i, A_i)}$$

The profit function to be maximised is

$$(27) \qquad \Pi = \sum_i P_i Q_i (P_i, A_i) - C(S(R)) - \sum_i A_i$$

where C(S) is defined as for the Nerlove-Waugh model.

As with the Nerlove-Waugh case, the marketing agency is constrained to adopt policies such that it sells all the output supplied when producers receive the average return, R. That is,

$$(28) \qquad \sum_i Q_i(P_i, A_i) = S(R)$$

The solution to this constrained maximisation problem would yield decision rules for the optimal allocation of output, and therefore prices, in individual market segments, and for the optimal allocation of advertising effort to these segments. However, the aggregate output produced is determined by market forces.

CHAPTER 3

THEORETICAL ANALYSIS

For analytical ease, a two-market segment case of the generalised model outlined in the previous Chapter will be considered. To avoid cumbersome mathematical expressions, some of the notation will also be redefined.

Let d(p,a) be the demand in the first market segment where the price is p and advertising expenditure is a. The corresponding variables for the second market segment are denoted by the corresponding upper case letters. Producers receive the average return per unit of output, or the pool price,

$$(29) \qquad r(p,P,a,A) \equiv \frac{pd(p,a) + PD(P,A)}{d(p,a) + D(P,A)}$$

Let the supply at this pool price be s(r). The aggregate cost of production of supply, s, is the area, c(s), under the supply curve to the left of s. The marketing agency maximises aggregate profits net of advertising costs.

$$(30) \qquad \prod(p,P,a,A) \equiv pd(p,a) + PD(P,A) - c(d(p,a) + D(P,A)) - a - A$$

Let excess supply be

$$(31) \qquad x(p,P,a,A) \equiv s(r(p,P,a,A)) - d(p,a) - D(P,A)$$

The marketing agency is constrained to adopt policies such that it sells all output supplied when producers receive the pool price, r.

Therefore, it solves

$$(32) \qquad \max_{p,P,a,A} \Pi(p,P,a,A) \text{ subject to } x(p,P,a,A) = 0$$

Let λ be the Lagrange multiplier associated with the constraint in (32). Using a subscript to denote partial differentiation with respect to the corresponding variable, the Lagrange equations can be written in the form

$$\frac{\Pi_p}{x_p} = \frac{\Pi_P}{x_P} = \frac{\Pi_a}{x_a} = \frac{\Pi_A}{x_A} = \lambda$$

or

$$(33) \qquad \frac{d + (p - c_s)d_p}{s_r r_p - d_p} = \frac{D + (P - c_s)D_P}{s_r r_P - D_P} = \frac{(p - c_s)d_a - 1}{s_r r_a - d_a} = \frac{(P - c_s)D_A - 1}{s_r r_A - D_A}$$

Since c(s) is the area under the supply curve to the left of s,

$$(34) \qquad c_s(s(r)) = r,$$

Moreover, recalling the definition (29) of r,

$$(35) \qquad p - r = p - (pd + PD)/(d + D) = m/d$$

where

$$(36) \qquad m \equiv (p - P)dD/(d + D)$$

Note that with this definition

$$(37) \qquad P - r = -m/D$$

Using (34) - (37), the first order conditions (33) simplify to

$$(38)\qquad \frac{d + md_p/d}{s_r r_p - d_p} = \frac{D - mD_p/D}{s_r r_P - D_P} = \frac{md_a/d - 1}{s_r r_a - d_a} = \frac{mD_A/D - 1}{s_r r_A - D_A}$$

or

$$(39)\qquad \frac{pd + mpd_p/d}{\frac{srs_r}{s} \cdot \frac{pr_p}{r} - \frac{pd_p d}{d}} = \frac{PD - mPD_P/D}{\frac{srs_r}{s} \cdot \frac{Pr_P}{r} - \frac{PD_P D}{D}} = \frac{mad_a - a}{\frac{srs_r}{s} \cdot \frac{ar_a}{r} - \frac{ad_a d}{d}} = \frac{-mAD_A/D - A}{\frac{srs_r}{s} \cdot \frac{Ar_A}{r} - \frac{AD_A D}{D}}$$

Define the elasticities

$$(40)\quad e^P \equiv -pd_p/d;\ e^a \equiv ad_a/d;\ t^P \equiv pr_p/r;\ t^a \equiv ar_a/r;\ f^r \equiv rs_r/s$$

with similar definitions for the second market segment using the corresponding upper case symbols. Then (40) becomes

$$(41)\qquad \frac{pd - me^P}{sf^r t^P + de^P} = \frac{PD + mE^P}{sf^r T^P + DE^P} = \frac{me^a - a}{sf^r t^a - e^a d} = \frac{-mE^A - A}{sf^r T^A - E^A D}$$

The transmission elasticities are now evaluated. Since

$$r \equiv \frac{pd(p,a) + PD(P,A)}{d(p,a) + D(P,A)}$$

then

$$r_a/r = \frac{pdd_a + pDd_a - pdd_a - QDd_a}{(pd + QD)(d + D)}$$

$$= \frac{Dd_a(p - P)}{(pd + PD)(d + D)}$$

Therefore

(42) $$t^a \equiv ar_a/r$$

$$= \frac{ad_a(p - P)D}{(pd + PD)(d + D)}$$

$$= \frac{e^a dD(p - P)}{(pd + QD)(d + D)}$$

$$= \frac{e^a m}{(pd + PD)}$$

Similarly

(43) $$T^A \equiv Ar_A/r$$

$$= \frac{E^A dD(P - p)}{(pd + PD)(d + D)}$$

$$= \frac{-E^A m}{(pd + PD)}$$

Also

$$r_p/r = \frac{d(d + D) + pd_p d + pd_p D - pd_p d - PDd_p}{(pd + PD)(d + D)}$$

Therefore

$$(44) \qquad t^P \equiv pr_p/r$$

$$= \frac{pd(d + D) + pDd_p(p - P)}{(pd + PD)(d + D)}$$

$$= \frac{(pd - e^P dD(p - P))/(d + D)}{(pd + PD)} = \frac{pd - e^P m}{(pd + PD)}$$

Similarly,

$$(45) \qquad T^P \equiv Pr_p/r$$

$$= \frac{PD + E^P m}{(pd + PD)}$$

Substituting (21) - (24) into (20) gives

$$(46) \quad \frac{pd - me^P}{(pd - me^P)f^r/r + de^P} = \frac{PD + mE^P}{(PD + mE^P)f^r/r + DE^P} = \frac{me^a - a}{me^a f^r/r - de^a} = \frac{-mE^A - A}{-mE^A f^r/r - E^A D}$$

Inverting all expressions in (46)

$$(47) \quad \frac{f^r}{r} + \frac{de^P}{pd - me^P} = \frac{f^r}{r} + \frac{DE^P}{PD - mE^P} = \frac{f^r me^a}{r(me^a - a)} - \frac{de^a}{me^a - a} = \frac{f^r mE^A}{r(mE^A + A)} + \frac{DE^A}{ME^A + A}$$

Subtracting $\frac{f^r}{r}$ from each term in (47)

$$(48) \quad \frac{de^P}{pd - me^P} = \frac{DE^P}{PD - mE^P} = \frac{f^r a}{r(me^a - a)} - \frac{de^a}{me^a - a} - \frac{-f^r A}{r(mE^A + A)} + \frac{DE^A}{mE^A + A}$$

Inverting each expression in (48)

$$(49) \quad \frac{P}{e^P} - \frac{m}{d} = \frac{P}{E^P} + \frac{m}{D} = \frac{me^a - a}{af^r/r - de^a} = \frac{mE^A + A}{-Af^r/r + DE^A}$$

(49) can be alternatively expressed

$$(50)\quad \frac{P}{e^P} - \frac{m}{d} = \frac{P}{E^P} + \frac{m}{D} = \frac{\frac{a}{e^a} - m}{d - \frac{a}{e^a} \cdot \frac{f^r}{r}} = \frac{\frac{A}{E^A} + m}{D - \frac{A}{E^A} \cdot \frac{f^r}{r}}$$

Expression (50) gives the first-order conditions in their final form. Optimal pricing and promotion policies in both market segments can now be determined by making the appropriate pairwise comparisons between equations in (50).

Consider the first two equations in (50) and substitute (35) and (37) into them. This gives

$$\frac{P}{e^P} + r - p = \frac{P}{E^P} + r - P$$

or

$$(51)\qquad p(1 - 1/e^P) = P(1 - 1/E^P)$$

The left and right hand sides of (51) are simply the marginal revenues from sales in the first and second market segments. Equation (51) gives the optimal pricing decisions in the first and second market and the relationship between them.

Without loss of generality, assume that, at the optimum, $e^P < E^P$, so that $p > P$ and $m > 0$.

Consider the first and third equations in (50). Since they are equal

$$\left(\frac{p}{e^p} - \frac{m}{d}\right)\left(d - \frac{af^r}{e^a r}\right) = \frac{a}{e^a} - m$$

$$\frac{pd}{e^p} - m - \frac{apf^r}{e^a r e^p} + \frac{maf^r}{rde^a} = \frac{a}{e^a} - m$$

$$\frac{pd}{e^p} \cdot \frac{e^a}{a} = 1 + \frac{f^r}{r}\left(\frac{p}{e^p} - \frac{m}{d}\right)$$

$$\frac{e^a}{a} = \frac{e^p}{pd} + \frac{f^r}{rd} - \frac{e^p}{pd} \cdot \frac{f^r m}{rd}$$

$$= \frac{e^p + f^r}{rd} + \frac{e^p}{d}\left(\frac{1}{p} - \frac{1}{r} - \frac{1}{p} \cdot \frac{f^r m}{rd}\right)$$

$$= \frac{e^p + f^r}{rd} + \frac{e^p}{dr}\left(\frac{r}{p} - 1 - \frac{f^r(p - r)}{p}\right)$$

That is,

$$\frac{e^a}{a} = \frac{e^p + f^r - e^p(1 + f^r)\left(1 - \frac{r}{p}\right)}{rd}$$

or

$$\frac{a}{rd} = \frac{e^a}{e^p + f^r - e^p(1 + f^r)\left(1 - \frac{r}{p}\right)} \tag{52}$$

This equation gives the optimal advertising decision for the first market segment when an optimal pricing policy is pursued in that segment.

By a similar comparison of the second and fourth equations in (50), the corresponding optimal advertising decision in the second market is given by

$$\frac{A}{rD} = \frac{E^A}{E^P + f^r - E^P(1 + f^r)\left(1 - \frac{r}{P}\right)} \tag{53}$$

Note that when a single market is assumed, (52) and (53) collapse to the Nerlove-Waugh theorem.

The relationship between advertising in the two market segments can be examined by considering (52) and (53). Under the convention that $e^P < E^P$, which gives $P < p$, then $P < r < p$, and

$$(54) \qquad \frac{a}{rd} > \frac{e^a}{e^P + f^r}$$

and

$$(55) \qquad \frac{A}{rD} < \frac{E^A}{E^P + f^r}$$

Now this implies that

$$\frac{a}{rde^a} > \frac{1}{e^P + f^r} > \frac{1}{E^P + f^r} > \frac{A}{rDE^A}$$

or

$$(56) \qquad \frac{a/d}{A/D} > \frac{e^a}{E^A}$$

That is, the ratio of advertising per unit sales in the less price elastic market segment to that in the more price elastic market segment exceeds the ratio of the corresponding advertising elasticities.

CHAPTER 4

CONCLUSIONS

In the previous Chapter, optimal pricing and promotion rules were determined for an agricultural marketing agency which has control over these marketing variables, but not over production. These optimal policies will now be briefly compared with those prescribed by alternative models.

The optimal pricing policy was to set prices in the two market segments so as to equate the marginal revenue from selling in each market. That is, a higher price should be charged in the market segment with the lower price elasticity. Thus, the conventional rule of the price-discriminating monopolist for allocating output to market segments should be maintained, even though the marketing agency is required to sell all output supplied to it. However, the marginal revenues in these individual market segments are not required to equal the marginal cost of production, and hence, the profit-maximising monopoly level of output is not produced.

Given optimal pricing, the optimal ratio of advertising in a market segment to producer returns from that segment is given by equations (52) and (53). That is, optimal advertising in a segment is a function of the advertising and price elasticities of demand in that segment, the price elasticity of supply, and a measure of the relationship between the optimal price in that segment and the pool price returned to suppliers.

Recall the Nerlove-Waugh theorem that a marketing agency facing a single market should choose policies such that the ratio of advertising to sales revenue equals the ratio of the advertising elasticity to the sum of the demand

and supply elasticities. By comparison, a price-discriminating marketing agency should choose advertising policies such that in the market segment with the lower (higher) price elasticity of demand, the ratio of advertising to producer payments should exceed (be less than) the ratio of the advertising elasticity in that market to the sum of the demand and supply elasticities in that market. That is, relatively more (less) advertising effort (as measured by the advertising to producer returns ratio) would be directed to the less (more) price elastic market segment than would be the case if this was the only market faced by the agency.

Finally, consider relative advertising effort in each market segment, and recall from inequality (56) that the ratio of advertising per unit sales in the less price elastic market to that in the more price elastic market exceeds the ratio of the corresponding advertising elasticities. Equation (23) indicates that where pricing is uniform across market segments and market determined, then the ratio of advertising per unit sales in one market segment to that in the other market segment equals the ratio of the corresponding advertising elasticities. That is, under optimal pricing, relatively more (less) advertising effort (as measured by advertising per unit sales) is directed to the less (more) price elastic market segment than under uniform pricing across these segments. This result makes intuitive sense, since relatively more advertising effort is directed to the less price elastic segment where the potential to exploit monopoly power through discriminatory pricing is greater.

REFERENCES

De Boer, A.J. (1977), Rural Product Promotion: Economic Aspects of Promotability, Organisation and Public Assistance. Review of Marketing and Agricultural Economics, 45(4): 121-145.

Dorfman, R. and Steiner, P.O. (1954), Optimal Advertising and Optimal Quality. American Economic Review, 44(2): 826-836.

Kotler, P. (1984), Marketing Management (5th Ed.). New Jersey, Prentice-Hall, 792 p.

Lambin, J.J. (1976), Advertising, Competition and Market Conduct in Oligopoly over Time. Amsterdam, North-Holland, 312 p.

Martin, S.K. (1985), An Extension of the Nerlove-Waugh Theorem to Multiple Market Segments. Unpublished Working Paper, Department of Agricultural Economics and Marketing, Lincoln College.

Nerlove, M. and Waugh, F.V. (1961), Advertising without Supply Control: Some Implications of a Study of the Advertising of Oranges. Journal of Farm Economics 43(4): 813-837.

Nerlove, M. and Arrow, K.J. (1962), Optimal Advertising Policy under Dynamic Conditions. Economica 29 (May 1962): 129-142.

Strak, J., Optimal Advertising Decisions for Farmers and Food Processors. Journal of Agricultural Economics 34(3): 303-315.

RECENT PUBLICATIONS

RESEARCH REPORTS

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