Factors Affecting Maize Producers Adoption of Forward Pricing in Price Risk Management: The Case of Vaalharts

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Abstract

Logistic regression is employed to analyse the factors which influence the decision of whether or not the respondent used forward pricing methods during the 2004/05 maize production season. Forward pricing methods include cash forward contracting and hedging with futures contracts and/or options, through the South African Futures Exchange (SAFEX). Based on the results, the use of forward pricing is associated with lower levels of risk aversion and higher levels of human capital. Factor analysis is employed to reduce the dimensionality of the personal reasons which help to interpret the underlying, common factor of the personal reasons why farmers are reluctant to use forward pricing methods. Three factors were extracted and were labelled "Lack of capacity", "Distrust of the market", and "Bad experiences". The results from the factor analysis confirm the finding that farmers need higher levels of human capital to use forward pricing methods and that farmers do not believe that the forward pricing market is effective. Education should furthermore, focus more on the practical application of alternative forward pricing methods and not purely on the benefits of the use of forward pricing methods.

Keywords: Forward pricing, Logit, Factor analysis

1.   Introduction

Price risk is perceived to be a major source of risk by farmers both locally (Woodburn, 1993) and internationally (Coble & Barnett, 1999). The importance of price risk to farmers is due to the fact that price variability is a major component of the overall variability in profit. Groenewald *et al.* (2003) argue that the variability of input and product prices have increased since the deregulation of the agricultural commodities market in the mid 1990s. Jordaan *et al.* (2007) compared price volatility of field crops that are traded on SAFEX (yellow maize,

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white maize, wheat, sunflower seed and soybeans). They found the volatility associated with the price of white and yellow maize to be substantially higher than that of other crops that are traded on SAFEX.

Price risk ,may be managed in a number of ways. Forward pricing methods such as cash forward contracting and hedging with futures and/or options are effective in reducing price risk. International studies which investigated the forward pricing behaviour of farmers, however, found that very few farmers actually use forward pricing methods. Asplund *et al.* (1989), Musser *et al.* (1996), and Isengildina & Hudson (2001) found that less than 20% of their respondents used hedging methods to manage price risk. Some studies, however, did find higher adoption rates. Goodwin & Schroeder (1994) found that 45% of their respondents used cash forward contracts. Sartwelle *et al.* (2000) found that 70% of their respondents used cash forward contracts and 52% used futures and options. Bown (1999) investigated South African maize producers' use of forward pricing methods. The research showed that 47.1% of respondents used some form of forward pricing arrangements during 1998/99. Only 15% of the sample of maize producers, however, directly participated in derivatives trading through SAFEX during the same period.

Given the importance of price risk in overall income variability, the adoption rate of forward pricing methods to hedge against price risk in South Africa is still lower than expected. Bown (1999) conducted his research only a few years after the deregulation of the markets. The anticipation is that adoption rates will increase over time due to a learning effect. To the author's knowledge, no research other than that by Bown (1999) has been conducted in South Africa to determine adoption rates and the factors affecting the adoption of forward pricing methods. The objective of this research is to investigate the factors affecting Vaalharts maize producers' adoption of forward pricing methods in price risk management. Since the adoption rate of derivatives trading through SAFEX by respondents in this study is only four percent, it is impossible in this study to distinguish between cash forward contracting and derivatives trading as forward pricing methods. Therefore, the adoption of forward pricing methods as referred to in this study refers to the adoption of both cash forward contracting and hedging through SAFEX, which is consistent with Bown (1999). The objective of this research is achieved by employing logistic regression to investigate the factors influencing the decision as to whether or not a respondent used forward pricing methods during the 2004/05 season. Previous research efforts by Bown (1999) are extended through the use of factor analysis to analyse the personal reasons restricting farmers from using forward pricing methods.

The rest of the paper is structured as follows. Section 2 covers the discussion of the data and the procedures used in this study. The results are presented and discussed in Section 3, after which some conclusions are drawn and recommendations made, in the last section.

2.   Data and Procedures

2.1   Data and characteristics of respondents

The management of the water supply to Vaalharts irrigation farmers is based in three distinct regions, namely Northern Canal, Western Canal, and Taung. The Northern Canal region is by far the most important commercial production region in the irrigation scheme. The Northern Canal supplies water to about 460 farmers. A database from Vaalharts Water was obtained and a random sample of 78 farmers[3] was drawn from the farmers in the Northern Canal region. The sample size is consistent with the guidelines proposed by Strydom *et al*. (2003) with regard to sample sizes. Primary data was obtained by conducting a questionnaire survey during October 2005. Personal interviews were used to complete the questionnaire in order to obtain a sufficiently high response rate. Fifty of the respondents produced maize during the 2004/05 production season and were analysed further[4].

The questionnaire was used to obtain information on the characteristics and marketing behaviour of maize producers included in the sample. The personal characteristics on which information was obtained include, amongst other things, the age and level of farming experience, the level of marketing skills and the risk attitude of the respondent. With regard to the business characteristics, information was obtained on the level of specialisation in production practices, the use of centre pivot irrigation technology and other risk management tools, land ownership and communication infrastructure. Information on the use of different marketing strategies, with a specific focus on the use of forward pricing methods, was also obtained.

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[3] The number of farmers who were initially drawn from the database was slightly higher than 78 to account for subject mortality (Strydom *et al*., 2003).

[4] The fact that only 50 of the respondents actually did produce maize means that the number of respondents is lower than the suggested guidelines for sample size. By implication, the lower number of respondents may lead to possible bias in the results, which may have a negative influence on the ability to generalise the results obtained to the general population of irrigation farmers in Vaalharts.

Table 1 represents a summary of some of the personal and business characteristics of the respondents to this study. A distinction is made between those respondents who adopted forward pricing and those who did not.

Table 1: **Summary of some of the personal and business characteristics of the sample of Vaalharts maize producers with a distinction being made between respondents who adopted forward pricing methods and those who did not**

Characteristics	Adopters (n=22)		Non-adopters (n=28)	
	Mean	Standard deviation	Mean	Standard deviation
Age (years)	51.16	10.11	49.82	10.71
Tertiary education (Yes/No)	0.54	0.50	0.57	0.50
Experience (Years)	23.06	12.16	21.36	10.80
Marketing skills (1-7)	4.37	0.87	4.02	1.08
Off-farm economic activities (%)	0.12	0.22	0.13	0.24
Insurance (Yes/No)	0.91	0.28	0.64	0.48
Specialisation (index where 1 = specialisation in one crop)	0.33	0.12	0.34	0.16
Proportion farmland rented (%)	0.18	0.24	0.27	0.88
Centre pivot adoption (Yes/No)	0.87	0.33	0.50	0.50
Yield risk premium*	14.20	12.58	15.97	15.49
Forward price perception (Yes/No)	0.79	0.41	0.64	0.48
Free market preference (1 - 7)	3.91	2.63	3.23	2.67

* The yield risk premium is a proxy for the respondent's level of risk aversion. It is the proportion of the current expected yield that a respondent is willing to sacrifice for the opportunity to produce a crop with a constant yield (Musser *et al.*, 1996).

From Table 1 it is clear that the biggest differences between the characteristics of adopters and non-adopters of forward pricing are in terms of the use of crop insurance, the adoption of centre pivot irrigation technology, respondents' perceptions of forward pricing as a price risk management strategy, and their preference for the free market system over a government-regulated marketing

system. In all these cases the adopters scored higher on average than the non-adopters.

An interesting fact to note from Table 1 is that the average yield risk premium of the respondents who adopted forward pricing is lower than that of respondents who did not use some form of forward pricing method. It thus appears that forward pricing is associated with lower levels of risk aversion. With regard to personal characteristics, the average age, tertiary education and farming experience of adopters does not differ significantly from that of the non-adopters.

Information was also gathered on the personal factors that restricted farmers from using forward pricing methods in price risk management. Respondents who produced maize during the 2004/05 season were presented with a number of statements that could be personal reasons restricting them from using forward pricing methods (adoption and quantity). They were asked to rate these statements on a Likert-type scale from 1 (did not restrict them at all), to 7 (restricted them 100%).

2.2 Procedures

2.2.1 Logistic regression

The dependent variable in the analysis of the factors which influence the adoption of forward pricing is the binary choice of whether or not the respondent used forward pricing methods. Forward pricing methods in this study includes both cash forward contracting and hedging with futures and/or options through SAFEX. Furthermore, no distinction was made between direct and indirect means of forward pricing. A value of 1 was given to respondents who have used forward pricing methods irrespective of whether the participation was direct or indirect and 0 to the others. Twenty -two (44%) of the fifty respondents indicated that they have used some form of forward pricing when they marketed their 2004/05 maize crop and were given a value of 1. Only 2 of them (4%) have used futures contracts, while not a single farmer used options[5].

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[5] Although Vaalharts has no SAFEX-certified silo, there is no reason why the absence of such should influence the adoption of hedging methods. At harvest, a producer who hedged against price risk using a futures contract can sell his/her crop in the spot market, after which he/she can offset the futures position by buying back a similar futures contract prior to the delivery date.

The fact that the dependent variable is a binary choice, suggests the need to choose between the use of discriminant analysis, the linear probability model, probit, or a logit model. Mohammed & Ortmann (2005) argue that the criticism of the discriminant analysis is the fact that the assumption of multivariate normality on which it is based, is normally violated. The criticism of the linear probability model is that it is assumed to be constant. The results obtained when using the logit and probit models are very much similar (Mohammed & Ortmann, 2005; Gujarati, 2003). Since available computer software can easily perform logistic regression, this was used in the research. The logit model may be expressed as:

$$\phi_i = E(y_i = 1 | X_i) = \frac{1}{1 + e^{-\left(\beta_i + \sum_i^k \beta_j x_i\right)}}$$

Where: ϕ_i is the probability of respondent *i* using forward pricing strategies, y_i is the observed use of forward pricing by respondent *i*, x_i are the factors which determine the use of forward pricing by respondent *i, and* B_{ij} stands for the parameters to be estimated.

2.2.2 Hypothesised explanatory variables

The explanatory variables that were hypothesised to influence the adoption decision and the hypothesised direction of their influences are presented in Table 1.

Table 2: Variables expected to influence the forward pricing decision and the expected signs of the influence of the variables on the forward pricing decision

Variable	Definition	Expected sign
Experience	Number of years of farming experience the respondent has	+/-
Marketing skills	Respondent's self-rating of his/her marketing skills relative to that of other farmers in the region (measure on scale from 1 (much lower) to 7 (much higher)).	+/-
Education	Dummy variable scoring 1 if respondent has some form of tertiary education, 0 otherwise.	+
Yield risk premium	Level of risk aversion measured by means of a yield risk premium (Proportion of current expected yield that respondent is willing to sacrifice for opportunity to produce crop with constant yield (Musser *et al.*, 1996)).	+
Perception of forward pricing	Dummy variable scoring 1, if respondent perceives forward pricing to be effective in reducing price risk, 0 otherwise.	+
Free market preference	Rating of respondent's preference for a free market rather than a market regulated by government on a scale from 1 - 7 with 7 indicating a 100% preference for the free market.	+
Off-farm economic activities	Proportion of total income that was generated from off-farm economic activities (%).	+/-
Crop insurance	Dummy variable scoring 1, if respondent used crop insurance, 0 otherwise	+/-
Diversification	Level of diversification (index compiled by summing the squared proportional contributions of all enterprises to the total farm income. A value of 1 indicates the specialisation in the production of 1 crop.)	+/-
Centre pivot	Dummy variable scoring 1, if respondent adopted centre pivot technology, 0 otherwise.	+/-
Proportion land rented	Proportion of farmland that is rented (%).	+
Communication infrastructure	Dummy variable scoring 1, if respondent has access to a reliable internet connection, 0 otherwise.	+

The expected signs of experience and marketing skills are ambiguous. A person with more years of farming experience is likely to be in a healthier financial position. Such a person will be more likely to adopt a new technology, such as forward pricing (Davis, 2005). Isengildina & Hudson (2001) argue that a person who rates his/her marketing skills higher than that of other farmers will be more comfortable about using forward pricing methods. On the contrary, a person who does not rate his/her marketing skills very highly, is more likely to use marketing agents to make marketing decisions. The agents again, are more likely to use forward pricing methods. The ambiguity thus, is clear.

The use of forward pricing is hypothesised to be positively influenced by the level of formal education, the respondent's level of risk aversion, the farmer's perception that forward pricing is an effective risk management strategy-, and the farmer's preference for the free market system rather than a regulated marketing system. Goodwin & Schroeder (1994) argue that a more educated farmer is more likely to adopt a new technology and thus, to use forward pricing methods. The yield risk premium of the farmer is also expected to have a positive influence on the use of forward pricing methods since risk aversion becomes the primary motive for farmers to use forward markets (McNew & Musser, 2000). A person who perceives forward pricing to be an effective method to manage price risk, is more likely to adopt forward pricing methods (Isengildina & Hudson, 2001). If a person prefers the free market system to a regulated marketing system he/she is expected to be more likely to use forward pricing methods because he/she realises the opportunity to increase profits.

The use of off-farm economic activities, crop insurance, diversification and centre pivot technology are methods that may be used to manage risk. These risk management strategies affect the overall risk of farmers' enterprises and asset investments (Bown *et al.*, 1999). The direction of the influence depends on whether the specific risk management strategy is used complimentarily to (positive influence), or as a substitute (negative influence) for forward pricing. When off-farm income is considered within the risk-balancing framework, it is expected to substitute for hedging (Turvey, 1989). Asplund *et al.* (1989) argue that off-farm work activities by farm family members may be complementary to hedging, if they are used as a response to income or price variability. The direction of the influence of crop insurance depends on the type of insurance purchased and the level of coverage (Isengildina & Hudson, 2001). Sartwelle *et al.* (2000) expected that specialised grain operations would enable the decision maker to devote more resources toward marketing, therefore making greater use of futures and options -oriented marketing practices. Grové *et al.* (2006) found

that the variability of gross margins of centre pivot irrigation is lower than flood irrigation. If centre pivot technology is adopted as a response to income variability, the adoption of centre pivot technology is expected to be used complimentarily to forward pricing.

A high proportion of farmland that is rented incurs a fixed cost which has to be met, regardless of the price or yield of the crop. The fixed cost suggests that a producer who rents a high proportion of farmland is expected to be more likely to use forward pricing methods to hedge against price risk (Bown, 1999). Farmers with access to more sophisticated communication infrastructure are able to monitor price fluctuations and therefore manage price risk more effectively than others (Bown, 1999).   The expected relationship between the level of sophistication of communication infrastructure and the use of forward pricing methods is therefore, positive.

2.2.3 Factor analysis

Factor analysis was employed on these responses to explain the variance in the observed variable in terms of underlying latent factors (Habing, 2003). Thus, the technique reduces the dimensionality of the personal reasons which helps to interpret the underlying, common factors of respondents' personal reasons why they did not use forward pricing methods to manage price risk.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) was used to determine whether individual variables are suitable for inclusion in the factor analysis. The MSA lies between 0 and 1 and is described by Kaiser as a measure of the extent to which a variable "belongs to the family" of the larger group of variables. Berghaus *et al* (2005) states that a value which is lower than 0.5 may be considered "unacceptable". Eight variables scored KMO-values greater than 0.5 and were included in the factor analysis. The number of factors to be specified in the factor analysis was determined by performing a principle component analysis (Woodburn, 1993). Only principle components with eigenvalues greater than one were accepted. Three principle components had eigenvalues greater than 1 and thus, 3 factors were extracted in the factor analysis. Once the factor analysis is completed the goodness of fit needs to be measured. The communality is an indication of the proportion of the variation of a variable that is accounted for by the retained factors. An indicator variable with a low communality indicates that the factor model is not working well for that indicator. It furthermore suggests that the specific indicator should possibly be removed from the model. A communality of 0.75, however, may seem high, but is meaningless unless the

factor on which the variable is loaded is interpretable. Likewise, a communality of 0.25 may seem low, but may be meaningful if the item contributes to a well defined factor. Thus, it is not the communality coefficient *per se* which is critical, but rather the extent to which the item plays a role in the interpretation of the factor. The role of the variable is, however, often greater when the communality is high (Garson, 2004). Cronbach's Alpha was used to calculate the overall reliability of internal consistency in the factors (Lazenbatt *et al.*, 2005).   It measures the extent to which each item measures the same concept as the overall factor. Lazenbatt *et al* (2005) uses a value greater than 0.7 as an indication that the reliability is acceptable.

The discussion of the procedures used to meet the specific objectives of this study concludes this section. The results are presented and discussed in the next section.

3.   Results and Discussion

3.1   Logistic regression of the factors which affect the adoption of forward pricing in price risk management

The results of the logistic regression of the factors which influence the decision whether or not to use forward pricing methods are shown in Table 2. Since the main objective of this research is to identify factors that significantly affect the adoption of forward pricing methods, the partial effects were omitted and only the signs of the coefficients were interpreted.

The model correctly predicted 72% of the observations which implies that the model is a good fit. The McFadden R-Squared value of 0.3011 is low: however, it is consistent with the findings of Sartwelle *et al.* (2000) (0.108) and Katchova & Miranda (2004) (0.36). The LR-statistic of 7.1290 with a probability of 0.0070 indicates that the overall model is significant. Except for the coefficient of the yield risk premium variable, the signs of all the variables are the same as were initially hypothesised. Two variables are significant at 15% but were included in the model since the intention is not to predict, but rather to identify, significant factors that influence the use of forward pricing methods.

Table 2: Logit model results for Vaalharts maize producers' forward pricing adoption decision

Variable	Coefficient	Std Error	t-test	Prob(t)
Intercept	-7.7047	2.8268	-2.7256*	0.0064
Yield risk premium (Risk aversion)	-0.0584	0.0297	-1.9688*	0.049
Proportion of farmland that was rented	2.9896	1.5141	1.9745*	0.0483
Centre pivot adoption	2.4124	0.9532	2.5308*	0.0114
Marketing skills	0.6578	0.4171	1.5772***	0.1148
Specialisation	6.9422	3.7249	1.8637**	0.0624
Insurance	1.6411	1.0766	1.5243***	0.1274
Percentage correctly predicted (%)	72			
McFadden R-Squared[1]	0.3011			
LR-statistic[2]	7.1290			
Probability(LR stat)[3]	0.0070			

Note: *, **, and *** indicate statistical significance of 5%, 10%, and 15%, respectively.

[1] McFadden R-Squared is an analog to the R^2 reported in linear regression models

[2] LR-statistic is the analog of the F-statistic in linear regression models and tests the overall significance of the model.

[3] Probability(LR stat) is the p-value of the LR test statistic

Risk aversion significantly (p<0.05) affects forward pricing decisions. The negative sign of the coefficient of the **yield risk premium** variable is of interest since it implies that the more risk averse a producer is, the less likely he/she is to use forward pricing methods to manage price risk. The negative influence is consistent with the findings of Shapiro & Brorsen (1988); Goodwin & Schroeder (1994); Musser *et al*. (1996); and Sartwelle *et al*. (1999). Isengildina & Hudson (2001), however, found the relationship to be positive. The negative influence of risk aversion on the use of forward pricing may be explained in a number of ways. It may be an indication that the sample of Vaalharts maize producers does not perceive forward pricing to be an effective method of reducing price risk. Respondents furthermore may perceive forward pricing as a risky marketing alternative, or as a tool which may be used to increase their income rather than to manage risk. The latter is consistent with the segment of the literature which suggests that farmers can use forward pricing to achieve higher prices (McNew & Musser, 2000).

Crop insurance ($p<0.15$) and centre pivot irrigation ($p<0.05$) have positive signs which suggest that Vaalharts maize producers use these factors complementarily to forward pricing. The positive sign of the coefficient of specialisation ($p<0.1$) indicates that more specialisation results in a higher likelihood that the respondent will use forward pricing. Thus, it is concluded that crop diversification is used to substitute for forward pricing to reduce income variability. In the previous section it was hypothesised that a larger proportion of rented farmland incurs a fixed cost which needs to be covered, regardless of the price or crop yield that is realised. Forward pricing is therefore used to stabilise income variability which will result in a higher probability that the fixed cost will be covered. The positive sign of proportion of farmland rented confirms the hypothesis.

Interesting to note is that the combination of factors that significantly influence the adoption of forward pricing methods may indicate that forward pricing is associated with higher levels of human capital. The **proportion of farmland rented**, use **of centre pivot irrigation technology**, **specialised crop** production, and **marketing skills** are all significantly positively related to forward pricing. Compared to flood irrigation, centre pivot irrigation is seen as much more sophisticated and requires a higher level of managerial skills if one wants to reap the benefits of adopting the new technology. Farmers who are renting extra land to farm are expected to be the prosperous farmers. Most probably these farmers are also the ones who are better managers. Specialisation may indicate that the farmer tends to be the type of person who likes to be on the cutting edge of production and is therefore also expected to specialise in marketing activities. In order to specialise in these activities requires a higher level of human capital. The relationship between a higher level of marketing skills and human capital is self explanatory.

The most important conclusion from this section is that farmers may perceive forward pricing as an ineffective management strategy to manage price risk. Most of the factors are used to complement or substitute for forward pricing. Important though, is the fact that it seems as if farmers with higher human capital resources are most likely to adopt forward pricing methods. In the next section, the personal reasons why farmers are not using forward pricing methods are analysed with factor analysis.

3.2 Factor analysis of the personal reasons which restrict farmers from using forward pricing methods

Factor analysis was conducted to reduce the dimensionality of the personal reasons which restricted farmers to use forward pricing methods, with the results being presented in Table 3.

Table 3: Factor loadings and communalities after Varimax rotation

	Factor 1	Factor 2	Factor 3	
		DISTRUST		
Variables	**LACK OF CAPACITY**	**OF THE MARKET**	**BAD EXPERIENCES**	**Communality**
Lack of trust in role players	**-0.7791**	-0.1089	0.3352	0.7313
Lack of knowledge	**-0.6906**	-0.1758	0.1318	0.5252
No tools available	**-0.6130**	-0.2934	0.3670	0.5966
Too much speculation and manipulation	-0.4818	**-0.6636**	0.1435	0.6931
Time may be better spent focusing on production	-0.1390	**-0.7048**	0.2602	0.5837
Afraid that prices may increase after I fixed a price	-0.1331	**-0.7390**	0.1720	0.5935
Bad experiences (personally)	-0.1298	-0.2801	**0.8428**	0.8057
Bad experiences (others)	-0.2896	-0.3802	**0.6910**	0.7059
Cronbach alpha	0.72	0.76	0.84	

With regard to the goodness of fit measures, the communalities of all the variables are more than 0.5 which indicates that the factors explain more than 50% of the variation in the variables. These variables also contribute significantly to the interpretation of the respective factors and therefore, the results were

judged to be acceptable. The internal consistency of the extracted factors was reliable and all three extracted factors had Cronbach's Alpha values greater than 0.7. Each item in the respective factors thus measures the same concept as the overall factor.

In the first factor, **Lack of knowledge**, **No tools available**, and **Lack of trust in role players**, scored high factor loadings and thus were grouped into Factor 1. All these factors were found to be positively related to one another. A person who feels that he/she does not have sufficient knowledge to use forward pricing also believes that there are no tools available which can assist him/her to use forward pricing effectively. Such a person therefore does not trust the judgements of consultants because they do not have a sound knowledge and understanding of the alternative forward pricing methods. Factor 1 was therefore labelled "Lack of capacity". Recall that it was stated that many of the factors that affect forward pricing adoption in the logistic regression model were related to higher levels of human capital. The fact that respondents feel that they lack sufficient capacity to use forward pricing methods effectively confirms the observation. This finding has important implications for marketing institutions and institutions which provide education in the use of forward pricing methods in price risk management.

Too much speculation and manipulation, **Afraid that price may increase after I fixed a price**, and **Time may be better spent focusing on production** scored high factor loadings in Factor 2 and thus were grouped together. A person who believes there is too much speculation and manipulation in the forward pricing market and who is afraid that the price may increase after a price is fixed, may feel that his/her time may be better spent when he/she focuses on production. In essence such a person does not believe that the market is working effectively and therefore is of the opinion that the only way to achieve a positive outcome is to focus on production. Factor 2 was labeled "Distrust of the market". In the previous section it was concluded that the respondents do not perceive forward pricing to be an effective strategy to reduce price risk. Factor 2 confirms this conclusion.

The variables **Bad experiences (personally)** and **Bad experiences (others)** scored high factor loadings in Factor 3. A person who has had a bad experience-, or who knows someone else who has had a bad experience when using forward pricing methods in the past will be reluctant to use forward pricing methods in future. Factor 3 was labelled "Bad experience".

4.   **Conclusion and Recommendations**

Results from the logit analysis indicated that farmers may perceive the use of alternative forward pricing methods as an ineffective management strategy to manage price risk. Furthermore, it seems as if farmers with higher human capital resources are more likely to adopt forward pricing methods. The factor analysis revealed that the personal reasons for not using forward pricing methods relates to the fact that they lack the capacity to use these types of marketing strategies. Moreover, they do not believe that the market is effective and therefore they are of the opinion that the only way to achieve a positive outcome is to focus on production. Farmers are also afraid to use forward pricing methods because of bad experiences.

In future, educational institutions should focus more on the practical application of alternative forward pricing methods and not as much on the benefits of the use of alternative forward pricing methods. The latter only convince farmers of the benefits, but do not empower them to use alternative forward pricing methods effectively. More research and educational efforts are needed with respect as to how much to contract, which type of contract to use, and to identify the frequency of contracting. Guidelines should be developed which may assist farmers to employ effectively forward pricing as a risk management strategy. These guidelines should be specific to the personal and business characteristics of the specific farmer who wants to employ forward pricing in price risk management. Thus, it is argued that the generalised strategies advocated by cooperatives and agricultural advisors may not be applicable to all the farmers. These views are also shared by Katchova & Miranda (2004).

Since this research was conducted only in the Vaalharts region, the results are not representative of all maize producers in South Africa. Similar research has to be conducted in other regions of South Africa in order to gather information on the factors that influence the adoption of forward pricing methods in price risk management that are representative of South Africa as a whole. Such information may contribute to the improvement of educational material that is used to educate maize producers in the use of forward pricing methods in price risk management, and consequently also to more farmers using forward pricing methods in price risk management.

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