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**Agricultural Marketing Channels:
Determinants of Contract Choice**

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Abstract

Although the use of various forms of marketing contracts is increasing within agricultural marketing channels, there has been only a limited number of research efforts which investigate the factors influencing the structure of agricultural marketing channels and individual firms selection decisions. In this paper, issues relating to why a number of standardised marketing channels may exist within an industry, why alternative marketing channels may predominate in different industries, and how the marketing competencies of individual firms influence the channel selected by a business are examined.

The theoretical model illustrates why it is possible for multiple marketing channels to exist in an industry by measuring how the expected returns and variations in returns change for different marketing channels. The optimal choice for a farmer will depend on the risk aversion parameters of individual firm, the information balance between producers and agents, and the degree to which an agent's marketing margin varies over channels. The results of a more encompassing empirical model indicate that for an individual farmer, marketing channel choice is influenced by marketing competencies and strategy, farm and farm manager characteristics and the structural characteristics of the industry in which the transaction is taking place.

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1. Introduction

The increasing use of marketing contracts within many agricultural commodity and food distribution channels has led to a growing interest in empirical and theoretical studies of agricultural marketing channels (Royer, 1995; Barkema & Drabentstott, 1995; Akridge, Whipker, Downey & Hooper, 1993; Harrington & Manchester, 1986). The escalating use of sales contracts has been attributed to more complex consumer tastes which are increasing the demand for specialised qualities and quantities of food, and changing risk environments (Barkema & Drabentstott, 1995; Barkema, 1995; Schroder & Mavondo, 1995; Barkema, Drabentstott & Welch, 1991; Bokenhoof & Lohner, 1992; Akridge, Whipker, Downey & Hooper, 1993).

Recent developments have been made which may enhance the theoretical understanding of contracts and vertical co-ordination and provide new opportunities for explaining and empirically testing key relationships in agricultural marketing channels (Westgren, 1994; Weleschuk & Kerr, 1995; Barry, Sonka & Lajili, 1992; Sporleder, 1992; Bergen, Dutta & Walker, Jr, 1992; Dwyer & Oh, 1988). However, there has been little formal analysis of the nature of vertical contractual arrangements and relationships between various stages of the food chain (Sheldon, 1994), and the forces that lead to alternative exchange mechanisms developing in different commodity markets are not clearly understood (Sporleder, 1992).

Several studies have measured the degree to which contractual arrangements are used and the extent of vertical integration in American agricultural industries. Drabentstott (1994), and O'Brien (1994) present figures which suggest that between 1970 and 1990, the percentage of total American agricultural production marketed through contracts or vertical integration has increased significantly in many agricultural industries. Their figures also indicate that the use of contracts and extent of vertical integration varies widely between industries. Over 90% of production in the egg, broiler, processed vegetable and turkey industries is marketed using contracts or other forms of vertical integrated channels, while in the feed grain and hog industries, figures fall to below 20% of production. These estimates appear to be consistent with those published by other authors (Henderson, 1994) and although that data was collected in America, similar trends appear to be occurring in other parts of the world such as Australasia (Schroder & Mavondo, 1995). Other studies have identified optimal sales

strategies for individual producers (Nelson, 1985; Bailey & Richardson, 1985; Zacharias, Zaunbrecher, Traylor & McManus, 1987). These show that the method of sale, timing of sale, and volume of product sold through various channels influences returns, and have helped explain why farmers with different risk preferences may sell through different marketing channels.

Data collected in a survey of New Zealand crop farmers by McLeay (1994) indicates that farmers use different forms of market arrangement for different crops they produce. A market or cash sale occurs where farmers sell produce after harvest or at some time later, directly to the marketing agent or firm. An alternative marketing channel for which data was collected is a forward contract which specifies a stable price or pricing formula, in order to provide security to the producer concerned. It is apparent that these alternative contracts represent different levels of integration in the marketing channel, and although they are simple in structure they provide individual firms with alternative marketing opportunities. The data presented in Table 1 shows the range of market arrangements used for the different products. While some producers use both types of channel, there appears to be a large number of producers who consistently use only one form of marketing arrangement for a particular crop.

The objective of this paper is to investigate in more detail why these different marketing channels may exist in an industry and to explain the factors that might influence an individual producer's choice of contractual arrangement. Two related models are developed to give both a theoretical and empirical perspective on these issues. The first part develops a simple theoretical model that is used to examine the expected returns and variations in returns, from using alternative marketing contracts. The results of this model show the complexity of the decisions involved, help explain why multiple marketing channels may exist in an industry, and suggest variables that might influence an individual producer's choice. In the second part, an empirical model is developed to demonstrate how internal marketing competencies, firm characteristics and external structural industry characteristics influence an individual firm's selection decisions. The two models are complementary in that the empirical model makes it possible to account for differences between individual participants, while the theoretical model identifies more fundamental variables that influence the decisions.

2. A Model of Expected Risks and Returns for Alternative Marketing Channels

In this section we develop a simple supply and demand model which identifies the incentives for producers, and processors or marketing agents, to select specific marketing channel arrangements. In models of market channel arrangements it is commonly assumed that the principal alternatives facing firms are: to exchange products in a market, to develop a contract to provide the product in the future, or to form an integrated firm. These forms of contractual arrangement have become accepted as standard despite the fact that the literature suggests that optimal contractual arrangements could be flexible (Zusman & Etgar, 1981). The tendency towards standardised contracts is perhaps stronger in agricultural marketing channels where there are normally considerably more producers than there are marketing outlets and there are obvious transaction cost savings from using standardised contracts. It should also be noted that alternatives such as futures contracts are not considered as a form of contractual arrangement in this study. Although they are a common feature of many dominant agricultural industries in some countries, they are viewed as a specialised form of risk management that is an additional element in the marketing channel. In the industries under study there are no futures markets in existence.

The objective of this model is to identify the impacts of the different marketing channels on the expected level and variability of returns for the producers and marketing firms. These are equivalent to the outcomes that would be expected in a competitive market environment where there are a large number of both producers and marketing agents. The analysis is based upon a simple linear stochastic supply and demand model of the following general form:

$$(1) \quad D = a - bP_c + \varepsilon$$

$$(2) \quad S = Q + \eta$$

where: D is the quantity demanded.
 S is the quantity supplied.
 P_c is the consumer price.
 $\varepsilon \sim (0, \text{Var } \varepsilon)$ is the stochastic element in the demand curve.
 $\eta \sim (0, \text{Var } \eta)$ is the stochastic element associated with supply.
 $E(\varepsilon, \eta) = 0$.
 Q is the expected level of supply.
 a and b are relevant demand parameters.

The model is essentially a short run representation of conditions in an agricultural industry within a given season. It is further assumed that marketing contracts are arranged between the producer of the product and a marketing agent who has a fixed average cost of handling or processing the product (M). These costs reflect the physical costs associated with marketing the product such as distribution and handling. It would also include some expected level of normal profits for the marketing agent's activities. At this stage of the analysis it is assumed that this cost is the same for all contract forms.

2.1 Expected Revenue and Risk

Using the simple model and considering each form of contract in isolation, it is possible to derive expressions for the expected level and variability of aggregate returns. Costs of production are not included and are assumed to be fixed in the short run. It is further assumed that both the agent firms and the principal firms (producers) are homogeneous and have equal market shares of their respective industries. Thus, aggregate revenues can be used to reflect the profitability of individual firms at either level. The alternative contractual arrangements considered are assumed to reflect the most commonly used alternatives in agricultural marketing channels; commission sales, forward selling, and market sales. The detailed derivation of the expressions for the expected returns and variability are reported in appendix one. Table 2 presents a summary of the analytical results and shows the expected level of returns, and the variance of those returns for both a producer and a marketing agent, under three types of marketing contract. These are described in more detail below.

2.2 Commission Sales

This contract assumes that the producer assigns the product to the agent for sale in the market. The agent is assumed to deduct marketing costs M (which would reflect the minimum commission that a competitive agent might expect), and return the residual revenue to the principal. This arrangement is widely used in a variety of situations in both developed and developing countries. It corresponds to commission selling which is also used in a wide variety of non-agricultural markets, and is an approximation of co-operative selling where producers received a pooled return after actual marketing costs have been deducted.

The common characteristic of these arrangements is that the uncertainty in the market place is assumed to be fully understood by both producers and agents before a price is established for the product. In the model it is assumed that both ε and η are known and the consumer price is established before the marketing costs are deducted and the residual payment made to the producer of the product.

The results in Table 2 show that under this form of contract, the determinants of the agent's income are relatively straightforward, and variability of that income is influenced by fluctuations in the actual level of output within the season. The expected level of producer revenue however is influenced by supply variability, and the variability of this revenue is a complex function of the variability in both supply and demand.

2.3 Forward Selling

At the other extreme are forward selling agreements where it is assumed that a producer price is agreed upon before either supply or demand conditions are known. The producer in this case receives a fixed price, which reflects the producer's and agent's expectations before the product is produced, but revenue is still influenced by variability in production. The return to the agent is determined by the difference between the producer contract price and the realised consumer price. A contract of this nature would normally be established before the final level of production for the season is known, and before the demand conditions are known.

Thus, the contract price to the grower is based upon the expected consumer price which is determined by assuming that ε and η are zero. Forward contracts of this type are used in all types of industries and are generally assumed to remove the price risk from producers. In this case the producers still face some risk from the variability in production as it is assumed that the forward price is paid for all of the product produced. This is common in agricultural crop contracts but may be less common in other industries where the contract may only apply for a certain volume of output.

As would be expected, this alternative contract influences the expected returns and the allocation of risk between the producers and the agent. From Table 2 it can be seen that the expected returns to producers are higher than under the commission sale and are not

influenced by the variability of supply or demand. The expected value of returns to the agent are lower than under a commission contract, and are influenced by the variability in supply. In both cases the variability of returns is different from that under the commission contract, and is influenced by the parameters of the model.

2.4 Market Sale

Under this arrangement the product is sold to the agent after the total level of production is known, but before the demand conditions are known. This situation might be found where a producer sells the product to the agent at harvest, and it is assumed that neither the agent nor the producer are aware of actual demand conditions at that time. This probably reflects the most common situation where the product is sold to the agent after it is produced and where the agent takes ownership of the product and bears some of the total risks. Under the conditions assumed for the market contract, the producer price would be determined by the intersection of the known supply curve and the expected demand curve after allowing for the marketing cost. The agent would be prepared to purchase the product at this price for resale in the consumer market.

2.5 Results

A simple comparison of expected revenue and variations in revenue for the different contracts indicates that for the producer and agent alike, the expected values of revenue are equal with either a commission sales contract or a market contract. The variability of this revenue, however, is less for the agent under a commission sales contract and less for the producer with the market contract.

These results appear logical and suggest that the commission sales contract would offer the greatest security for the agent while the market system would suggest a sharing of risk. With this reasoning it might be expected that the forward contract system would lead to a less variable revenue to producers. The results show, however, that the variability of revenue for the producer could in some circumstances be greater than in either of the other cases. This is possible because although the forward contract fixes the producer price, the revenue is still influenced by the variability in supply. Under the alternative contracts, revenue changes

caused by supply variability are to some extent compensated for by changes in the price received. This is not the case in a forward contract where the effective demand curve facing the producer is perfectly elastic once the contract has been established.

Under the assumption of a fixed marketing costs the expected revenue of the agent would also be lower with a forward contract and the expected revenue for the producer would be higher by the same amount ($\text{Var } \eta/b$).

In general, it can be seen that these results identify trade-offs between the expected levels and variability of revenue. Figure 1 provides a schematic summary of the results of this analysis and shows the nature of the tradeoffs that have been identified in the simple model. In order to identify the factors that might influence channel choice for either agents or producers it is necessary to clarify assumptions about attitudes to risk and consider the realities of the joint decision process.

2.6 The Contract and Channel Selection Problem

The results derived can be used to evaluate channel choice decisions facing individual producers, but there is an equivalent problem facing the agent in determining which alternative contract to offer. Under the assumption that the marketing cost or margin (M) is fixed, and a general assumption of risk aversion by both producers and agents, the only conclusion that can be drawn is that an agent would always prefer a commission sales to a market contract, and conversely producers would prefer a market to a commission sales contract. In each case the expected revenues are the same, but the variability of revenue is minimised by the preferred contract. The importance of a forward contract as an alternative would depend on the parameters of the market system under consideration. Even though the expected returns may be higher for the producer with this type of contract, the possibility exists that the variability may also be high.

These conclusions rest on the assumption that the marketing cost M is the same for each contract. If the variability of revenue or the expected level of revenue to the agent is different then the marketing margin would be expected to differ between contracts. For example, with the simplifying assumption of risk neutrality of both producers and agents, agents would be

indifferent between offering a commission sales contract or a market contract. The producers, however, would prefer a forward sales contract where expected revenue is greater by $\text{Var } \eta/b$. However, if the margin or cost of a forward contract M^* was set as:

$$(3) \quad M^* = M + \frac{\text{Var } \eta}{bQ}$$

where M is the cost of the other contracts, then the agents would be indifferent between offering any of the three contracts. While the increased costs would reduce the revenue to producers, it can be shown that in this particular case the producers would also be indifferent between the contracts.

The problem becomes more complex if the assumption of risk neutrality is removed. It is still theoretically possible to define a set of marketing changes, M^*_1, M^*_2, M^*_3 , which might ensure that the agent is indifferent between offering any of the contracts.

The important point to note is that while such a set of margins may ensure that agents are indifferent between contracts, the probability that producers are also indifferent is very low. There are another set of margins M^*_1, M^*_2, M^*_3 , which agents might use to ensure that a producer would be indifferent between the contracts, but at these costs, agents may not wish to offer all contracts. In a perfect world of dyadic contracts such situations are resolved by individual negotiation. In the agricultural system however, relatively few agents are dealing with a large number of producers, and contracts are infrequently negotiated on an individual basis.

In reality it must be acknowledged that individual firms have different attitudes to risk and different capabilities for collecting information and dealing with the risks. This would make it possible for individual firms to choose different contracts in the same market situations. It can be argued that the particular channel chosen might be influenced by a set of factors that are internal to the firm and its management; for example, risk preferences that differ between firms and the importance of that product to individual firms.

In addition the theoretical model shows clearly that the expected returns and risk trade offs are influenced by the structural parameters of the model such as the variability of supply and

demand, and the coefficients of the response functions. The model also assumed that both producers and agents had equal access to the information that was available and that the risks came only from production and demand uncertainty. In reality the risk environment is more complex and there may be other factors associated with the industry and the product itself, that influence the decision to offer or use a particular type of contract.

This would suggest that the range of contracts that are offered and chosen in any particular situation is dependent on the structural characteristics and risk environment of the industry or products. These would be expected to include such factors as the uncertainty in the markets, the price responsiveness, and the information environment. These latter factors are generally external to the individual firm and might be termed external or industry related factors.

3. An Empirical Model of Channel Choice

The theoretical model provides an overview of the channel choice problem and indicates some of the important variables. The discussion has also shown that there are further variables, such as those related to differences between firms that cannot easily be included in such a model. In this section of the paper an empirical model is developed to test whether some firms have a propensity to use a particular type of marketing channel, and whether this preference differs across industries, or for products that have different structural characteristics. The analysis is based upon data which describe the type of contract that individual farmers use to market a range of specific crops. There are a number of other studies in the general literature that are relevant to this problem, and even though they consider a range of different circumstances and forms of channel arrangements, it is useful to review them here.

3.1 Empirical Studies of Channel Choice

In the marketing literature, researchers have attempted to evaluate the factors influencing an individual firm's choice of marketing channel, using logistic regressions to focus on the specific factors affecting export marketing channels or sales force arrangements for a number of products. These studies have examined either the relationship between external industry

characteristics and marketing channel choice, or the influence that internal firm characteristics have on channel choice, but rarely both sets of factors at once.

The majority of research has focused on the nature of marketing channels for export products, and has examined the extent of integration of individual firms into export channels (Anderson & Coughlan, 1987; Klein & Roth, 1990), the extent of vertical integration of a business's sales force (Krafft, 1995; Lal & Srinivasan, 1993), market entry strategies (Erramilli & Rao, 1993), and optimal contracts for sales compensation schemes (John & Wieitz, 1989). Perhaps the earliest and most frequently cited study which incorporates external variables is that of Anderson and Coughlan who used data from the electronics industry to consider why firms chose to use export market agents, rather than develop an integrated market channel. Using transaction cost theory they developed a list of ten possible variables which included factors such as asset specificity, product maturity, service requirements, product differentiation, and existing distribution channels. Results show that the most significant factors were the level of asset specificity, degree of product differentiation, and the nature of existing arrangements. It should be noted that this study covered a single industry but it is one in which there is a wide range of product variability. This has led to the use of variables which primarily reflect product characteristics, to predict producers' channel choice.

In a later study, Klein, Frazier and Roth used data from a wide range of different industries to analyse the factors influencing channel integration in international markets. They developed a range of more general variables which measured factors such as the volume exported in a market channel, the level of asset specificity, and measures of external uncertainty in the market place. These variables are related to transaction cost arguments which suggest that the level of dependence on a marketing channel and the level of risk in a marketing channel, would effect the nature of the contracts which exist. However, other internal factors such as the firm's attitude towards risk and ability to deal with risk are largely ignored.

In the economics literature researchers examining the relationships between external industry characteristics and channel choice have suggested that human and physical asset specificity (Barry, Sonka & Lajili, 1992; Sporleder, 1992; Westgren, 1994; Stigler, 1951; Macdonald, 1985), price instability, and product perishability (Sporleder, 1992) are considered to be positively associated with vertical integration and contractual arrangements. However data restriction problems, and difficulties with parameter specification have limited the scope for

empirical analysis (Macdonald, 1985) and many theoretical constructs which may help explain the influence that firm and industry characteristics have on marketing channel choice have not been empirically tested. In relation to agricultural marketing channels, empirical applications of theoretical developments have been limited and often relate to very specific problems or issues such as the tenancy arrangements used in contract hog production, share-cropping or the egg, broiler and turkey industries (Knoeber & Thurman, 1995; Rhodes, 1991; Allen & Lueck, 1992). A further shortcoming of these studies is the inference that it is the exporting, selling or buying firm alone which shapes the channel and resulting channel structure.

Studies that have focused on internal farm-business and farm management characteristics have investigated how farm size, manager's education, financial status, business location, and manager's policy and information preferences are associated with the use of different marketing channels (Kwakyi, Epperson, Fletcher & Carley, 1989; Edelman, Schmiesing & Olsen, 1990; Fu, Epperson, Terza & Fletcher, 1988; Fletcher & Terza, 1986). However, few attempts have been made to relate these characteristics to the theoretical constructs which are developing in the literature.

A small number of studies have incorporated both internal and external factors or variables in models of channel choice. Klein and Roth (1990) extended the work of Klein, Frazier and Roth (1990) to include measures of psychic distance which reflect the perceived risk involved in a particular marketing channel, and incorporate some of the key product characteristics. They also included a variable which measured the level of experience that firms have in a particular marketing channel. This in some way incorporates the response or preparedness of a firm to deal with the risk involved. Erramilli and Rao (1993) extended this range of variables even further and incorporated other similar variables to measure both the industry environment, and level of risk faced by an individual firm, but they did not incorporate any measure of the firm's ability or approach to deal with the risk in the marketing channels. Etgar and Valency (1983) examined three distinct groups of factors which affected domestic firms' use of contracts in marketing channels. These measured the uncertainty in the industry, a measure of interdependence which seems to be a proxy for asset specificity, and a measure of the firm's aversion to risk. The latter variable was measured in a somewhat crude manner, but it does appear to be one of the few situations where this key factor is incorporated in a formal study.

While it is plausible to argue that the firm's attitude to risk would have an affect on the firm's preference for particular types of channels or contractual arrangements, it is also important to acknowledge that individual firms may not only be prepared to accept different levels of risk, but may have quite varied competencies to deal with that risk. In this case, it could be argued that the particular channel chosen might be influenced by the business strategy a firm is following, which incorporates their ability to deal with that risk. Perhaps the only study which incorporates such factors is that of Carney and Gedajlovic (1991) who examine the nature of retail franchising arrangements across a wide range of firms. They identified five strategic groups which they argue have different approaches to marketing channels, and, although they do not specifically link these strategies to channel choice, they do show that a range of franchising strategies exist.

In this study the results of the theoretical model have suggested that a more balanced approach should be taken to identifying external and internal factors affecting channel selection. Internal characteristics are incorporated by measuring the marketing strategy a business is following. These variables measure not only a managers' characteristics, but also their competencies in dealing with different marketing channels and attitudes towards risk. External variables measure the extent to which industry or structural variables influence channel choice.

3.2 The Current Study

The empirical model developed here is based upon data which describe the two types of sales arrangements that individual New Zealand crop farmers most frequently use to market a specific range of products. This was collected as part of a study of crop farmers management and marketing strategies and is described in detail in an earlier issue of this Journal (McLeay, Martin & Zwart, 1996). A logit model is developed to examine the factors that influence the probability of selling crops only by forward contract as opposed to only on the free market. Although the theoretical model also examined commission sales, this alternative is not examined here because it is not widely used in the specific industries included in this study. In addition, more specialised contractual arrangements such as those offered by futures markets are not available for these farmers.

These data are particularly useful for this type of study, because the farmers grow and market a wide range of different crops, that have distinctive marketing channels. This allows the industry or external effects to be separated from firm characteristics. In addition, the highly competitive nature of these industries minimises the impact of market power on channel structures. The deregulated environment in which these farmers operate means there are no policy restrictions or price support measures which restrict or influence their choice of strategy.

The data were collected from 190 farmers who were growing and selling a range of 26 crops. They represent the most commonly grown crops in the area surveyed, and include traditional crops such as wheat, barley and oats, as well as more specialised or seed crops such as borage, and garden peas. Some of these crops and their relative importance are described in Table 1. Although the marketing arrangements are defined from the producers' point of view, they represent the equilibrium arrangements that exist between the producers and buyers of crops. The specific derivation and expected coefficients for each of the variables in the model are described below.

3.3 Internal Variables

Internal or firm specific variables measure the dependence of a firm on a particular product, and most importantly, the marketing strategy that a firm is following. Firms following different marketing strategies are likely to have different core competencies, goals, attitudes to risk and abilities to deal with risk, and therefore utilise different sales arrangements. In this analysis a set of complex variables that describe a farmer's marketing strategy or approach to marketing, and incorporate the characteristics of individual farms, is used to represent these factors. The dummy variables *production/production flexibility*, *stability*, *production/market outlet focus*, *differentiation* and *arbitrage*, are derived from a cluster analysis that groups farmers with similar marketing strategies, and have been described in detail in an earlier volume of this Journal. These variables incorporate producers' levels of involvement in marketing activities and marketing competencies. In Table 3 a summary of the marketing strategies is presented, and the expected utilisation of marketing contracts is listed.

The cluster analysis showed that farmers following the *production/production flexibility* and *stability* strategies do not focus on sales concerns, and it is hypothesised that they are likely to attempt to reduce their sales risk by selling crops under contract. Farmers following a *differentiation* strategy have entrepreneurial competencies and ambitions, industry contacts and high levels of market involvement, while farmers following an *arbitrage* strategy concentrate on sales and investment opportunities. This suggests that both groups of farmers would appear more likely to sell on the free market. Farmers utilising a *production/market outlet focus* strategy collect production rather than market information, however they also sell to a large number of agents which makes it difficult to predict the sales method that will predominate.

These variables are obviously a complex measure of the importance that individual growers place on their involvement in marketing activity. They not only incorporate farmers' attitudes to market risk which was implied in the theoretical model, but also their competency with marketing activities and their perception of the riskiness of different sales arrangements.

The extent to which a firm is dependent on a product is also likely to influence the choice of channel because it affects the total risk faced. This is measured by the percentage of effective crop areas individual farmers grew in a particular crop (*percent*). It can be argued that as the level of dependence on a product increases, so does the exposure to falling prices. Therefore, where a business is dependent on a crop, it is likely that they would enter into a contractual arrangement to avoid sales risk and the expected coefficient on this variable is hypothesised to be positive.

3.4 External Variables

The external variables are dummies which represent the degree to which these structural characteristics vary over the 26 crops or industries for which data were available. The characteristics of the crops were classified by seeking expert advice from farmers and academics about the nature of the products. Five binary variables which were scored as 0 (low) or 1 (high) were used to quantify: the level of risk as measured by the price variability, the perishability of the crop, the level of asset specificity, and the nature of the information

environment associated with each crop. The expected coefficients of each of the variables is illustrated in the bottom half of Table 3.

The level of vertical integration and use of forward contracts is perceived to be relatively high in industries where products are perishable because reciprocal dependency means high level co-ordination between producers and traders is important. For perishable crops (*perishable*) contractual arrangements may act as a mechanism which reduces the risk of spoilage for both producers and agents.

It has frequently been argued that in industries where there are highly variable prices (*price variability*) risk averse producers reduce the risk of unfavourable price movements by hedging (Newbery & Stiglitz, 1991). Forward contracts provide a similar mechanism to protect producers against downward movements in crop prices.

For industries where there are high levels of capital intensity or physical capital involved in production or marketing there will be sunk costs and high levels of asset specificity. This could lead to an expected predominance of vertical integration or contractual arrangements (Macdonald, 1985; Sporleder, 1992). For some crops such as frozen peas there is likely to be high levels of physical capital specificity (*physical capital*) for both producers and agents, however for others such as borage, the specificity may be restricted to the producer level.

It is possible that the nature of the risks may be as important as the absolute level of risk in a market. For example new products may have a higher perceived level of risk because farmers lack knowledge in both growing and selling these crops. For traditional crops (*traditional*) producers are likely to have high levels of production and market knowledge. In a similar manner agents will also be familiar with the market for traditional crops, so producing and marketing these crops is likely to require relatively low levels of human capital and lead to a greater use of market sales.

In contrast, there are a number of the crops or industries (such as hay, potatoes and oats) where local prices are not influenced by international market conditions (*domestic price*). Fluctuations in prices are generally caused by changes in domestic supply or demand conditions and there are opportunities for both producers and agents to understand the marketing environment. Although prices may be variable, there is a greater level of

understanding about the nature of the risk and producers may tend towards market sales. In such a case it is possible that forward contracts could even increase the risk that farmers face because changes in production within a season are not reflected in price changes, as shown in the theoretical section of the paper. Selling on the free market therefore has a built in stabilising or risk adjustment impact and would be preferred.

3.5 Empirical Results and Discussion

The results of a maximum likelihood estimation of the logit model are presented in Table 4. The model has a binary dependent variable which takes the value of 1 when an individual business sells a crop only by contract, and zero if the sale is by the free market. The coefficients for the strategy variables are measured relative to that for the *differentiation* strategy, which provides the base. The relative sizes of the coefficients are logical and reflect the expected probabilities of selling by contract. Farmers following a *differentiation* strategy are significantly less likely to use contracts than farmers following *production/production flexibility, stability or production/market outlet focus* strategies. *Differentiators* have high levels of market knowledge which should make market sales less risky. Farmers following the *stability* strategy were the most likely to use contracts. These farmers take a relatively simple and standardised approach to management and do not spend a great deal of time or energy collecting information or making decisions. This suggests that the costs and risks associated with selling only by contract may be relatively low for these farmers. Other farmer groups fell in between these two extremes.

The coefficient for the *percent* variable is negative and significant. Earlier in this paper it was argued that as the percentage of farm area grown in a crop increases, the level of dependence on a product increases, as does the exposure to falling prices, suggesting that contractual sales may predominate. A possible explanation for the negative coefficient is that crops which make up a large proportion of farm area are crops which have well established marketing channels, and their producers have high levels of market knowledge. This result would suggest that these crops are the more likely to be sold on free markets, and that variability does not seem to be important for these crops.

The coefficients for the *physical capital*, *domestic price*, and *tradition* variables are significant and of the expected sign, giving support to the arguments presented in the previous section. The price variability and perishability variables were not significant. It is possible that for many products that have highly variable prices, the factors causing price variability are well understood by producers. Therefore variable prices may not represent a major source of uncontrollable or unanticipated risk. While some crops that are perishable, such as processed peas, have a high degree of asset specificity and are sold using contracts, other crops outside this study such as flowers or vegetables are usually sold on the free market. For these other crops, agents may not want to offer contracts because they perceive there is risk of spoilage as the product moves from them to the final consumer or processor further down the food chain. In general these results suggest that the resultant choices of contracts in any channel are likely to be complex and are not related to simple measures of variability. It would seem that the knowledge of the market, and the ability to understand the sources of the uncertainty are important factors in determining the nature of the marketing channels, and may be more important than simple measures of price variability.

4. Conclusion

The existence of multiple marketing channels in many agricultural industries, and the different marketing arrangements that predominate in particular agricultural industries, provide opportunities for research. The problem facing an agricultural producer involves selecting an appropriate contract form or marketing channel from a limited set. Conversely marketing firms face a problem of developing a set of contractual arrangements which are then offered to producers. It is apparent that although these different contracts may be simple in structure, they represent different levels of vertical integration in a marketing channel, and this analysis provides methodological approaches that would be suitable for analysing more sophisticated marketing channel selections. In this paper theoretical and empirical models were developed to examine the nature of choices and the resulting marketing channels. The results help explain why multiple marketing channels may exist in an industry, and how internal management and external structural characteristics influence marketing channel selection.

The theoretical model showed that even in simple situations there are complex trade offs in the risks and expected levels of returns to both the producers and buyers of agricultural commodities. The information environment and timing of decision making differ for each alternative. In the use of forward contracts, producer prices are determined prior to information about the actual supply and demand conditions in the market being known. At the other extreme, the commission sale contract implies that both supply and demand conditions are known before the price is determined. This latter contract has characteristics that are similar to a marketing co-operative and is commonly used in a wide range of industries.

The model is useful in helping to explain why a number of marketing channels may exist in a single industry, and shows that there may not be any simple optimal or equilibrium contract that would suit both parties. This suggests that the contracts chosen by any individual agent or producer are likely to depend on characteristics such as the size of marketing margins, and the management characteristics of individual businesses including, market knowledge, management competencies and attitudes to risk. In addition it was argued that external structural characteristics will influence the marketing channel choice set that exist in a industry, or for a particular product.

These arguments provided the specification for an empirical model that is much richer in reflecting (if not capturing) the heterogeneity of the real world. The model depicted a more sophisticated risk environment by considering both the external industry environment and the internal management and firm characteristics of the individual suppliers involved in the exchange process. The fact that farmers following different marketing strategies utilised different sales arrangements suggests that internal or strategic characteristics have a major influence on a firm's choice of marketing channel. The marketing strategy that a farmer follows provides a substantive measure of a firm's relationships with other firms in a marketing channel and reflects not only the firm's attitudes to marketing risk, but also involvement with the marketing place, knowledge of market information, and competencies in dealing with uncertainty.

Products that required high levels of physical capital to grow or harvest were likely to be sold using contracts while free market sales predominated for traditional crops, and those exhibiting high levels of domestic price variability. No evidence was found to suggest that

contractual arrangements are likely to prevail for perishable crops or those which have high levels of price variability. It is possible that simple price variability itself may not be an adequate measure of risk in an actual market situation, and studies which assume that the determination of optimal sales arrangements can be based solely on price variability and risk aversion parameters may be somewhat naive.

Further research which explores the nature and structure of marketing channels in different types of industries and different geographical locations could provide insights into the use of increasingly complex contractual arrangements and vertical integration in other markets, and marketing environments.

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Table 1. Marketing Alternatives Used by NZ Crop Farmers

Crop	Percentage of Farmers Using		% Growing this Crop	% of Effective Crop Area
	Market Sales	Contract Sales		
Wheat	3	74	85	23
Clover	37	37	80	22
Peas	18	69	79	16
Barley	11	60	61	21
Ryegrass	24	51	35	15
Fescue	14	54	26	15
Oats	35	39	22	10
Malting barley	7	77	21	24
Process peas	0	90	13	7
Evening primrose	6	81	11	6
Borage	0	93	11	5
Hay - Silage	40	27	10	16
Potatoes	77	8	9	6
Oilseed rape	0	90	7	10
Seed barley	0	100	7	24
Process beans	0	90	7	8
Turf grass seed	0	90	7	7

Source: Adapted from McLeay (1994).

Table 2. Expected Returns and Variations in Returns

Agents

Producers

Commission Sales

Commission Sales

$$E(R_a) = QM$$

$$E(R_p) = \frac{aQ - Q^2 - bQM - \text{Var } \eta}{b}$$

$$\text{Var}(R_a) = \frac{b^2 M^2 \text{Var } \eta}{b^2}$$

$$\text{Var}(R_p) = \frac{(2Q + bM - a)^2 \text{Var } \eta + (2\text{Var } \eta)^2 + \text{Var } \eta \text{Var } \varepsilon + Q^2 \text{Var } \varepsilon}{b^2}$$

Forward Sales

Forward Sales

$$E(R_a) = QM - \frac{\text{Var } \eta}{b}$$

$$E(R_p) = \frac{aQ - Q^2 - bQM}{b}$$

$$\text{Var}(R_a) = \frac{(Q - bM)^2 \text{Var } \eta + (2\text{Var } \eta)^2 + \text{Var } \varepsilon \text{Var } \eta + Q^2 \text{Var } \varepsilon}{b^2}$$

$$\text{Var}(R_p) = \frac{(aQ - bQM)^2 \text{Var } \eta}{b^2}$$

Market System

Market System

$$E(R_a) = QM$$

$$E(R_p) = \frac{aQ - Q^2 - bMQ - \text{Var } \eta}{b}$$

$$\text{Var}(R_a) = \frac{b^2 M^2 \text{Var } \eta + \text{Var } \varepsilon \text{Var}(\eta) + Q^2 \text{Var } \eta}{b^2}$$

$$\text{Var}(R_p) = \frac{(2Q + bM - a)^2 \text{Var } \eta + (2\text{Var } \eta)^2}{b^2}$$

Table 3. Description of Variables

Dependent Variable	Measure		
<i>Contract Use</i>	Use of forward contract = 1, Otherwise = 0		
Internal Variables	Characteristics	% of producers in cluster	Expected use of contracts
<i>Product/ Production Flexibility</i>	<ul style="list-style-type: none"> - Production rather than market focus - Flexible production mix - Gather information on production planning, production - Techniques and management practices 	20	High
<i>Stability</i>	<ul style="list-style-type: none"> - Stable product mix - Older producers which show little attention to marketing - Little attention paid to market signals or other information sources 	32	High
<i>Production/ Market Outlook Focus</i>	<ul style="list-style-type: none"> - Stable product mix - Sell to a large number of market outlets - Change agents frequently - Collect information related to production 	20	Medium
<i>Differentiation</i>	<ul style="list-style-type: none"> - Young farmers who differentiate their produce from other producers - Often highly involved in other business activities or farmer co-ops - Utilise a wide variety and sources of information 	10	Low
<i>Arbitrage</i>	<ul style="list-style-type: none"> - Focus on sales - Attempt to increase prices by obtaining quality premiums, selling at an optimal time of year and having flexible sales arrangements - High degree of market knowledge 	18	Low
<i>Percent</i>	Proportional of farm in each crop	n.a.	High
External Variables	Measure (low = 0, high = 1)		Expected Coefficient
<i>Traditional</i>	Familiarity with crop		Negative
<i>Perishability</i>	Perceived perishability of crop		Positive
<i>Physical Capital</i>	Specialised capital requirements for production or marketing		Positive
<i>Price Variability</i>	Level of market price variability		Positive
<i>Domestic</i>	Importance of domestic market		Negative

Table 4. Results of Empirical Analysis

Variable	B	S.E.	Wald
Constant	0.9397	0.2753	11.6548***
P/PF ¹	0.6132	0.2770	4.9000**
Stability	0.9880	0.2678	13.6085***
P/MOF ²	0.6496	0.2243	8.3847***
Arbitrage	0.4001	0.2401	2.7762*
Percent	-2.2621	0.8218	7.5770***
Traditional	-.06044	0.2028	8.8786***
Perishability	0.0338	0.2100	0.0259
Physical capital	0.6600	0.2424	7.4167***
Price variability	-0.2546	0.2477	1.0567
Domestic	-0.6789	0.2133	10.1314***

¹ Production/Production Flexibility Strategy
² Production/Market Outlet Focus Strategy
2Log Likelihood 1040.3646
Correct predictions 65.56%
Level of significance: <0.01 *** <0.05 ** <0.1 *
n = 563

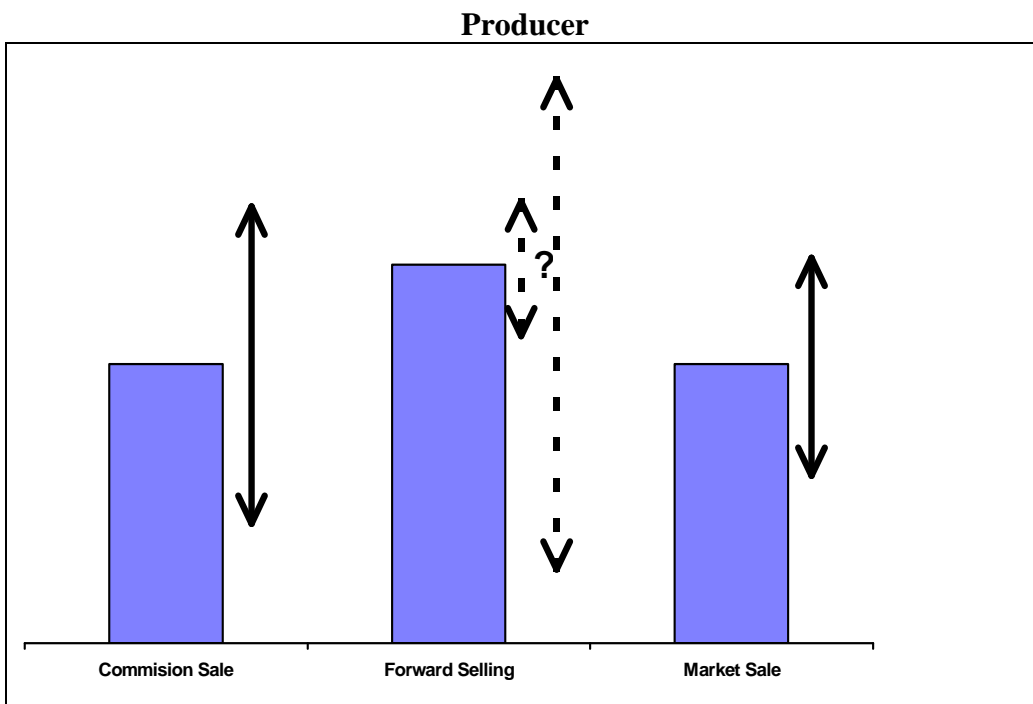
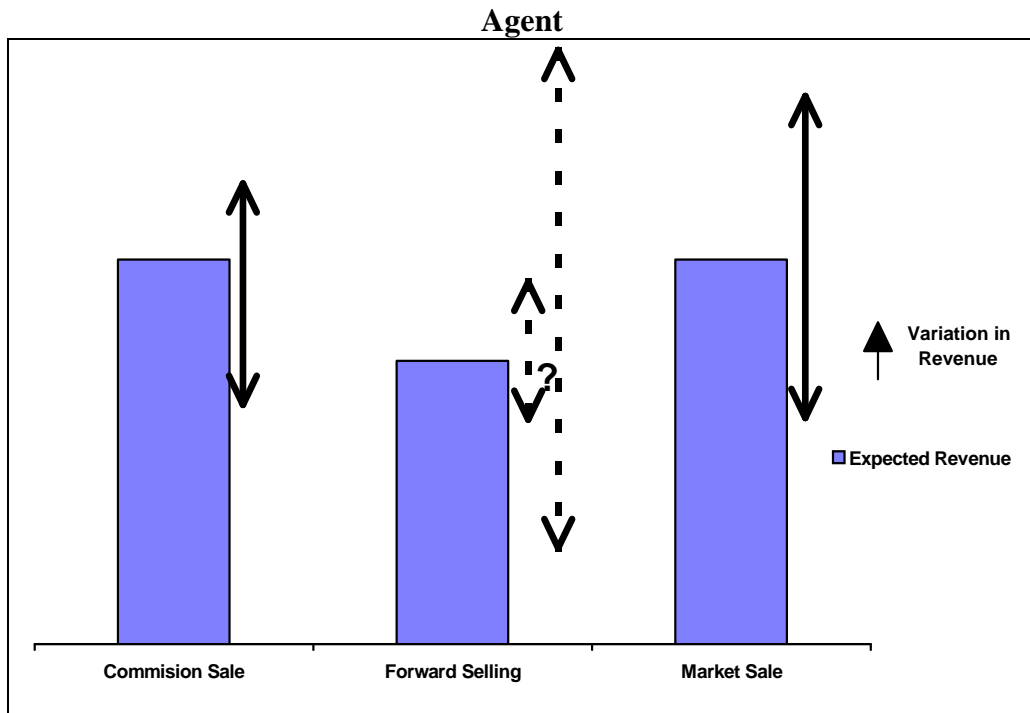


Figure 1. Relative Sizes of Expected Returns and Variations in Returns

Appendix One

Derivation of Expected Returns and Variability

Commission Sales

It is assumed that both ε and η are known and the consumer price is established before the marketing costs are deducted, and the residual payment is made to the producer of the product.

Equating supply and demand makes it possible to determine the consumer price:

$$(A.1) \quad P_c = \frac{a - Q + \varepsilon - \eta}{b}$$

and the producer price is this price minus marketing cost

$$(A.2) \quad P_p = P_c - M$$

Producer revenue (R_p) is thus:

$$(A.3) \quad R_p = \frac{(a - Q + \varepsilon - \eta - bM)(Q + \eta)}{b}$$

The expected value of producer revenue (under the stated characteristics of the stochastic terms) is:

$$(A.4) \quad E(R_p) = \frac{Qa - Q^2 - bMQ - \text{Var } \eta}{b}$$

Returns to the agent (R_a) are determined by the marketing margin and the quantity actually sold.

$$(A.5) \quad R_a = (Q + \eta)M$$

Thus

$$(A.6) \quad E(R_a) = QM.$$

The variance of producer returns can be defined as follows:

$$(A.7) \quad \text{Var}(R_p) = E[R_p - E(R_p)]^2$$

and by substituting in equations (A.3) and (A.4) and simplifying the expression it can be shown that:

$$(A.8) \quad \text{Var}(R_p) = \frac{1}{b^2} [(a - 2Q - bM)^2 \text{Var } \eta + 2(\text{Var } \eta)^2 + \text{Var } \varepsilon \text{Var } \eta + Q^2 \text{Var } \varepsilon]$$

Similarly it can be shown that;

$$(A.9) \quad \text{Var}(R_a) = \frac{b^2 M^2 \text{Var } \eta}{B^2}$$

Forward Selling

A competitive agent would offer a producer a forward contract at a price which equates expected demand with expected supply minus the marketing cost.

Thus the producer revenue and its expected value is as follows:

$$(A.10) \quad R_p = \left(\frac{a - Q}{b} - M \right) (Q + \eta)$$

$$(A.11) \quad E(R_p) = \frac{aQ - Q^2 - bMQ}{b}$$

The agent's revenue is determined by the difference between the contract price and the final realised price, and the quantity actually produced.

The revenue to the agent is thus:

$$(A.12) \quad R_a = (Q + \eta) (P_c - P_p)$$

and:

$$(A.13) \quad E(R_a) = MQ - \frac{\text{Var } \eta}{b}$$

Expressions for the variability of producer and agent's revenue can be derived in a similar manner to those for commission sales.

Thus, it can be shown that:

$$(A.14) \quad \text{Var}(R_p) = \frac{1}{b^2} [(a - Q - bM)^2 \text{Var } \eta]$$

and;

$$(A.15) \quad \text{Var}(R_a) = \frac{1}{b^2} [(Q - bM)^2 \text{Var } \eta + 2(\text{Var } \eta)^2 + \text{Var } \varepsilon \text{Var } \eta + Q^2 \text{Var } \varepsilon]$$

Market Sale

Under the conditions assumed for the market contract the producer price would be determined by the intersection of the known supply curve and the expected demand curve allowing for the marketing cost. The agent would be prepared to purchase the product at this price for resale in the consumer market.

The producer price can be defined as follows:

$$(A.16) \quad P_p = \frac{a - Q - \eta}{b} - M$$

and expected producer revenue:

$$(A.17) \quad E(R_p) = \frac{aQ - Q^2 - bMQ - \text{Var } \eta}{b}$$

This is equal to the level of expected revenue under the commission sales contract, but the variability of this revenue:

$$(A.18) \quad \text{Var}(R_p) = \frac{1}{b^2} [(2Q + bM - a)^2 \text{Var } \eta + 2(\text{Var } \eta)^2]$$

is clearly less than with the commission sales contract.

For the agent the revenue in the market contract is defined as follows:

$$(A.19) \quad R_a = (P_c - P_p) (Q + \eta)$$

From this it can be seen that the expected level of agent revenue are ,

$$(A.20) \quad E(R_a) = MQ$$

and

$$(A.21) \quad \text{Var}(R_a) = \frac{1}{b^2} [b^2M^2 \text{Var } \eta + \text{Var } \varepsilon \text{Var } \eta + Q^2 \text{Var } \eta]$$