THE UNIVERSITY
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THE FACULTY OF LAND AND ENVIRONMENT

DECISION-MAKING IN AUSTRALIAN
WHEAT MARKETING AND PRICE RISK MANAGEMENT

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DECLARATION

I declare that this thesis consists of original work and that information from published or unpublished sources has been acknowledged in the thesis. None of the work has been submitted previously for any other academic award.

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October 2009
ABSTRACT

Previous research that attempted to evaluate Australian farmers’ decision-making in a high risk environment has often been inconclusive and contradictory. The risks associated with wheat production, marketing, and hedging/pricing are high in Australia due to irregular rainfall, distance from major markets, and difficulties with suitable hedging benchmarks.

Much of the overseas research has limited value to Australia because of higher farming risks, deregulated markets, no price/income protection policies, and no public underwriting of risks. There have been few in-depth studies that have examined relevant marketing methods and hedging strategies from a behavioural decision-making perspective in a deregulated market.

In this research, the Fisher Exact Test (a variation of the Chi-square test) analysed five marketing strategies and six hedging/pricing methods used by wheat growers, across eighteen key management factors and seventeen risk attitude/adoption characteristics in NSW for the 2005 production year, with the results compared with South Australia and Victoria. The findings were then used to examine eight research questions relating to decision-making.

Different management approaches by Australian wheat growers were found to affect marketing decision-making more than hedging decision-making which was more influenced by risk perception. Cash flow might be a greater contributing factor leading to emotional anxiety than either the marketing method or hedging strategy. Growers were more likely to perceive that knowledge of variable costs of production led to price risk management, and were also more likely to perceive that they target more realistic price levels when variable costs are known. Alternatively, price risk management was an incentive to lower variable costs of production.

A wheat grower's farm size, debt, and farming experience influenced the choice of marketing method or hedging strategy, whilst age did not, while the impact of training was inconclusive. Regret and avoidance in decision-making was high for wheat growers. Rogers’ adoption criteria have some influence on decision-making. There was much evidence to support the application of the Kahneman and Tversky’s ‘certainty effect’ proposition to Australian wheat growers.
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GLOSSARY

A.F.F.A.  Agriculture, Fisheries and Forestry of Australia (Federal Department)

Basis  Difference between a local price and a benchmark price

Basis risk  Movement between a local price and the futures price during hedging

C.F.T.C.  Commodity Futures Trading Commission (Washington)

D.P.I.  Department of Primary Industries (Victoria)

F.M.D.s  Farm Management Deposits

Hedging  A method to offset physical price risk

N.S.W.  New South Wales

O.T.C.s  Over-the-counter bank pricing products

Pricing  Implies forward pricing or hedging

Qld.  Queensland

S.A.  South Australia

Swaps  An O.T.C. bank product that fixes a commodity price

Vic.  Victoria

Notes:


2. Forward pricing (locking in or establishing a floor price) also includes hedging (offsetting market position).

3. Some wheat growers included cooperative pooling under private pools, while others were more likely to include them under ‘other marketing methods’.
1. INTRODUCTION

This study began under an Australian wheat export monopoly (‘single-desk’) and finished with deregulation in both the exporting and domestic markets. The initial focus on decision-making in price risk management was therefore expanded to include the main marketing methods. This overcame such issues as to whether forward contracting should be examined from a marketing or a price risk management perspective.

The Australian wheat production environment is characterised by high production (yield) risk relative to many other countries, wide variability in production output (quality) between different localities, and relatively high commodity price volatility (including currency and basis), compared to previous regulated markets. This study was conducted at a time of declining wheat producer numbers, increasing farm size, and increased input costs.

Despite this uncertainty, many Australian wheat growers are still prepared to view risk positively. Whilst there is the risk of financial losses and hedging inaction by growers because of fear, anxiety, and regret, the high risk environment creates opportunities for growth.

Mergers and acquisitions amongst Australian merchants in a deregulated domestic market under persistent drought conditions (approximately four drought years in the last decade) have changed the methods of contractual business with producers. Some vertical integration by merchants, both backward (seed, fertilizer, chemicals, machinery and equipment) and forward (processing and stock-feed manufacturing), is intensifying the integration process at the same time that other businesses are increasingly becoming specialised.

Whilst traditional marketing methods have not changed in concept, the availability and type of hedging/pricing products in the wheat market (including both deliverable and non-deliverable forward contracts) is continually evolving in both conceptual design and application. However, there has been very little research into farmers’ risk attitudes on the full range of marketing methods and recent hedging/pricing strategies in a deregulated market environment where the government can be considered as decision-neutral.
2. INDUSTRY PROBLEMS AND LIMITATIONS OF PREVIOUS RESEARCH

2.1. Industry problems identified

Risks associated with wheat selling (contract default) and pricing (cash outflows in bank swap settlements) have been high recently, but they are an intrinsic element under Australian conditions with high production risk and significant price volatility. However, knowledge about the decision-making of wheat growers under these risky circumstances is relatively unknown, either in Australia or overseas, because of the private nature of transactions.

Previous research results have been inconclusive (Jordaan and Grove, 2008) and contradictory. Simmons and Rambaldi (1997) concluded that Australian wheat growers were largely risk takers, and that they generally were not in favour of using price risk management. In contrast, Goodwin and Schroeder (1994) found that risk-taking U.S. producers were more likely to adopt hedging/forward pricing strategies than risk-averse producers. Alternatively, the Agriculture, Fisheries and Forestry Australia (A.F.F.A.) survey in 2002 found that 60 percent of N.S.W. (New South Wales) grain growers had undertaken forward selling, 37 percent in South Australia (S.A.), and 55 percent in Victoria (A.F.F.A, 2003).

Gray and Rutledge (1971) and Tomek and Peterson (2001) conducted extensive research linking the demographic characteristics of U.S. grain producers with marketing and hedging/pricing strategies. This contrasted with European researchers who have focused on the psychology of marketing decision-making (Svenson, 1990; and Waldenström, 1997). However, conclusions about farm decision-making in the United States and Western Europe have little relevance to Australia because of the lower production risk combined with subsidy/market protection and public underwriting of risk in the US and Europe. Australian farmers operate under high production risk in a deregulated market with few subsidies and no public underwriting of risk in farmer insurance schemes.

The Agriculture, Fisheries and Forestry Australia (A.F.F.A.) survey in 2002 indicated that if commodity prices fell, 75 percent of Australian grain growers would perceive significant farm
viability problems (A.F.F.A, 2003). Only 23 percent of grain growers perceived a likelihood of a significant fall in grain prices within the next two years (2002-2004), 44 percent had specific strategies to deal with significant downturns in commodity prices, and only 10 percent intended to make changes to management practices during the next 12 months to be able to deal with commodity downturns.

The key concern from the A.F.F.A. 2002 survey was that 42 percent of Australian commodity producers perceived a significant farm viability problem because of the possibility of falling commodity prices but intended to do nothing about it in the next 12 months (A.F.F.A., 2003). Another key concern was that of the 44 percent of grain growers who stated that they had specific strategies in place to deal with grain price downturns, only 8 percent related to hedging price, with 12 percent relying on farm enterprise diversification, 8 percent relying on off-farm work, 3 percent had Farm Management Deposits (F.M.D.s), and 2 percent on value-adding. The remainder had very vague or ambiguous 'strategies' that included reducing expenditure, using investments, and better management, while 4 percent stated that they would speculate either by increasing or decreasing production or using storage strategies.

Whilst there is a significant gap between perception of commodity price risk and action to undertake price risk minimization strategies, there may exist an even greater gap between the real price risk and action taken to implement price risk minimization strategies.

The importance of risk identification and the development of risk management strategies regarding grain marketing has been establish in Australia (G.C.A./ R.I.R.D.C., 2004). There is a need to better understand the gaps between perceptions, actual risks, and response behaviour in both marketing and risk management for Australian wheat growers. As well, the influence of production risk on marketing decisions and risk management response behaviour requires specific research under conditions of low farmer protection in a deregulated market.

This research aimed to address these identifiable deficiencies in knowledge relating to both marketing methods and hedging/pricing strategies by focusing on the behavioural aspects in wheat grower decision-making.
2.2. Limitations of previous research

Many overseas research outcomes cannot be readily applied to local Australian conditions where production/specification risk is higher, farm type is extremely variable, soils are largely poorer and more vulnerable regarding sustainability, and cropping/diversification selection vary widely between both farms and regions (very heterogeneous). Hedging risks for Australian wheat producers are higher because local hedging facilities are relatively illiquid causing higher transaction costs, and overseas hedging risks (currency and basis) are larger.

Much of the research in Australia on producer behaviour in decision-making in the past 50 years focused on utility theory, 'equilibrium' theory, linear programming, and systems analyses. Whilst each of these approaches had limitations (Malcolm, 1990), there was little recognition of market risk, price risk, marketing risk (contract default) or pricing risk (settlement payout). Most research on Australian wheat marketing methods focused on the previous ‘single-desk’ selling system under a regulated market environment.

There have been Australian analyses on hedging effectiveness (Perkins et al., 1984, and Bond et al., 1985), and studies on hedging strategy outcomes (Bond and Wonder, 1980; Perkins, 1984; Sheales and Tomek, 1987; Simmons and Rabaldi, 1997; Kingwell, 2000; and Rambaldi and Simmons, 2000). However, there has been little management decision-making research in Australia to find what motivates wheat growers to use price risk management strategies, how the wheat growers evaluate the range of hedging strategies under different risk situations, and what are the factors limiting hedging given uncertain conditions.

Research conducted in France, Denmark, and Sweden on farmer behaviour in decision-making (Jacquet et al. 1994; Jacobsen, 1994; Hatteland, 1997; and Öhlmer et al. 1998) has mainly focused on production decisions. Any research on marketing decision psychology (Svenson, 1990; and Waldenström, 1997) was restrained by government intervention into agricultural commodity markets in these countries (Common Agricultural Policy - C.A.P.).
Research in the U.S.A. has focused on the development of producer profiles and commodity marketing/pricing 'optimal' models, but with little research on decision-making under conditions of high risk and uncertainty. Pennings et al. (2000) attempted to combine both the demographic and psychological approaches, acknowledging that different groups of producers have different decision-making processes. However, these approaches were influenced by lower production risk and U.S. farmer protectionist policies, which included the public underwriting of farmer risk.

There are a number of recent studies on risk management strategies both in Australia (Nguyen et al., 2005) and overseas (Miller et al., 2004), but these focused on the broader aspects of farming risk and not specifically to marketing and price risks.

Tomek and Peterson (2001) highlighted the problem in comparing either marketing or pricing strategies because of the difficulty in establishing valid results for benefits, costs and risk comparisons. The measurement of variables in a diversity of circumstances, as well as the dynamic market environment and the subsequent multivariate analytical problems, became almost insurmountable in terms of achieving valid outcomes when comparing strategies. Rather than seeking ‘optimal’ solutions, a better understanding on the psychology of decision-making may be required.

However, there are many variables and no constants when undertaking psychological and behavioural research. Computer modeling is limited because of complexity of interacting variables and too many unrealistic assumptions. Algorithm equations fail to reflect the impact of human behavior in decision-making, and cannot account for the effect of fear, anxiety, regret, and past experiences. Jordaan and Grove (2008) acknowledged these weaknesses when they concluded that future emphases should be placed on the factors affecting the adoption of forward pricing as a risk management strategy.

Tomek and Peterson (2001) indicated that farmer decision-making relating to risk management practices is incomplete. Carter (1999) concluded that previous research on hedging was too narrowly focused, and that further studies were needed to understand why farmers hedge.
3. RESEARCH QUESTIONS AND EXPECTED OUTCOMES

3.1. Research questions

Eight relevant research questions were identified in this study on northern NSW wheat growers:

1. Does the management approach to decision-making affect a wheat grower's choice of marketing method or hedging/pricing strategy?

2. Do wheat growers experience anxiety when choosing marketing methods or hedging/pricing strategies?

3. Does the knowledge of variable cost of production influence price risk management decisions for wheat growers?

4. Does price risk management act as an incentive to lower variable costs of production for wheat growers?

5. Does the wheat grower's farm size, age, debt, farming experience, or training influence the choice of marketing method or hedging/pricing strategy?

6. Do bad decisions in the past over marketing methods or hedging/pricing strategies lead to regret and avoidance by wheat growers, or to learning and seeking more knowledge?

7. Do Roger's adoption criteria have any influence on decision-making regarding marketing method and hedging/pricing strategy for wheat growers?

8. Is the 'certainty effect' (defined by Kahneman and Tversky as the tendency for an individual to be risk averse when certain gains are known to eventuate, but a risk taker when losses occur) relevant to Australian wheat growers?
3.2. Expected outcomes

The research outcomes are expected to develop profiles and increase the knowledge of the type of Australian wheat grower who uses particular marketing methods and hedging/pricing strategies in high-risk situations. A better understanding of the Australian wheat grower’s decision-making processes, including the motivation and limitations when adopting particular marketing methods and hedging/pricing strategies is also expected. The outcome should benefit Australian wheat growers in their marketing and hedging/pricing decision-making.
Yellow numbers indicate the average annual contribution of each state as a percentage of the national production from 1990-91 to 1994-95. States not numbered contributed less than 1% on average to national production annually.

- Major areas combined account for approximately 75% of the total national production annually.
- Major and minor areas combined account for approximately 99% of the total national production annually.
- Major and minor crop areas and state production percentages are derived from Australian Bureau of Statistics Agricultural Census data from 1990-91 to 1994-95.
4. LITERATURE REVIEW

4.1. Problems with previous research literature

The research literature on decision-making into agricultural commodity selling and price risk management can be divided into two epochs. The first dominated until the mid-1950s and focused on behavioural decision-making from the farmer psychological aspect. This contrasted with the more mathematical approach since the mid-1950s which has had many unrealistic assumptions with too few analysed variables and questionable analytical validity. Apart from this criticism, there is the underlying assumption from the physical sciences that somehow everything is in a state of natural equilibrium (including human behaviour), and that everything can therefore be reduced to algorithmic formulations (including decision-making processes).

The synergy of algorithmic modeling with derivatives in brisk management decision-making may be questionable because of the large number of variables. It ignores the impact of the psychological decision-making of millions of individual people that are reflected in the market dynamics. Also, econometricians often venture into derivative analyses because of the vast amount of readily available and cheap data sources, which can easily be incorporated into computer programming. By itself, this does little to enhance the understanding of the usage of derivative markets and associated decision-making.

Gray and Rutledge (1971) described the literature on the futures market as being amorphous and disjointed, and even more so under the current research environment (Carter, 1999). The literature on price risk management is biased towards the U.S.A., prejudiced against the behavioural approach to decision-making, dominated by algorithmic attempts to provide solutions, and voluminous in terms of research outcomes.

Uncertainty ill-defined
Mathematical probabilities have been used in the definition of uncertainty and risk (Knight, 1921; Robison and Barry, 1987). Uncertainty is purported to exist when the probability of outcomes cannot be determined objectively, whereas risk occurs when objective probabilities
can be determined. However, reducing uncertainty and risk to mathematical probabilities contributes little to understanding the impact of uncertainty and how risk can be managed.

Williams and Schroder (1999) suggested that there might be non-mathematical definitions of uncertainty, such as outcomes that have been derived through factors that cannot be clearly identifiable, measurable, and managed (the uncertainty of weather and its outcome is one example). In contrast, the adverseness side of risk can be identifiable, measurable, and managed (the risk of production losses is one example). However, the beneficial side of risk that drives business motivation and innovation remains ill-defined. The management problem still remains as to whether taking risk will result in positive or negative outcomes.

Weber and Milliman (1997) suggested that decisions based on weather represented chance (uncertainty) and was beyond the control of the farm manager. This contrasted to risk which can be managed through skills. MacCrimmon and Wehrung (1986) agreed with this differentiation.

Actually defining uncertainty is difficult when the definition of ‘drought’ is not standardized throughout the world. But even average rainfall contributes little to farming outcomes if timing, soil type, and local conditions are ignored. There are many facets to uncertainty which make it difficult to isolate and measure.

King and Robison (1981) indicated that agricultural producers make decisions in a dynamic highly uncertain environment with continual weather changes, seasonal influences, variable agronomic conditions, volatile prices, cost variations, and competitive markets. They make production decisions without any certainty as to the quantities that they will produce or the price that they will attain (Pope, Chavas, and Just, 1983). The problem in research is how to include all these variables and still make valid conclusions when outcomes are only known in hindsight.

Clear separation of certainty and uncertainty has been inadequately researched under farm conditions. Routhe (1962) found that the values and attitudes of farmers in an uncertain farm environment can result in goals and decisions that are supposedly ill-defined according to outsiders, and for reasons only known to the particular farmer.
King and Robison (1981) argued that the impact of uncertainty is largely ignored by farmers when making decisions. Farmers need some certainty over seasons, weather, rainfall and temperature, otherwise cropping could not occur. This might suggest that there may be a small element of uncertainty for farmers, which can sometimes make decision-making difficult and often stressful for some of them.

**Risk identification**

Johnson (1952) associated risk with farm decision-making because of the uncertainty involved with the production, prices, people, and organizations that impact on farm businesses. In contrast, Pennings and Leuthold (2000) suggested that risk must first be perceived before a producer can decide whether or not to respond to it. Some researchers therefore assumed risk to exist, while others indicated a need for it to be perceived in the first instance.

Researchers have largely ignored the differences in risk perception between countries and regions. Wheat farming in marginal regions such as Australia is characterized by large production variance and income uncertainty, while success is often influenced by constraints such as finance, debt, investment, age, estate/succession planning, and high price volatility. When compared against most of the wheat producing areas in the USA and western Europe, Australian growers produce wheat in a marginal high-risk environment.

Many researchers have been risk-specific, ignoring many other risk factors. Jacquet and Grusse (1994) indicated in their research that 'high risk' decision-making referred only to production sustainability, and excluded price variability. Limiting research to one risk type can narrow the understanding of farmer decision-making.

**Risk importance**

Previous research has generally agreed with Knight (1921) that there is a need for risk-taking to generate profit. The assumption is that if many businesses undertook a similar enterprise (low risk), there would be little opportunity for competitive gain. However, farmers produce and sell commodity (undifferentiated product), but profit is not always assured under such high risk
circumstances. From a management perspective, there is also doubt as to whether a farmer performs better under a high-risk commodity environment. This commodity association with risk and profit has been inadequately researched in the past.

Bell (1997) suggested that the linkage between perceived risk and financial return cannot be ignored when making decisions. Weber and Milliman (1997) found that decision-makers ideally prefer high financial returns combined with low risk. An individual risk/return trade-off preference may exist between the perceived risk relative to alternative choices, and the level of financial return. As financial returns increased relative to the perceived risk, the more likely would a risk decision be undertaken.

Weber and Milliman (1997) indicated that business risk exposure depends on the value at risk, the magnitude of potential losses, the probability (including frequency) of occurrence, the amount of existing wealth, and the controllability of the potential loss. This approach seriously challenged MacCrimmon and Wehrung (1986) who indicated that simply taking risk in a business was inseparable from profit and personal success.

Weber (1988) found that the potential size of the financial gain or loss relative to total wealth did affect an individual's perception of risk. Also, Anderson (1979) acknowledged that a producer's wealth and asset base (farm size and value) influenced risk behaviour that changed over time. This agreed with the theory that less wealthy farmers have a higher perception of risk because of their greater potential percentage losses relative to total wealth.

Bowman (1982) found a propensity for businesses that were encountering financial difficulties to take higher risks than for financially sound organisations. Management took on more risk as financial difficulties increased and financial returns decreased. This might explain why some farmers adopt higher risk strategies during periods of decreased income or under high debt situations.

Individuals may perceive risk differently under the same circumstances. Alternatively, Weber and Milliman (1997) suggested that it might be possible to perceive the risk of the same factor
differently at different times or in different situations. A person may perceive a certain risk today but perceive the same activity as a challenge in twelve months time. Sometimes, individuals can take on risk under a certain place and circumstance, yet avoid risk totally given other situations. Therefore, place, circumstance and time could be inter-related to a person's perception of what is risk and what is mundane.

Weber and Milliman (1997) indicated that a risk today by an individual might be perceived as a mere challenge at some future time, because of individual learning and personal experience. If individual risk attitudes change over time, then perceptions of risk may depend on the learning curve.

Researchers have largely ignored how financial losses can often occur at the most vulnerable time in business operations, and therefore cause unplanned high risk situations. Farmers often remember these events as being significant. The corollary might suggest that similar losses could easily be absorbed in profitable years and therefore are not recalled as being significant (and possibly be explained by ‘planned’ low risk situations).

Another issue in farming is how to know the financial returns in advance of making decisions. Krause (1994) indicated that farming sustainability under high risk depends on long-term profits outweighing long-term losses. The problem is knowing how to generate long-term profits in price-taking commodity markets without the benefit of hindsight. This contrasts with non-farm businesses which generally operate with price known in advance of production.

Nuthall (2001) indicated that the systematic approach to farm decision-making often falters because rural lifestyles and farm sustainability frequently do not align with financial objectives such as profit maximization and wealth creation. The role of risk-taking in differing rural lifestyles has been inadequately researched, presumably because of the difficulty in farmer perception of ‘lifestyle’, which could change over time with age, experience, and financial investment.
Williams and Schroder (1999) suggested that farm enterprise diversification might explain why many farmers are externally perceived to be ‘high risk’ even though their risk attitude is stated to be risk averse. It might be presumed that the outcomes of individual variables (costs, yields, and prices) tend to neutralize each other over many farm enterprises, thus reducing the total accumulative risk through a process of diversification. However, the presence of so many variables (and different methods of cost calculations) makes this theory difficult to prove from a research perspective.

The research findings therefore differ substantially between factors affecting risk exposure and risk taking/aversion. This might suggest some contradiction on the association between risk behaviour and financial (wealth/size) circumstances.

**Risk categorization**

One problem with international research relating to farmer risk profiles is the many assumptions that are made in a highly regulated market or government intervention environment. Risk-averse assumptions and outcomes are often required to justify market regulation or intervention. There has been very little research into farmers’ risk attitudes in a deregulated market environment where the government can be considered as being neutral in a farmer’s decision-making process.

Pennings and Leuthold (2000) indicated that agricultural producers are heterogeneous, which can be defined in this context as risk attitudes differing substantially between individuals. Both Brockhaus (1980) and March and Shapira (1987) found large differences in risk attitudes among farmers. However, these findings contrast with Dyer and Sarin (1982) who suggested that even though perceptions of risk behaviour vary with different factors at risk, an individual might still have a consistent overall relative risk attitude.

Xu (2005) suggested that farmers can be divided into those who are risk-takers (or farmers who prefer risk) and those who are risk-averse. But this does not account for those who outwardly describe themselves as risk-averse in attitude, yet take on huge amounts of risk in behaviour, either spontaneously or accumulatively. Alternatively, individuals can describe themselves as
supposed risk-takers when they take on relatively minor risk. This individual contradiction, which might suggest some dynamic behaviour-attitude complexity, can prevent accurate risk categorisation.

Contradiction between stated risk attitudes by farmers and subsequent behaviour may differ between farm enterprises, product type, and supply chains. Pennings and Leuthold (2000) found that U.S. pig producers' risk perceptions and beliefs were related to actual behaviour. However, this was for an industry that was characterised by forward contracting differentiated product (which does not exist for commodities) in an integrated supply chain.

Isengildina and Hudson (2001) found U.S. irrigated cotton growers perceived themselves to be moderately risk averse (4.73 on a scale of risk averse 1 to risk taker 10), despite relatively high income risk. Chavas and Holt (1996) compared risk attitudes for U.S. corn and soybean producers with Indian farmers (Binswanger, 1981) and Brazilian farmers (Dillon and Scandizzo, 1978), and concluded that U.S. farmers were relatively risk averse.

Australian farmers have been characterised as being 'typically risk averse' (Francisco and Anderson, 1972; Bond and Wonder, 1980), despite high risks in production, yield, quality, price, basis, and currency. In contrast, Goodwin and Schroeder (1994) found a high number of risk-taking farmers in their U.S. survey sample.

Another research problem with merely separating farmer risk attitude into risk averseness and risk taking is that what some individuals perceive as high risk, others would perceive the same situation as either low risk, or at the very least, a personal challenge (Weber and Milliman, 1997). There is a wide variance in the individual perception of risk.

In hindsight, perceptions of risk can change depending on the actual outcome (Kahneman and Tversky, 1979; Dyer and Sarin, 1982). When losses occur, individuals may perceive themselves as risk takers; but when gains accrue from the same action, then the perception of risk behaviour may be risk averse.
Much of the risk aversion evidence can derive from subjective assumptions made in econometric analysis (Hansen and Singleton, 1983; Friend and Blume, 1975; Siegel and Hoban, 1982; Wolf and Pohlman, 1983; and Szpiro, 1986). However, Pope and Just (1991) disputed any evidence of risk averseness and claimed ambiguity. The large number of variables and assumptions limited effective algorithmic examination.

**Risk avoidance**

Some researchers have attempted to separate risk attitude (which is intrinsic and associated with a personality trait) and risk preference (which is a behavioural variable that changes because of an extrinsic factor). Risk behaviour/preference can therefore be distinguishable from risk attitude. Sitkin and Pablo (1992) separated the perception of risk that changed according to certain circumstances, from an individual's personal character trait towards risk. However, others have used both attributes similarly and inter-changeably.

Weber and Milliman (1997) defined risk preference as the tendency to be attracted or repelled by alternatives that are perceived to be high risk. Smidts (1997) indicated that strength of preference was the desire or feeling for a particular outcome, which was quite different to an inherent risk attitude of an individual.

One issue is that many individuals (especially farmers) may not 'prefer' high-risk situations and may not want to acknowledge it. Smidts (1997) found that farmers face high risk (adverse weather) because they are forced to do so. They choose to plant a crop not knowing the final outcomes (production, yield, quality). Therefore, the strength of preference for an unfavourable farming outcome might be expected to approach zero for most farmers.

Risk aversion can be defined as a deliberate behavioural decision to avoid a perceived or identifiable risk. Kingwell, Morrison, and Bathgate (1992) assumed that such risk aversion is unaffected by wealth. As well, Pope and Just (1991) found that background financial circumstances, trends in wealth accumulation, and changes to profit did not alter the risk aversion characteristic of decision-makers.
Weber and Milliman (1997) found that risk behaviour could change based on the perceptions of a shift in the relative risk of alternative choices. This suggested that risk behaviour towards supposedly similar situations may actually change over time.

Dyer and Sarin (1982) indicated that an individual's risk behaviour will vary with different management roles and different factors at risk. Management decisions relating to price risk for farmers are likely to have different risk perceptions than for an investor making a long-term investment decision, despite having the same financial value at risk.

Measuring the strength or weakness of individual preference is based on the assumption that the outcomes are known in advance. Kahneman and Tversky (1979) defined the 'certainty effect' as the tendency for an individual to be risk averse when certain gains are known to eventuate, but a risk taker when uncertainty creates the possibility of either gains or losses occurring. This may offer a better explanation for farmers, however the problem is that the outcomes are not known in advance, and the 'certainty of gains' is a very rare occurrence when high production risk and price volatility occurs.

Weber and Milliman (1997) suggested that individual perceptions of high or low risk levels may depend on historical outcomes of previous decisions. Weber (1994) suggested that good or bad outcomes from similar past decisions can influence current decision-making, despite the outcome being caused by luck or particular circumstances at the time, rather than good management.

The problem lies with the relevancy of historical decisions to the current situation when the season, market, and market relativities are completely different. This can introduce complacency into decision-making when past decisions have been perceived to be good, but introduce regret and avoidance when past decisions have been perceived to be bad.

Waldenström (1997) indicated that farmers interpret new experiences based on past experiences, which may have positive (motivation) or negative (regret and avoidance) outcomes. Emotions such as regret over past actions and previous poor performance may be
significant in decision-making regarding avoidance. A farmer may avoid a particular decision because of a fear or anxiety that is recalled from a past experience, without perceiving how past mistakes were made in the context of a particular season or market circumstance.

Abelson and Levi (1985) referred to the selective filtering out bad outcomes from the memory to the exclusive recall of only good outcomes as the 'availability effect'. However, farmers can also filter out good outcomes to the exclusive recall of bad outcomes, thus perpetuating regret and avoidance. Regardless of the type of outcome, this exclusive recall can cause biased decision-making because of selective memory of the outcomes of certain historical events.

**Risk measurement**

Pennings and Leuthold (2000) found that segmenting farmers into different risk profiles is 'challenging' because risk is not directly observable. This unobservability of risk causes difficulty in accurately measuring both risk and attitudes towards risk. Cook and Stewart (1975) also concurred that this unobservability makes meaningful measurement of risk difficult.

Early risk/return models used historical standard deviation of risk variables to measure volatility, with little explanation as to how volatility was a useful measure of risk. Price volatility is perceived by some farmers as a profit opportunity rather than a loss-maker. Under such circumstances, standard deviation is a poor measure of perceived risk to the farmer.

Apart from this weakness, Weber and Milliman (1997) indicated that the standard deviation approach usually ignored the psychological aspects and personality differences of the individual decision-makers. Risk measurement that is based on historical data is largely inadequate in making decisions when individuals differ in their perception of the relevance of the past. Regret and avoidance over losses incurred through previous price volatility might limit opportunities when future price volatility occurs.

**Risk management decision-making**

Farmer decision-making relating to risk is frequently complex because of the dynamic environment. Willock (1997) suggested that because psychological factors are involved in
farmer decision-making, this causes difficulty in understanding farmer behaviour in decision-making. As well, different groups of farmers have different decision-making processes (heterogeneity), and these compound the decision-making process.

Routhe (1962) suggested that what appears to be correct today in a dynamic environment may become obsolete and outmoded tomorrow. Market dynamism eroded the capacity to make relevant decisions for the future based on past events. Having more flexible strategies might be the key to risk management, but these types of risk management strategies usually involve some financial cost outlay.

Anderson (1979) acknowledged that farm management decision-making that involves risk is difficult because it involves climatic variability, time lags in production, and institutional/legal constraints. In deregulated markets, there are also decisions to be made on market choice at a time when prices can be highly volatile. Anderson (1979) suggested that management must continually make adjustments to resource usage, adapt quickly to change, with an element of luck in any success. Again, the use of more flexible strategies might have been more useful, but were not considered in this early research.

Johnson (1952) suggested that farm managers make decisions without adequate knowledge, either because of the dubiousness and relevance of the existing information or because of the cost of receiving the relevant information is prohibitive. The problems of too much information or too little time were not considered in this early research. Robbins and Barnwell (2002) suggested that attempts to reduce business uncertainty through the provision of more information may only increase uncertainty. Perhaps as a result, many farmers still relied mainly on intuition, experience, and simple budgeting when making farm decisions (Malcolm, 1990).

Holthausen (1979) highlighted the dilemma for agricultural producers in that they must decide the level of production before the final price is known (price uncertainty). It is common practice for Australian growers to make decisions based on weather and sub-soil moisture, crop rotation considerations, and current price trends. The Holthausen research found that the number of hectares planted largely depended on forward prices, and was independent of the risk profile of
the producer and the probability of price movement. The problem is that many farmers misinterpret forward prices in commodity markets and therefore mistake market direction (Working, 1949).

Friend and Hickling (1987) suggested that management planning should lead to continuous decision-making through time (a dynamic strategic process). Continual changes in the complexity and inter-relatedness of variables that impact on the farm resulted in the need for regular adaptation to altered circumstance (Østergaard, 1997). Behaviour is therefore often a result of adapting to the continual change or resisting it. The alternative suggests choosing more flexible strategies in the first instance, but research has largely ignored the benefits of greater flexibility in risk management strategies.

Isengildina and Hudson (2001) indicated that if producers perceived a marketing method or pricing strategy to be risk reduction, then they were more likely to have positive usage. This contrasted with negative usage associated with strategies that were perceived to increase risk. One problem with this finding is that in a highly uncertain environment what begins as perception of risk reduction can end up with high risk and the potential for financial losses. Another problem is that what has been perceived as high risk in one year is carried over into subsequent years through regret and avoidance, even though markets and market relativities have dramatically altered.

Many decisions are taken to reduce error (Allee, 1959), which may be associated with risk minimisation. However, a farm decision taken today to reduce financial loss might result in the accumulation of extremely high risk tomorrow, because of changes in production and markets. Hindsight might indicate the folly of planting a crop in a particular year, but it cannot ignore the soundness of the decision at the time that it was made.

Nuthall (2001) highlighted the problem of continuing with a certain decision, despite continuing financial losses, in the hope that the situation will ultimately reverse and financial gains will occur. Under these circumstances, losses can often increase rather than diminish and thereby jeopardize the business. An example of this was wheat farmers using swaps and futures hedging
during 2007 and staying with these increasing losses, despite the backwardation (shortage) market conditions.

4.2. Review of price risk

Just (1974) acknowledged the importance of price, yield and income variability in a producer's production decision-making, but did not indicate how these were to be known or estimated in advance. Pope, Chavas, and Just (1983) indicated that although prices vary, it was assumed that there was no price uncertainty at the time when production decisions were made. Production decisions were based on current prices (assuming adequate soil moisture). The problem was that prices varied after the production decisions and the expenditure of money (taken a market position for that particular commodity) had been made.

Tomek and Peterson (2001) indicated that price risk was on the downside for producers (upside for end-users). The significance of price risk in relation to profit for the producer depends on both production risk and the cost of production. Price risk is zero when no production (no planting or drought) occurs; and when production does occur, price risk is directly proportional to the amount of production finally achieved. This can be contrasted with market position risk which exists as soon as expenditure occurs in the production of a particular commodity, and does not finish until final sale revenue is received.

Williams and Schroder (1999) linked the downside price risk for producers to the level of production costs. The higher the cost of production, the greater the risk that price will not be adequate to meet targeted profit margins. Alternatively, the lower the cost of production, the more likely that price will be adequate to meet targeted profit margins. It is the uncertainty of price movement relative to production cost that creates price risk when production occurs.

From a different market position perspective, if producers have locked in prices in a rising market and delivery default occurs (such as in a drought year), settlement risk (the risk of pay-outs at maturity when using either forward contracts or bank swap pricing products) is then high (Williams and Schroder, 1999). If producers have locked in price using futures contracts under
similar conditions, then margin risk occurs (the risk of having to deposit more working capital into the hedge trading account).

Pope, Chavas, and Just (1983) maintained it was important to distinguish between price variability (volatility due to the market) and price uncertainty (defined as current price movement relative to a former price). This assumed that there was a clear distinction between the two, and that farmers could both recognize the differences and measure each of them.

This may still not indicate how an individual makes a risk decision, how much risk actually exists (assuming that the risk can be measured), the amount of uncertainty (assuming that this also can be measured), the individual attitude towards risk and how this fits into the overall business risk, the amount of risk that an individual is prepared to absorb, and whether the individual manages risk.

The effect on farmer decision-making of time lags to production and responses to price movement has been inadequately researched, except for theoretical cobweb theorem models. For Australian agricultural commodities, there generally is an inverse correlation between local domestic prices and production (Williams and Schroder, 1999) - local production goes up when good seasonal rainfall is received, and local prices come down; when droughts occur, local production goes down while local prices go up.

The impact of income averaging in risk management cannot be ignored (Williams and Schroder, 1999). Farmers might expand production during periods of low prices to compensate for income losses (assuming marginal revenue exceeded marginal cost), or average out income through farm enterprise diversification (assuming minimal time lags to production).

Producers of different size or from different regions may have different risk decision-making processes (Pennings and Leuthold, 2000). Risks other than production, cost and price need to be assessed in decision-making. These include risks such as income (percentage of total income at risk), basis, currency, transaction cost, liquidity of markets, and cash flow (including settlement risk and margin risk). Distances from major end-users and merchant activity are also important.
Regardless of these research outcome contradictions and inadequacies, price is one of the key determinants of farm income. Income is intricately linked to uncertainty over price, cost, and production. Producers need to adapt quickly to income changes (Schickele, 1950), more so than any other business variable. However, the link between pricing decision-making when high production risk exists under shortage market conditions has not been fully examined.

Tomek and Peterson (2001) highlighted the difficulty in analyses to obtain 'good' forecasts of commodity price movement. The authors did not consider the contribution of Working’s (1949) contango-carry-surplus (bearish) market and backwardation-inverse-shortage (possible bullish) market characterization of the forward markets and its role in market price direction and pricing strategy selection.

Selection of an adequate forecasting model involves problems with subjectively selected variables, inadequate and too rigid assumptions, and extrapolation into the future based on historical data, as well as subjectively biased inferences from analyzing single-set historical data (White, 2000). Replicating results is extremely difficult, suggesting that outcomes from forecasting models are more likely to be due to chance occurrences.

Whilst a liquid forward market can only be developed under the auspices of a futures market, there are many misconceptions regarding forecasting that are based on the forward markets of non-perishable commodities (Working, 1949). Lapan, Moschini, and Hanson (1991) defined price 'bias' as the difference between the producer's expectation of final futures price and the actual futures price. However, forward futures prices are either indicative of carry (storage) costs in the market or discounts to current premium prices (backwardation), not to any forecast of where forward prices are likely to be in the future (Working, 1953).

4.3. Impact of price risk

The impact of price risk on agricultural producers depends on individual farming and business circumstances, the amount of business equity (or debt), production techniques/productivity/
efficiency criteria, and risk preference/tolerance levels (Tomek and Peterson, 2001). Cash reserves, the amount of working capital, size of operation, and the degree of specialization/diversification are also important factors (Isengildina and Hudson, 2001).

When considering the impact of price risk on diversified farming operations, the correlation of price movements between groups of commodities (all grain crop prices might be similarly affected), and the price volatility (and frequency) of each commodity is important (Kingwell, 2000). This contrasts with farmers who are more specialized and have exposure to only one commodity.

However, when production is highly specialized, the risks are higher (Profarmer, 1998). These single commodity risks include production, price, costs, quality, basis and currency. Variation in financial returns from major single enterprises can have a serious impact on the farm profitability compared to more diversified businesses (Collins, 1997).

Brownlee and Gainer (1950) and Williams (1951) indicated the large impact of price uncertainty on farm planning and decision-making. Danthine (1978), Holthausen (1979), and Feder, Just and Schmitz (1980) found that U.S.A. farmers' production decisions (as reflected in the number of hectares planted) were correlated to the spot U.S. futures price, and to be independent of the producer's risk profile or future price movement expectations.

However, Danthine (1978), Anderson and Danthine (1983), Batlin (1983), Holthausen (1979), and Feder, Just and Schmitz (1980) all found that basis risk and production risk can influence a grower's decision about how much to produce. Johnson (1957) found that producers often ignore price changes (either physical price or futures price) when making production decisions because of compensating price effects either through enterprise diversification or input prices, or because of asset fixity (fixed production constraints).

Manfredo and Leuthold (1999) suggested that Value-at-risk (VaR), which is the measure of potential loss at a particular confidence level for a specific time period under 'normal' circumstances, could be used to measure the impact of commodity price falls. However, this
method still has the disadvantage of complexity of many variables, the inter-dependence of variables (VaR analyses usually assumes mutually exclusive variables), the frequency and variance of non-'normal' circumstances, the inability to forecast medium/long term volatility, the dependence on historical data, the dynamic production and market environment that often deems averaging to be quite meaningless, and it ignores the impact of real price falls due to inflation.

All four variables (income, production, cost and price) are somewhat inter-dependent for many commodities (production, cost, and price will influence income; while income, cost and price can influence production). However, there is also some mutual exclusivity in that individual production may not reflect the district/national average, local price may not be dependent on global influences, and income may come from diversified sources (Williams and Schroder, 1999). Input usage may be difficult to influence on-farm (depending on the agronomic circumstances), but farm input prices usually reflect global supply-demand conditions and currency exchange movements.

A worse-case scenario for some Australian producers is prolonged low production due to drought, coinciding with depressed prices that reflect national and global surpluses, falling real grain prices (discounted for inflation), combined with increasing costs and debt (Williams and Schroder, 1999). It is a scenario which if it is prolonged can seriously affect the viability and sustainability of the whole farming enterprise.

Periods of high prices were acknowledged by Kingwell (2000) to be extremely important for the future viability and prosperity of the producer. The decisions made during these periods need to be based on the assumption that 'windows of opportunity' caused by high prices will only occur during a limited number of favourable years for the producer (Kingwell, 2000). The dilemma for farmers is to be in a position to take advantage of these opportunities without incurring added margin risk and default/settlement risk.

For crops, the short periods of high prices need to coincide with periods of adequate production. However, there will be times of high prices coinciding with low production (drought) years, and
the opportunities could therefore be wasted in the physical market (Kingwell, 2000). The problem is that often the high prices are a result of the drought in the first instance.

Alternatively, high prices coinciding with a number of favourable production years can often lead to a false belief among farmers of the continuation of success, which can lead to the incurring of new high debt levels and subsequent years of impoverishment when high debt repayments coincide with low prices and low production (Kingwell, 2000). Rising interest rates and subsequent credit tightening can worsen the situation.

Previous price troughs of 3-4 years duration have seriously challenged the viability of producers in some regions of Australia. Producers usually survive by debt restructuring, cost cutting, and deferment of maintenance and capital expenditures (Gray, Lawrence, and Dunn, 1993). However, such a price trough when combined with low production, high debt, little off-farm income, and no off-farm assets to liquidate would seriously impact on producers in many regions of Australia (Kingwell, 2000).

4.4. Hedging benchmark

Perkins, Sniekers, and Geldard (1984) indicated the price linkages between the United States and Australia for wheat. U.S. wheat prices establish a competitive benchmark for most wheat traded internationally because the U.S. is one of the largest exporters of wheat and because it has some transparency of its price discovery mechanism. Even as a significant exporter, Australia is not in a position to influence global wheat prices because its production only represents approximately 3 per cent of global wheat production.

Local spot f.o.b. (free-on-board) wheat prices in Australia are derived from up-country wheat futures prices in the U.S.A. Australian producers either use the U.S.A. futures market as the benchmark price for hedging, or else use the current local ex-port (track) price that is the basis for A.S.X. grain futures pricing and hedging.
Perkins, Sniekers, and Geldard (1984) argued that basis risk between local Australian prices and the C.B.O.T. soft (9 per cent protein) wheat futures price was too high, and that basis might be lowered by hedging against the Kansas City Board of Trade hard (11.5 per cent protein) wheat futures. The A.S.X. futures contracts somewhat overcame this basis risk problem by having a milling wheat contract (Australian Prime Wheat - APW2) and a feed wheat contract, with the advantage of hedging in Australian currency, thereby removing currency risk.

4.5. Types of price risk management strategies

Tomek and Peterson (2001) indicated three categories of physical marketing methods in the U.S.A. - spot cash market sales, forward contracts (that may or may not lock in flat price), and delivery against a futures contract. On-farm or warehouse storage must also be considered as a physical marketing method in the U.S.A.

In Australia, there are five main categories of physical marketing methods - spot cash market sales, pooling (National/export or private), forward contracts, delivering against ASX futures contracts, and unsold storage/warehousing. There are two main categories of forward pricing strategies - futures/options hedging, and O.T.C. (over-the-counter) bank pricing products that extend forward pricing to up to three years.

There are five types of O.T.C. bank pricing products - swaps (lock in price), floors (downside protection plus full upside gain), participating forwards (higher floor but only 50 per cent participation on the upside), ceilings, (upside protection plus downside gain), and collars (zero cost but with a floor and ceiling). There is a choice as to whether currency is packaged or not with a particular pricing product. Sometimes there is a choice of price benchmarks to establish the futures price.

Bank swaps are non-deliverable and are cash-settled at maturity. There is empirical evidence that suggests the usage of swaps in Australia might vary with production risk, seasonal conditions, forward market characteristics, and price volatility.
Swaps, participating forwards, and collars incur high hedging risk through settlement risk, but this is zero for floors and ceilings because losses are limited to the premium paid. The usage of floor price strategies has generally been limited by the perceived high cost of the premium.

Flexible floor strategies using options include a buy put options hedge, minimum price forward contract (not used when high production exists), O.T.C. floor product, an O.T.C. participating forward product, and a collar to a limited extent. These strategies have the flexibility of both a floor price as well as enhancing price because of the opportunity to gain on the upside by selling the physical commodity at a higher price.

The cost of the premium and liquidity are often limitations when hedging using options (Leuthold, 1989). Budgeting for a minimum risk capital cost outlay is therefore essential if farmers are to attain pricing flexibility and to reduce many hedging risks (such as production, margin and settlement risk).

The impact of taxation on strategy selection has been lessened in Australia through the availability of tax spreading (averaging) methods, such as the use of Farm Management Deposits (F.M.D.s). Therefore, the use of delayed payment contracts in the U.S.A. to defer or average tax over a number of years has not occurred in Australia.

The voluntary Farm Management Deposits (F.M.D.s) scheme for agricultural producers evolved in Australia from previous compulsory income stabilisation schemes. This scheme must be considered as a method to manage the income risk associated with adverse price movement and production variability. Producers make tax deferred deposits in high-income years, and withdraw them in low-income years.

Arias, Brorsen, and Harri (2000) indicated that off-farm work income, off-farm investment income, government payments (such as drought relief), and enterprise diversification should all be included under the broader heading of price risk management. Under such income diversification, the management of one activity would have some positive or negative financial
impact on other activities and outcomes of the business. Price risk management cannot be seen independently of other financial activities.

However, enterprise diversification usually requires more capital investment, higher overall operating costs, few economies of scale, little specialization of skills and knowledge, and lack of market focus. Producers tend to be price-chasers with diversification, with lag times to production often resulting in being too late in the market and forever receiving low prices (Williams and Schroder, 1999). There are serious trade-offs between price risk benefits and costs/lag time disadvantages with enterprise diversification.

As well, Kingwell (2000) admitted that it is difficult for a producer to choose an appropriate portfolio of enterprises. Any price correlations between diversified commodity enterprises need to be based on historical prices, and historical price relativities are never a good measure of future price relativities. Also, agronomic practices can often determine which mix of enterprises is more appropriate for longer-term sustainability.

Until 2008, wheat producers who did not undertake any price risk management usually delivered into the National/export pool (single-desk). Whilst prices were average selling prices over the life of the pool (18 months), less administrative and financing costs, this cannot be construed as price risk management. Because of strategic reasons (basis risk), physical forward selling constraints (particularly when global surpluses occur), and position limits on futures exchanges, the wheat National/export pool was usually less than 40 per cent hedged (Bond, Thompson, and Geldard, 1985).

Both Futrell (1982) and Rhodes (1993) discussed storage decision-making at harvest time, as well as the advantages and disadvantages of storage, and under what market conditions commodity should be stored. Fackler and Livingston (2002) indicated a simple producer strategy whereby if price rises more than the cost of storage plus the opportunity cost of capital, then the producer should store. If not, then the commodity is sold. Lence, Kimble and Hayenga (1993) also confirmed this strategy. The weakness of this research is that it was performed in
hindsight, with little indication as to how the producer can predict forward price movement relative to the cost of storage in advance.

Working (1949) indicated that much storage is undertaken without due regard for the storage cost, in the hope that market prices will rise greater than the carry (storage) charge. This situation results in commodity speculation, because prices can fall.

4.6. Characteristics and functions of futures markets

Commodity futures exchanges provide four major marketing functions. Firstly, they can facilitate the offsetting of market position (hedging) for both buyers and sellers (Working, 1953), or lock in profit margins for local merchants and end-users who have a known forward sale price to protect their purchase price (Kenyon and Clay, 1987). Secondly, they establish a forward price discovery mechanism (Gray and Rutledge, 1971), which would not exist with spot selling or auctions.

Thirdly, futures prices provide an indication of the expected forward carry charge for storing commodity (Working, 1949). Fourthly, forward futures prices can act as the benchmark for physical forward contract prices, thus facilitating forward contracting between physical buyers and sellers.

For merchants, there is another function of a futures exchange such as hedging for the purpose of basis gains (Gray and Rutledge, 1971; Working, June 1953), either with regards the relative movement of spot cash-futures price or forward grade spread prices.

Futures markets do not forecast price because they establish a premium/discount forward market based on the spot price. They are not 'forecasting agencies' (Gray and Rutledge, 1971). Because there are too many fundamental variables impacting on the market, there is no reliable method (fundamental, technical, or econometric modeling) to forecast future price.
Both Working (June 1953 and July 1954) and Irwin (1954) indicated that futures markets are hedging markets, and were never designed for speculation. However, speculators and large portfolio fund managers have provided important liquidity in U.S. futures markets in the recent past, enabling easy market entry and exit with little price slippage (narrow bid: offer spreads). In contrast, Australian agricultural futures exchanges are characterised by few speculators, low liquidity, wide bid: offer spreads, and therefore high price slippage for many contract months.

Much of the impetus for the initial development of futures exchanges came from localized merchants, in conjunction with producers and end-users (C.F.T.C., 1977). Until very recently, the ownership of many of the U.S. futures exchanges still lay with physical commodity personnel, and not from the finance, investment, or banking industries.

Local merchants were involved with earlier futures markets because they needed to protect profit margins, but still have the flexibility to gain from local basis movements by delivering or taking delivery against the futures contract (C.F.T.C., 1997). Distant merchants, producers, and end-users were forced to adapt to less-than-ideal hedging circumstances, basis risk and currency risk. This led to relevancy issues such as the inter-relationship of the local physical price to the futures price.

Hedging risks such as basis factors (quality, grade, locality, distance) and currency movement were factors that a standardized futures market was never designed to either manage or minimise. The alternative was to introduce another more specific and local futures exchange, but this only alienated other merchants, end-users, and producers who could not be considered local and most likely had different conditions and gradings. To increase the number of exchanges only decreased the liquidity of each exchange, and to date, this has not overcome the problem of relevance, liquidity, and basis risk.

Producers can eliminate basis risk by delivering against the futures contract (e.g., A.S.X. deliverable grain futures). This is correct for those growers able to produce to contract specification and have minimum locality constraints for delivery. However, where high quality and grade variability exists, or when different grade standards operate, or where producers are
distant from delivery locations, this strategy of delivering against contract to remove basis risk is not practical or cost effective. There is also the possibility of liquidity risk (and price slippage) on the futures exchange, particularly for specific forward months.

Carter (1999) acknowledged that while hedging by individual producers was not common, the benefits of having a futures market may flow to the producer through hedging activities of market participants further down the supply chain. Hedging by supply chain participants can influence demand (with buyers more willing to buy), lower input costs through hedging make the supply chain more efficient, and hedging can directly cause stability (taking price out of the supply chain relationship). These benefits may flow back to the producer indirectly.

Forward month futures prices reflect spot market conditions. When forward month prices are at a premium to the spot month, this reflects surplus conditions and the necessity for merchants and end-users to factor costs into the forward market in order to carry this surplus. This is known as a contango (or carry) market.

Working (1949) stated that the inter-temporal price relations (the price difference between two forward months of the same commodity) under surplus conditions (contango) depend on the cost of carry for storing the commodity. The larger the surplus, the carry factored into the forward market might exceed the actual cost of storage. This is because a shortage of warehouse space combined with high demand can force up storage charges beyond actual cost of storage in deregulated markets (Weymar, 1966).

When smaller surpluses occur, competition should ensure that the carry charge approximates the actual cost of carry (Working, 1949). Forward month prices under surplus conditions (contango) should be a direct measure of the expected return from storage.

Producers were excluded from this carry market when market regulation occurred. Under partial deregulation, producers often benefited through tactically selling anticipated local new crop into overseas old crop selling months, hoping that merchants and end-users did not discount the carry from the producer’s market price. However, as the market became fully deregulated, more
local end-users have been prepared to offer carry directly to the producer to store on-farm for a certain period of time.

When spot month prices are at a premium to the forward month prices, this reflects shortages and a market signal for merchants to sell any unsold commodity to end-users immediately. This is known as a backwardation or inverse market. In backwardation (shortage) markets, the negative storage returns should provide a market signal in terms of a sufficient market premium for an immediate (spot) sale.

Benirschka and Binkley (1995) were concerned that the actual cost of storage (including the direct financial cost plus the opportunity cost of money) was not being reflected in the differences between the forward futures prices in a contango market. However, the carry cost factored into forward months in a contango market is only a compromise between the local merchants and end-users and often depends on the propensity for moisture loss from the commodity.

The carry cost does not reflect the size of the storer, economies of scale, quality deterioration or opportunity cost of money. End-users traditionally only compensate merchants for physical carry costs and moisture loss, and regard the cost of money, any financial opportunity costs, and quality control as the responsibility of the merchant.

4.7. Evaluating the benefits of marketing methods and pricing strategies

Forward pricing and hedging are perceived by some producers to increase returns through higher prices. Hedging strategies are attractive to producers whenever the instruments used are perceived to increase financial freedom (Pennings and Leuthold, 2000).

Wisner, Blue, and Baldwin (1998) found that the pre-harvest usage of futures and/or options hedging could increase average financial returns for U.S. corn and soybean producers compared to cash sales at harvest time. Also, Kolajo, Hurst, and Martin (1988) concluded that pre-harvest
forward contracting in the U.S.A. increased producer financial returns relative to cash sales at harvest time.

Producers can gain higher price benefits through hedging in three market scenarios. Firstly, producers can capture higher prices when price volatility occurs, which usually is a consequence of an expected market uncertainty. Secondly, producers can capture early prices before seasonal downturns occur (e.g., northern hemisphere harvesting), which usually are a result of contango (surplus) markets. Thirdly, producers can capture forward carry in future months, which also is a characteristic of a contango (surplus) market. Hedging when backwardation has occurred is high risk for as producer (margin or settlement risk).

Johnson (1947) compared producer decisions based on cash (spot) sales with locked-in forward prices, and found that greater industry and individual financial stability can be attained with the latter. The implication was that locking in forward prices should reduce cyclical price and income fluctuations in the supply chain (Working, 1953). However, the assumptions were that the majority of the commodity was forward priced, which is rarely the case, and that hedging risks (basis, currency, and delivery default) were ignored.

Another possible benefit of hedging is more favourable bank lending policies with producers who manage their price risk. In the study by Harris and Baker (1981), 70 per cent of surveyed lenders indicated that hedging increased a farmer's loan limits. However, when price risk is replaced by production risk in risk management, credit risk may actually increase under drought conditions in Australia.

Capturing favourable basis movement is another benefit from hedging (Working, 1953). Favourable basis movement occurs for a producer during a futures/options hedge (or an O.T.C. product) when there is a local shortage driving prices up (local backwardation market), coinciding with global surpluses driving prices down (global contango market). Recognising basis opportunities and subsequent timing of hedging entry and exit tactics can therefore be important in basis management, but the problem of production risk remains.
Alternatively, local basis opportunities can be captured by using local futures/options contracts (such as A.S.X. grain futures or options contracts) and delivering against the futures contract. Authorised delivery sites are now widespread in eastern Australian States. Delivery against futures contracts assists producers in locking in favourable basis, provided that deliverable grades and the grade price are acceptable by both the buyer and the seller.

Gray and Rutledge (1971) indicated that merchants could extend the futures market opportunities to producers through forward price contracts incorporating a futures component. Industry empirical data suggests that approximately 20 per cent of Australian wheat growers were using some type of merchant derivative forward contract prior to the 2002/03 drought. However, delivery default and settlement payouts in the aftermath of the drought caused the usage of this type of merchant contract to greatly diminish.

4.8. Measuring pre-harvest hedging strategy effectiveness

Pennings and Leuthold (2000) found that perceived performance of hedging by agricultural producers can differ from actual hedging effectiveness. However, measurement of hedging effectiveness has always been a challenge in research. Much of the literature on hedging effectiveness is biased towards strategic situations in the U.S.A., and therefore has little relevancy to other countries, particularly when high risks (production, basis, and currency) exist.

Risks associated with basis, currency, production, and liquidity (which widens bid: offer spreads and thus causes price slippage) can reduce the effectiveness of the hedge. Whilst Miller and Kahl (1987) acknowledged the benefits of forward contracts and futures/options hedging to reduce price risk, overseas hedging with high basis and currency risk, can actually increase flat price risk.

Risks differ with each particular hedging strategy. The financial return to risk of each strategy should be compared (preferably before the decision is made but with the limitation of using historical data). Low financial return to risk ratios would be expected when production risk and
settlement risk are high such as in Australia. Alternatively, if the financial return to risk ratio is high, then hedging strategies with higher risk might be selected. (Forward contracting pulse crops might be expected to provide higher return to risk ratios compared to grains.)

A major problem in comparing strategies with simple statistical analyses lies in the assumptions and the use of averages, particularly regarding the individual producer and the farm situation. It is theoretically possible to measure each producer situation by the deviation from the mean and the individual risk involved. However, the relevancy of this approach under Australian conditions of wide disparity of circumstances and heterogeneity must be questionable.

It is too simplistic to measure the effectiveness of a particular price risk management strategy just on the transaction costs involved or the least-cost alternative method, as suggested by Lence (1995, 1996). There are too many variables, opportunity costs must be considered, and the objective of the strategy cannot be neglected in any strategy comparison.

Veld-Merkoulova and De Roon (2003) found that under stable market conditions (presumably a contango market), long-term hedging through roll-overs outweighed the extra transaction cost. However, any hedging rollover analysis is extremely meaningless without assessing whether the forward market is in contango or backwardation, and whether basis movement has occurred. Gardner's (1989) study on sequential rollovers for nth-year periods therefore had serious weaknesses.

Carter (1999) evaluated the effectiveness of hedging by measuring the reduction of price risk. However, the impact of price risk reduction depends on the initial hedge ratio (the percentage of physical commodity hedged) and any subsequent changes in this ratio. Any decision on a particular hedge ratio cannot be made independently from the risks (production, basis, currency, and quality/specification) within a country or within a locality. Therefore, measuring any one risk cannot be made independent of other risks.

Blank, Carter and McDonald (1997) found that U.S. agricultural producers prefer physical forward contracting to futures hedging. However, this again ignores production and delivery
risks, which are usually much higher in other countries relative to the U.S.A. After any significant drought in Australia, it often takes up to five years for producers to build up enough confidence to resume physical forward contracts with merchants and end-users. Blank, Carter and McDonald (1997) ignored the consequences of physical default risk.

The early closing-out cash settled procedure of futures contracts appeals to those growers who have experienced delivery defaults against physical forward contracts. This early closing-out flexibility also helps to explain the popularity of cash-settled bank swaps in Australia.

Production uncertainty may require the hedge to be continually adjusted, therefore hedging should be viewed as dynamic and not static (Anderson and Danthine, 1983; Lence, Sakong, and Hayes, 1994). However, Martinez and Zering (1992) found that the gains through continually revising and adjusting hedging strategies based on new production information were relatively small for producers.

Townsend and Brorsen (2000) placed more weight on the relatively high cost of forward contracting compared to futures hedging, but the problem here was the subjective bias in selecting the initial weighting of variables, especially when a large number of variables existed.

Brorsen, Coombs, and Anderson (1995) estimated that the U.S.A. producer cost of forward contracting varied between U.S. 2 - 7 cents per bushel for hard red winter wheat compared to 2 cents per bushel for futures hedging. However, their conclusion (which was supported by Tomek and Peterson, 2001) was weighted towards forward contracts, which were perceived as more desirable for producers because of no margin calls, no basis risk, and no minimum incrementals in terms of contract size.

Analytical weakness lies in accurately determining the cost of forward contracting, which depends on the length of time to delivery (time value of money), opportunity costs (prices foregone), and settlement losses under default situations. Any risk analyses needs to account for important inter-country differences (production risk, specification risk of not meeting contract requirements, basis risk, and currency risk).
Tomek and Peterson (2001) indicated that the cost of default (settlement risk) must be considered, which would be highly probable under Australian conditions. The cost of default risk could be estimated to be zero for futures hedging because of the choice of closing out the contractual delivery obligations, but high for forward contracting (Tomek and Peterson, 2001) where physical delivery is obligatory.

4.9. Measuring post-harvest hedging strategy effectiveness

Regarding post-harvest price risk management, Heifner (1966) indicated to store and hedge with futures contracts only in those years when the financial returns of storage outweigh the cost of storage. Tomek and Peterson (2001) also indicated that hedging can be used during storage in those years that ‘profitable’ prices exist. Both researchers ignored basis risk and currency risk. There was a major research weakness in that storage strategy outcomes were only known in hindsight.

Favourable financial returns to storage depends on the final realized price exceeding the initial price plus storage expenses, opportunity costs (including the time value of money and cash flow foregone), and shrinkage from moisture losses. For unhedged storage, profitability depends entirely on speculating on price increases to cover costs and losses.

Alternatively, by having a futures or options hedge during storage, opportunity costs and transaction costs may still erode the capacity of the storage financial returns to exceed storage expenses and losses (moisture and quality). A financial return on storage by producers is not simply assured by a futures hedge, as stated by (Tomek and Peterson, 2001).

Zulauf and Irwin (1998) indicated that when favourable basis movement was larger than storage costs in post-harvest hedging, then store with a short hedge in place. The problem with this finding is knowing the final basis movement in advance of making storing decisions. If basis is weather-driven, then this research outcome assumes accurate weather forecasting both locally and internationally.
Whilst in theory and hindsight, storage should occur until marginal revenue from storage equals the marginal cost of storage, there needs to be an allowance for risk in the calculation of storage costs (Tomek and Peterson, 2001). The problem lies in the measurement and calculation of a suitable risk factor.

The problem of old crop discounts can also be encountered in a storage strategy, particularly when there is an abundance of low quality commodity. If the new crop is expected to be of a higher quality, and plentiful supply, the old crop will be discounted, thereby eroding favourable storage returns.

Except when carry is contracted to be paid by merchants or end-users, or when there are known annual special high-demand events, or major shortages (backwardation) occurring and significant price rises occur, the probability of favourable outcomes from a storage strategy is low. Direct costs of carry (in/out, quality control, quality deterioration, moisture loss) and indirect costs of carry (investment outlay, cost of money, debt repayment, falling prices, inflation) including opportunity costs (lack of cash flow, accrued interest on debt, interest foregone, silo rent foregone) plus basis and currency risk, all decrease the probability of favourable financial outcomes being realised from a storage strategy, even when price is hedged.

4.10. Adoption of price risk management practices in the U.S.A.

There is much contradiction amongst researchers towards the adoption of price risk management practices by agricultural producers. Tomek and Peterson (2001) highlighted the problems with analytical measurement, as well as the contradictions between answers to questions and actual actions/decision-making by producers.

The main issue with price risk management is that there are hedging risks (basis risk, currency risk, margin/settlement risk, and transaction cost) and production risks in any hedging strategy.
There is a risk inter-change in the hedging process that does not facilitate a clear division between risk-taking and risk averseness. Some farmers view hedging as a risk taking strategy.

The U.S. Commodity Futures Trading Commission (C.F.T.C., 1978) estimated that one-third of total U.S. producers do not know how the futures markets work (or what might be more pertinent, they do not want to know regardless of the availability of training programs). Approximately one-third of U.S. producers do not know how 'the markets work' (Berck, 1981), with the definition of ‘markets’ not being confined to futures markets.

Berck (1981) challenged the C.F.T.C (1978) findings that more education and training was required for farmers on the futures markets. It may have been that the producer has little interest in using the futures markets, because of perceived ‘high’ physical production risks and futures exchange transaction costs (such as opportunity costs associated with the trading account).

In contrast, Pennings and Leuthold (2000) found the usage of futures contracts was positively related to the level of understanding of the futures market. As well, adoption was more likely to occur if support groups were favourably disposed towards usage of the futures market.

However, basis risk is small in the U.S.A. and often manageable via physical delivery against the futures contract, no currency risk exists, and liquid forward markets prevail at least in the near months. Yet only 7 per cent of U.S. grain producers directly used futures contracts, and many of these used futures contracts for speculation (C.F.T.C., 1978). Berck (1981) found that less than 5 per cent of U.S. producers directly used futures contracts. Even in the U.S. Corn Belt, Lasley and Sharp (1993) found only 26 per cent of producers had directly hedged at some time using futures contracts, and 24 per cent had used options contracts.

In addition, the C.F.T.C. (1977) survey found that only 20 per cent of U.S. farmers had ever used physical forward contracts. The results suggested that even many of these farmers only used forward contracts either intermittently or as a once-only experience.
In contrast, Goodwin and Schroeder (1994) surveyed Kansas farmers and found 55 per cent had used forward contracts and futures/options contracts during the study period (1990 - 1992). As well, over 66 per cent had participated in one or more related education programs.

Goodwin and Schroeder (1994) surveyed 1963 Kansas farmers (32 per cent response rate, with 509 used in the final analyses) who produced wheat, corn, grain sorghum, soybeans, cattle and pigs. Although the sample was based on those farmers belonging to the Kansas Farm Management Association, this group had been found to be representative of the commercial farming operations in Kansas (Featherstone et al., 1992).

Table 4.10.1 details the marketing/pricing strategies used by the Kansas farmers in the Goodwin and Schroeder (1994) survey over the study period for each crop.

Table 4.10.1 Marketing/pricing strategies used by sampled Kansas farmers
(percentage of these farmers who used each strategy during 1990-92)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Wheat %</th>
<th>Corn %</th>
<th>Grain sorghum %</th>
<th>Soybeans %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash sale</td>
<td>96.28</td>
<td>93.22</td>
<td>97.24</td>
<td>97.19</td>
</tr>
<tr>
<td>Forward contract</td>
<td>32.17</td>
<td>34.46</td>
<td>17.18</td>
<td>30.92</td>
</tr>
<tr>
<td>Futures hedge</td>
<td>5.91</td>
<td>10.73</td>
<td>1.84</td>
<td>5.22</td>
</tr>
<tr>
<td>Options on futures</td>
<td>14.88</td>
<td>9.60</td>
<td>2.76</td>
<td>4.42</td>
</tr>
</tbody>
</table>

Source: Goodwin and Schroeder (1994)

One conclusion from Table 4.10.1 is that producers use a combination of physical marketing methods (cash sale, forward contracting, or delivery against futures contract) to sell their commodity. However, producers can price using one strategy (futures and options hedging) and sell the physical commodity via another strategy (cash sale), so the marketing methods and pricing strategies are mutually independent.

Whilst over 90 per cent of the Kansas producers used cash sales to market their commodity, there could have been prior hedging using either futures or options (futures contracts were favoured by corn producers and options contracts favoured by wheat growers). Approximately
20 per cent of the Kansas wheat and corn producers hedged with either futures or options contracts, hedging between 20 - 34 per cent of the estimated total crop. Over 30 per cent of wheat, corn and soybean producers used forward contracting during the surveyed period. The averaged hedged ratio through forward contracting was between 30 - 40 per cent.

Isengildina and Hudson (2001) compared research outcomes in the U.S.A. (Table 4.10.2), and the results demonstrated that low direct usage of futures contracts was the norm rather than an aberration.

Table 4.10.2: Percentage of U.S. growers who have used futures contracts in hedging

<table>
<thead>
<tr>
<th>Research</th>
<th>Locality</th>
<th>Year</th>
<th>Crop</th>
<th>Directly used futures contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asplund et al. (1989)</td>
<td>Ohio, U.S.A.</td>
<td>1987</td>
<td>All crops</td>
<td>7%</td>
</tr>
<tr>
<td>Goodwin et al. (1994)</td>
<td>Kansas U.S.A.</td>
<td>1992</td>
<td>Wheat, Corn, Grain sorghum, Soybean</td>
<td>5.91%, 10.73%, 1.84%, 5.22%</td>
</tr>
<tr>
<td>Patrick et al. (1998)</td>
<td>Indiana U.S.A.</td>
<td>1995</td>
<td>Corn, Soybeans</td>
<td>16.2%, 8.10%</td>
</tr>
</tbody>
</table>

Source: Isengildina and Hudson (2001)

This evidence by Isengildina and Hudson (2001) was supported by Carter (1999) and Harwood et al. (1999) who concluded that hedging at the individual producer level even in the U.S.A. is uncommon.

Table 4.10.3: Marketing methods and pricing strategies used by U.S. cotton growers 1990 - 2000 (excluding post-harvest methods)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash sale</td>
<td>57.4 %</td>
<td>49.37 %</td>
<td>41.3 %</td>
<td>36.4 %</td>
</tr>
<tr>
<td>Pool</td>
<td>34.2 %</td>
<td>48.73 %</td>
<td>52.1 %</td>
<td>58 %</td>
</tr>
<tr>
<td>Forward contract</td>
<td>39.4 %</td>
<td>37.34 %</td>
<td>32.3 %</td>
<td>27.8 %</td>
</tr>
<tr>
<td>Futures hedging</td>
<td>0.04 %</td>
<td>0.06 %</td>
<td>7.2 %</td>
<td>8.6 %</td>
</tr>
<tr>
<td>Options hedging</td>
<td>0.03 %</td>
<td>0.06 %</td>
<td>9 %</td>
<td>11.1 %</td>
</tr>
</tbody>
</table>

Source: Isengildina and Hudson (2001)
As a comparison to grain hedging, Isengildina and Hudson (2001) in their study on U.S. cotton growers compared the usage of cash sales, forward contracting, pooling, and futures/options hedging (Table 4.10.3). They demonstrated that during 1990 - 2000, U.S. cotton growers were using less cash sales and forward contracting, and more pooling and hedging with futures and options. As a percentage of total marketing methods used, cash sales at harvest decreased from 57 percent in 1990 to 36 percent in 2000.

Isengildina and Hudson (2001) indicated that the higher usage of options hedging over futures hedging was because of cash-flow problems associated with margin calls, with 45 percent of respondents indicating margin calls in futures hedging as a problem. The higher usage of futures and options hedging after 1996 was explained through decreasing government assistance programs and increased farmer educational efforts.

Berck (1981) noted that the production risks incurred by Californian irrigated cotton growers (even when irrigation water was assured), and combined with transaction costs, were valid reasons for the low usage of futures hedging by these producers. Also, 47 per cent of these producers used farm enterprise diversification to spread their risks and minimize the market exposure of any one enterprise (Blank, Carter, and McDonald, 1997).

Hill (1972) found in a much earlier survey with Kansas grain producers that only 4 per cent had ever hedged (using futures or options) and 12 per cent had ever forward contracted. This possibly suggests that hedging may have increased since 1972. The outcome of a survey involving 353 Ohio corn and soybean farmers in 1986 by Asplund, Forster, and Stout (1989) indicated that only 7 per cent of these producers had hedged (using futures or options), but 42 per cent had forward contracted.

Blank, Carter, and McDonald (1997) studied Californian producers who had access to relevant physical forward contract and futures market facilities. Only 23 per cent of these surveyed (1993) producers undertook forward contracts, and 6 per cent hedged with futures contracts.
4.11. Adoption of price risk management practices in Australia

Feder and Umali (1993) indicated that farm size, tenure, education levels, and cash flow/reserves are important considerations in the early phases of farmer adoption behavior. However, the latter adoption stages and the diffusion of new ideas was complex and required more research to identify key determinants.

Rogers (1983) divided the normal statistical distribution curve into one and two standard deviations from the mean, and then allocated the percentage of each adoption category to the relevant area of the normal curve. Innovators (2.5 percent) were less than two negative standard deviations from the mean; Early Adopters (13.5 percent) were between negative one to two standard deviations from the mean; Early Majority (34 percent) were between the mean and negative one standard deviation; Late Majority (34 percent) were between the mean and positive one standard deviation; and the laggards (16 percent) were greater than one positive standard deviation from the mean. Figure 4.11.1 summarises the adoption categories of Rogers (1983).

Figure 4.11.1. Rogers' adoption categories based on innovativeness

![Diagram showing Rogers' adoption categories based on innovativeness](source: Rogers, 1983, page 247)
The assumptions of Rogers (1983) relating to adoption percentages within the normal curve distribution might not be applicable in all cases of adoption of new ideas. Adoption of ideas might be expected to depend on the actual event and circumstance.

Issues in adoption relating to risk might include uncertain consequences (desirable or undesirable), difficulties in measuring relative advantages, the impact of a cluster effect of new ideas (e.g. ideas caused by sudden market deregulation), the role of education and training, separating knowledge decisions from action decisions, the different individual behaviour when making decisions based on time and circumstance, and reasons for discontinuance (avoidance) after adoption (possibly with regret).

Some farmers may use new knowledge to adopt even more risky decisions. An example of this is when physical commodity speculation on production and price is replaced by futures market speculation based on price alone. In this case, the production uncertainty has been eliminated. The risk profile of such a farmer may not have dramatically altered.

Risks such as basis, currency, production, and quality/specification, and the lack of liquid forward markets, have often been cited as explanations as to why Australian agricultural producers do not adopt hedging practices (Lubulwa, Beare, Bui-Lan, and Foster, 1997).

However, A.F.F.A. (2003) determined that 55 percent of Australian grain growers entered into 'forward selling arrangements' for their output. However, there are many research issues with this type of question with farmers, including ambiguity over what is meant by 'forward selling arrangements', the type and quality of commodity, hedge ratios, regularity, and it ignores the distinction between forward pricing and forward selling, and whether pooling came under such ‘arrangements’.

Lubulwa, Lim-Applegate, and Martin (1997) indicated that only 4 per cent of Australian grain producers used futures/options directly through futures exchanges in the 1996 season, while 25 per cent used some form of physical forward selling which often had a futures or options
component attached. Producers were either forward selling prior to sowing, or during the growing season.

However, the sample data were collected before the 2002-2003 drought, which resulted either in many production defaults on the physical forward selling contracts or margin losses incurred through futures hedging. Whilst some roll-over contract provisions into the next year were permitted, most grain growers under default had to cash-settle the difference between the forward contract price and the high grain market price that was prevalent during the drought.

Coming at a time of little cash flow caused by the drought, farmer relationships with merchants seriously deteriorated. In the immediate aftermath of the 2002-2003 drought, Australian agricultural producers seriously reduced their usage of forward contracts with merchants.

Simmons (1999) mentioned two reasons commonly expressed why futures contracts were not popular with producers undertaking hedging. Firstly, there was the complexity of futures hedging, which Simmons (1999) dismissed as a valid reason, because producers often undertake other more complex marketing arrangements. The second reason is grade basis risk (difference between the local production specification compared to the futures contract specification).

Basis risk is often the result from a cross-hedge between two different commodity grades and specification (grade basis), in two different markets (locality basis relates to different supply/demand conditions in different localities), in two different countries (time basis in terms of different old crop/new crop years and different carry months). It was in this context that Bond, Thompson, and Geldard (1985), and Bond and Thompson (1985), found that basis risk can render overseas futures hedging ineffective.

Hedging Australian wheat against U.S. futures exchanges must strictly be considered cross-hedging because of basis and different market characteristics. The evidence against cross-hedging by Grant and Eaker (1989) was particular damning when they stated that there was no value for cross-hedging beyond 'naïve hedging'.
Working (June and November 1953) indicated that futures hedging was more likely to take place if there was an anticipation of favourable basis movement during the life of the hedge. However, in Australia, favourable basis movement generally occurs when local prices move above the futures price, in response to a local shortage such as a drought (local backwardation). Under such situations, a short hedger with high production risk usually would incur either margin risk (using futures contracts) or settlement risk (using bank swaps or physical forward contracts).

Although local wheat might have similar grain characteristics to the U.S.A., there are country grade and varietal differences, as well as end-usage differences. Any adverse movement in net basis (the difference between the local physical price and the overseas futures price) must be considered as a hedging cost (Castelino, Francis, and Wolf, 1991). Castelino (2000) indicated that the amount to be hedged (hedging ratio) should be reduced in response to increasing basis risk.

The significance of the local A.S.X. wheat futures market regarding relevancy for producers in eastern Australia and the minimization of cross hedging risks therefore becomes apparent (with no currency risk), particularly when producers can deliver against contract to eliminate basis risk (and be guaranteed immediate payment). There is the choice of closing out or delivering against the local A.S.X. wheat futures contract (delivery against contract is only available in eastern Australia).

Because of the 2002-2003 Australian drought, wheat producers shifted to O.T.C. swaps to avoid the problems with forward contracts. However, the hedging risk for producers using swaps during the 2006-2007 drought was high, which was reflected in the high number of large payouts at settlement time when there was low production and little cash flow. It meant that all strategies with settlement risk (forward contracts, swaps, participating forwards, and collars) had major disadvantages during drought situations.

When drought (backwardation) occurs, producers need to focus more on cash sales at harvest for three reasons. Firstly, there is production uncertainty in a drought; secondly, there is high
risk of production default if a forward contract is undertaken; and thirdly, the producer psychology when prices are rising in a known local shortfall period usually favours cash sales at harvest or storage.

Time and resources are major factors why small producers do not adopt hedging practices (Kingwell, 2000). It takes time to monitor prices and measure hedge effectiveness if basis and currency movements are continually occurring. Also, human resources are limited on family farms, particularly when off-farm work is also undertaken.

Hedging of any commodity cannot be considered without the aspect of timing. Some Australian wheat growers hedge during early booting stage when they perceive that they have a crop for the season. However, this coincides with the bottom of the international grain market (usually during August when peak harvesting/surpluses are occurring in the northern hemisphere). Hedging at this time usually incurs subsequent large margin calls. Psychological barriers involving anxiety and regret can then hinder hedging adoption in the future.

Regret at locking in a lower than market price, and being forced to forego a higher price is also a real psychological impost (opportunity cost) for many producers who actually produce a crop. This also can result in adoption barriers for many years, especially when compounded by forward contract delivery default as a result of drought conditions.

Risk attitude did affect hedging adoption practices (Simmons and Rambaldi, 1997). Bond and Thompson (1985) indicated that Australian farmer risk attitudes (on a scale from risk averseness through to risk taking) were significant whenever the cost of the hedge was non-linear (when the cost of the hedge was not proportional to the hedge ratio).

Rambaldi and Simmons (2000) found that Australian farmers are significantly risk averse in their decision-making when responding to price and climate (weather) variability. Because of high production and quality/specification risk in Australian agricultural production, it is easy to conclude that these risks explain the low hedge ratio percentages and hedging adoption rates.
The problem with this conclusion is that the low hedging ratio percentages and adoption rates also occur in the U.S.A., where production and quality risk are relatively much lower in comparison, with no currency risk, and where basis risk can more easily be managed through contract delivery. The conclusion is that low adoption of hedging amongst producers occurs globally, and is independent of the actual hedging risks involved.

4.12. Usage of price risk management

Usage of price risk management can depend on risk attitudes and perceptions, size of the farm, cost of production, and debt levels. Carter (1999) recognized that attitude towards risk will influence a producer's decision to hedge forward prices using futures contracts.

Managing price risk tends to favour the large producers who have adequate cash reserves and cash flow. Kingwell (2000) noted that large producers are more likely to see merit in price risk management than smaller producers with small incomes and low debt levels. Simmons (2002) claimed that farmers with higher cost of production and greater debt exposure may also be more likely to manage their price risk because they have more value at risk than a producer with lower costs and debt.

The cost of the hedge can affect producer hedging behaviour and limit the usage of futures hedging (Lence, 1996). Castelino, Francis, and Wolf (1991) indicated four costs to futures hedging - brokerage, financial cost of margin requirements, slippage in the bid: offer prices, and adverse basis movement. Pannell, Hailu, Weersink, and Burt (2007) indicated that the net advantages of hedging should out-weigh the cost of hedging implementation before hedging occurred.

Goodwin and Schroeder (1994) claimed that risk-taking producers are more likely to adopt forward pricing/hedging strategies than risk-averse producers. The corollary might suggest that risk-averse producers are less likely to adopt price risk management strategies. This contradicts the standard theory that hedging will be undertaken by risk-averse producers wanting to reduce risk.
Holthusen (1979) found that the risk attitude of the producer did influence the amount of hedging (hedge ratio) - supposedly, as farmers risk averseness increased, the more the farmer was likely to hedge. Also, hedging increased with the level of price uncertainty, and the existence of a forward market generally induced greater production (hectares planted).

In contrast, by correlating producer risk attitudes with the usage of forward pricing strategies, Goodwin and Schroder (1994) found that those producers who adopted forward pricing strategies were more likely to be risk-takers rather than being risk averse. Tomek and Peterson (2001) stated that this finding was consistent with producers perceiving forward pricing as being more risk-taking than other marketing methods.

There is an obvious contradiction in the research, with earlier work linking hedging with risk averseness, while later studies linked forward pricing with risk-taking. Simple questioning of producer attitudes is not adequate in this situation. There has to be a market scenario analyses performed with the producer (Tomek and Peterson, 2001) that is linked to the perceived risk attitude of the producer under the market circumstance at a particular time.

As the volatility of physical price increased, producers were more likely to use hedging strategies (Brorsen, 1995). But as price up-trends and volatility introduce opportunities to capture better prices, the motive of price protection needs to be separated from the incentive of price enhancement. Brorsen (1995) assumed that producers recognised the opportunities that arise during price volatility, and the benefits resulting from hedging.

Working (1953) argued that the role of hedging in risk avoidance was greatly over-emphasized. Gray and Rutledge (1971) rejected risk reduction as the primary motivation of producers for hedging, and suggested that price enhancement had a more contributory role. Producer's motives for forward pricing have been subsequently questioned to ascertain whether it is for the purpose of transferring price risk or price enhancement to increase income (Tomek and Peterson, 2001).
Those Australian producers who are favourably disposed to price risk management when prices are seasonally high (and in contango) can use futures contracts (either directly themselves, or through merchants when production is assured, or bank swaps to capture prices for more than one year). When backwardation and/or price spikes occur, producers can use buy put options (either directly themselves, or through privately managed pools when production is assured, or through bank floor products).

Under such circumstances, it is not logical to neatly divide these producers into those who perceive their motive as transferring price risk (loss minimisation), and those that perceive it to be price enhancement. It has been observed that producers do not make decisions based on such 'logical reasoning'.

This division between two rigid motives might exist in the mind of some researchers who possibly attempt to link price enhancement motives to price speculation. In a paradoxical sense, the producer who speculates with physical commodity can be perceived as also adopting a price enhancement strategy, but with the added risk of falling prices.

As well, if prices fall in a contango (surplus) market, it might be assumed that those producers who have hedged their price (loss minimization) would be also achieving an enhanced price when compared to the low price achieved by non-hedgers (assuming no adverse basis movement).

Alternatively, if prices rise in a backwardation (shortage) market, some producers are tempted to remove their futures hedge to avoid margin calls. This practice upsets the hedging purists by returning to physical commodity speculation, but it is human nature to avoid what is perceived to be unnecessary margin losses (immediate cash-outflows) when backwardation occurs and production risk is high.

When price discounts in the forward market (a characteristic of shortages in a backwardation market) occurs, hedging cannot be associated with profit maximization. To hedge when backwardation occurs, results in producers being forced to take substantial price discounts in
the forward market. Because the majority of growers are not prepared to accept this forward discount, they speculate in the physical market for price/profit maximisation. However, except for options hedging, hedging in backwardation markets is high risk because of margin or settlement risk.

Producers have an aversion to give up high prices in order to reduce price risk (Tomek and Peterson, 2001). Pricing flexibility is therefore important when considering the use of price risk management strategies by producers. Because options contracts provide the necessary flexibility in managing price, the problem in using flexible pricing strategies often is because of a lack of understanding of the options market or the high transaction cost.

Kingwell (2000) suggested that it is vital that Australian producers do not use price risk management strategies that limit the producer's physical upside price potential in good years (presumably this means having production in a backwardation market). Pricing flexibility under such circumstances would entail the use of options strategies.

Instead of segregating producers into whether they use risk transferring or price enhancing strategies, producers can be classified into those who are more proactive towards price risk compared to those who are non-active regarding price risk (those that physically speculate and sell at a spot cash price).

It is hypothesized that price proactive producers are more likely to have controlled their cost of production compared to non-active producers. Costs are an important component of profitability, and price risk management is often wasted if costs are too high. It is also hypothesized that being pro-active on price can act as a motivator to decrease costs and improve profit margins.

Simmons (1999) suggested speculation as a possible explanation of why some producers use the futures market. If physical production is not speculative enough, some producers desire even greater speculation and higher risk situations. This desire for high-risk situations cannot be ignored as a major psychological factor in decision-making.
The most consistent finding in both the U.S.A and Australia is that the usage of forward pricing methods depends largely on the size of operations. This was a major finding by Patrick, Musser, and Ekman (1998) in their study on large-scale U.S. mid-western grain producers.

However, the possible association between large-scale operations and higher debt levels cannot be ignored. There may be pressure by some bank managers for price risk management on larger size farmers because of their credit risk. Therefore, both debt and farm size may be key influences in forward pricing usage.

Brorsen (1995) supported this association by indicating that producers will increase hedging activity as debt levels increase. Whenever high debt attracts increasing interest rate payments, the risks in debt repayment could motivate farmers to use hedging practices (Simmons, 1999).

Asplund, Forster, and Stout (1989) and Shapiro and Brorsen (1988) also found that producers' usage of forward pricing increased with debt/asset levels. High debt-to-asset ratios meant that producers were more likely to use price risk management strategies than low debt producers (Brorsen, 1995; Turvey and Baker, 1990; Arias, Brorsen, and Harri (2000); Pennings and Leuthold, 2000).

However, Kingwell (2000) found that high debt situations could limit the producer's decisions to manage risk. Without sufficient reserves and cash flow, it is very difficult to manage business operations efficiently, even without the added burden of risk management costs. The organizational (amount of control and integration) and financial (equity and working capital requirements) structures of the business are therefore important determinants of risk perceptions and risk attitude (Pennings and Garcia, 2004; Garcia, Leuthold, and Egelkraut, 2004).

A forward contract in a highly differentiated niche-market product situation is entirely different to considering a commodity forward contract where there are no distinguishing product characteristics. The former might be considered with an end-user, the latter with a merchant.
Therefore, the type of buyer has a major role in strategy selection, as does seasonal and agronomic factors, as well as weather conditions.

Miller (1986) reasoned that producers are more likely to use forward contracting when basis was high. However, basis cannot be viewed independently from production and quality/specification risk. Usually basis is only positive for producers because of local production shortfalls, in which case, the producers could be incurring high production risk by forward contracting. Also, high basis is usually indicative of a local backwardation (shortage) market, which means that any locked-in price could incur a significant opportunity cost of windfall upside profits foregone.

Sakong, Hayes and Hallam (1993) suggested that when production uncertainty exists, buying put options (to establish a floor price together with upside physical price windfall potential) had a better hedging outcome compared to using futures contracts. However, producers are still reluctant to buy put options because of the premium outlay and the perceived low probability of profitability (time decay and volatility issues), particularly when selecting a strike price out-of-the-money.

This may suggest timing is an important consideration when buying put options, rather than any innate disadvantages of the strategy. As well, there are serious liquidity issues in options markets because of the reluctance of option sellers to take on too much risk, particularly in those distant forward months that are required for hedging.

Basis risk, currency risk, as well as transaction costs, liquidity issues, time, skills, experience and knowledge are all major limitations perceived by producers in making decisions regarding hedging price risk using futures and options contracts in pre-harvest conditions.

Isengildina and Hudson (2001) indicated that farm size, financial performance, availability of labour/management (related to time constraints, capacity/training, and resources), and farm enterprise diversification were factors influencing the marketing behaviour of commodity producers. Larger producers were more likely to use alternative marketing methods and pricing
strategies because of economies of scale/lower unit costs, improved access to computer software and data sources, ability to appoint external marketing advisers, and better management of hedging transaction costs.

Shapiro and Brorsen (1988) in a study on 42 selected innovative Indiana farmers found that the adoption of hedging was influenced by experience, education, management style, debt levels, farm size, off-farm income, expected income change from hedging, and beliefs that hedging could stabilize income levels. They found that education was inversely correlated with hedging, but this could be explained by the selection of the sample group, where innovativeness was not always dependent on education levels. Risk attitudes were found to be not significantly related to hedging.

In a survey of 353 Ohio crop farmers, Asplund, Forster, and Stout (1989) found that forward contracting was significantly dependent on age, attendance at farm organization meetings, use of computers or consultants, farm income, and farm debt levels. With regards hedging with either futures or options, the study found that these strategies were only dependent on the use of computers or consultants, and farm income.

Makus, Carlson, and Krebill-Prather (1990) studied 595 producers who were part of an existing futures and options marketing program (biased sample), and found that hedging activity was dependent on education, farm income, and locality.

Pennings and Leuthold (2000) in a study of 440 U.S. pig (perishable non-commodity product) producers found that risk attitude, market orientation, risk exposure, previous market performance, decision-making support, debt-to-asset ratios, and entrepreneurial behaviour all contributed towards decision-making regarding hedging with futures contracts. Market orientation was defined as an effort to obtain price information, while entrepreneurial behaviour was explained by the financial ability to take advantage of opportunities when they arose.

In a similar study on small to medium size pig producers, Pennings and Garcia (2004) found that hedging decisions depended upon risk exposure, size of the operations, debt levels, the
level of education, and both risk attitude and risk perceptions. There was an attempt to separate the initial risks perceived from subsequent changes in risk attitude, and subsequent action taken.

Given the complexity in above reasons for low hedging usage, the economic concept of 'utility' is not a good method to explain and measure the adoption process of price risk management practices. Economists assume that every decision must be taken as a preference towards maximizing profit (utility). The problem is that profit has many dimensions, including cost reduction, loss minimization, price enhancement, and debt payment scheduling, all of which can be motives and reasons for managing price risk.

Some producers confuse futures hedging with high risk speculation because of the perceived distance separating the physical and futures markets. Because of personal perceptions, paradoxes between beliefs and actions, and lack of clarity on issues such as basis and price benchmarking relevancy, this issue needs to be handled with caution in conducting questionnaires and interviews. Many of these producers would not consider a cash sale at harvest was speculating on the physical commodity price.

Gray and Rutledge (1971), Powers (1994), and Carter (1999) all identified the low usage of futures markets for hedging purposes by producers as one important area for greater in-depth research. Brorsen and Irwin (1996) argued for more primary research on the hedging activity to explain the low uptake, but this suggests that it is the hedging mechanism per se that might be at fault, rather than some more deeper psychological aspect of the agricultural producer, as well as the production environment in general.

Carter (1999) indicated that much of the research literature on the futures markets 'fails to address fundamental broad-based issues' such as the low usage of hedging mechanisms by agricultural producers. This low usage rate is not country-specific, as it appears to be a global phenomenon.
4.13. Usage of price risk management post-harvest

There remains a common but misguided belief amongst some producers, bankers, and governments that possession of physical commodity is an asset that has some static value. The problem of falling values (in terms of real and actual price falls, quality deterioration, moisture loss, direct storage/warehouse costs, indirect monetary costs, and opportunity costs) is rarely considered under such circumstances. In effect, possession of unpriced physical commodity is speculation.

Reasons why some producers store include backwardation (shortage) markets, over-confidence in market expectations, past regret on previously missed opportunities, or buyers might be dependent on seasonal conditions (Yoon and Brorsen, 2002). If these producers have not pre-sold, then they risk losing some of their cash flow in the expectation that the commodity shortage (backwardation) will be prolonged and prices will continue to rise.

In terms of rationalizing why a producer might store unsold commodity post-harvest, Brorsen (1995) indicated that only low debt producers would chose to store grain. Producers with low debt levels and adequate cash flow may have little incentive to hedge when storing unsold commodity.

Despite the carry advantages in a contango market, producers who store unhedged are speculating on price, basis, and currency in a surplus market with no cash flow, sometimes with high debt, and with critical working capital locked into capital and inventory investment. Large cash reserves are usually required for these high risk storage strategies, particularly when surplus (contango) conditions exist.

The relative advantages or disadvantages of hedging lie in the forward market characteristics. The greater the carry (surplus) factored into the forward months, the higher the probability of major price falls, which favours producer hedging activity. Alternatively, the greater the backwardation (shortage) factored into the forward months, the higher the probability of major price rises, which discourages producer hedging activity.
There is an irony whereby the existence of sufficient carry in the market is an indication that prices should fall and no storage should be undertaken. However, no carry in the forward market is an indication that prices are likely to rise, and therefore storage might be profitable. This means that carry should be viewed as an inverse indicator when deciding on a storage strategy.

The probability of occurrence of backwardation (rising price) markets in relation to the occurrence of contango (falling price) markets must therefore be taken into account when deciding a storage strategy. If this probability is low, then most speculative storage strategies will have negative returns in most years.

If carry charges only apply in surplus (contango) markets, and these markets have a propensity to fall because of the surplus, then contango markets only benefit those storage users who both hedge price and store to capture carry. For those storage users who merely speculate on price and store, there is a high probability that the fall in subsequent prices because of the surplus conditions will outweigh any carry advantages.

4.14. Summary of price risk management adoption and usage

The farmer’s psychology in making decisions on risk-related variables and adoption practices is complex because of the biological nature of production and the climatic/weather influences, compounded by differences in individual trait and attitude-response mechanisms. Learning experiences may affect subsequent behaviour in many ways for each individual. There may be a filtering effect through farming family generations that generally selects risk-taking individuals.

Risk attitudes may change over time and through experience/learning. Perceptions about risk are current thoughts that may alter with timing, role, circumstance, and outcome. The paradox of risk suggests that what may be perceived might actually contradict subsequent behaviour or action. It would be erroneous to assume that a certain risk attitude is static, or that a particular risk attitude would lead to a specific behaviour or action.
Adoption of new ideas that relate to risk may not strictly follow Rogers’ adoption curve. Apart from differing risk attitude and perceptions, there is uncertainty over outcomes, the effect of learning through experience, and psychological issues such as regret and avoidance.

Possible factors that influence hedging adoption and usage have been summarized according to six major researchers in Table 4.14.1. The factors have been sub-divided into farm characteristics and factors associated with management, financial, and risk.

Table 4.14.1 Factors influencing hedging adoption/usage - major research findings

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5. METHOD OF RESEARCH

5.1. Research approach

Because of past research problems identified with algorithms and econometric analyses, such as the subjective assumption of constancy of too many variables, the approach to this research will be non-mathematical. It will focus on the behaviour aspects of farmer decision-making regarding selling methods and pricing strategies for wheat growers.

Any attempt to categorize farmers merely into risk averse and risk takers will be avoided in this study. It will be assumed that farmer perceptions of risk may differ to actual actions taken regarding this risk. Separating inherent risk attitude from risk behaviour will be attempted throughout the analyses.

The approach adopted in this research will follow that of Pennings and Leuthold (2000) who acknowledged that different groups of producers have different decision-making processes regarding marketing and pricing, and Weber and Milliman (1997) who have previously analysed grower's risk behaviour.

Eleven key major issues (management psychology, anxiety, variable costs of production, farm size, age, farm debt, farm experience, training, risk attitude, regret/avoidance, and adoption) were identified in the Literature Review, which were considered both important and under-researched both from a marketing method and hedging/pricing perspective. The research design needed to focus on these variables to enable adequate statistical testing to occur.

5.2. Research questions

The research will focus on eight key areas for wheat growers:

1. Does the management approach to decision-making affect a wheat grower's choice of marketing method or hedging/pricing strategy?
2. Do wheat growers experience anxiety when choosing marketing methods or hedging/pricing strategies?

3. Does the cost of production influence price risk management decisions for wheat growers?

4. Does price risk management lead to better production cost control for wheat growers?

5. Does the wheat grower's farm size, age, debt, farming experience, or training influence the choice of marketing method or hedging/pricing strategy?

6. Do bad decisions in the past over marketing methods or hedging/pricing strategies lead to regret and avoidance by wheat growers, or to learning and seeking more knowledge?

7. Do Roger's adoption criteria have any influence on decision-making regarding marketing method and hedging/pricing strategy for wheat growers?

8. Is the 'certainty effect' (defined by Kahneman and Tversky as the tendency for an individual to be risk averse when certain gains are known to eventuate, but a risk taker when losses occur) relevant to Australian wheat growers?

5.3. Previous research design knowledge

Important lessons were learnt from the 2002 National Farmer Survey conducted by A.F.F.A., which surveyed 229 grain growers throughout Australia (40 grain growers in N.S.W., 41 in Victoria, 44 in Queensland, 55 in S.A., and 49 in W.A.). These included results being easily lost in generalities, and ambiguity masking the real issues and preventing potential findings. Large grower surveys based on determining grower behaviour and decision-making still had to have a strong focus on very specific questioning such as those pertaining to marketing and pricing decision-making.
Xu (2005) published a behavioural study in Canada, focusing on the Myers-Briggs personality indicators with farmer decision-making. Large farm size Canadian corn-soybean growers who participated in university workshops were compared over three years, and all external variables were assumed to remain constant over time. The Canadian research analysed two marketing methods (cash sale and forward contracting) and two hedging/pricing strategies (futures contracts and options contracts). The mean of each Likert question was compared over three years.

Comparing the mean of the questions over a three year period limited the scope of the Canadian research. The Canadians compared standard deviations based on statistical means between questions, which suggested some question dependency.

There were statistical validity questions over the usage of regression analyses that was undertaken by the Canadians. It is common occurrence for regression analysis to be not suitable for behavioural responses when the data is categorical and not continuous, when there is uneven and unequally distributed response data, and where there are more than 10 percent of expected frequencies being less than 5 for sample sizes equal to or less than 40.

5.4. Research design

The study involved a Pilot Survey amongst wheat growers in the Wimmera/Mallee district of Victoria as a preliminary to the main study. This region was selected because of its high concentration of dedicated wheat growers in a marginal district that had identifiable problems such as small farm size and questionable profitability. It was thought that by surveying these growers, some of the major local problems and issues could be identified, which could then be developed into more focused questioning in the major study.

The cropping year under study was 2005 because it was a relatively good year for most wheat growers in most districts of Australia. This meant that alternate districts could be compared for the same year, based on the assumption that the variation of weather was minimal between the districts for that particular year.
The Pilot Study was followed by the Main Study amongst wheat growers in northern N.S.W. for 2005. Northern NSW wheat growers were selected for the Main Study because the region covered a wide selection of different wheat grower types. These varied in farm size (from medium to very large), specialization (from highly specialized to very diversified), cropping types (from solely winter cropping to both winter and summer cropping), marketing method (from no farm storage to on-farm bunkers), and financial circumstances (from very high debt to large cash reserves as reflected in the land values/sales).

Two comparison surveys were then undertaken to test the results from the Main Study for the same 2005 year using the same questionnaire as the Main Study. One survey was conducted with wheat growers in the Upper Yorke Peninsula of South Australia and the other with wheat growers in the Wimmera/Mallee district of Victoria. These regions were selected to test the findings across a range of regional diversity. Wheat growers from the Upper Yorke Peninsula of South Australia were characterized as being medium-size winter grain mono-culturalists, which contrasted to the wheat growers in northern NSW. It was considered that regional robustness would test the survey findings.

By undergoing comparative studies in northern NSW (large-sized diversified farms with both winter and summer crops, across a range of production marginality, with a range of end-usage intensity), South Australia (medium-sized specialized farms across a range of production marginality, with no end-usage intensity), and Victoria (small-sized diversified farms generally with high production risk/marginality, with medium end-usage intensity), most of the broad range of production and marketing conditions would be covered in the research to enable conclusions to be drawn for most Australian wheat growers. Wheat growers in Queensland (medium-sized diversified farms with high production risk/marginality, with high end-usage intensity), southern NSW (medium-sized specialized farms with medium production risk/marginality, with medium end-usage intensity), and Western Australia (large-sized diversified farms with medium production risk/marginality, with low end-usage intensity), have characteristics that are common to the three selected study regions/States.
The Main Study in NSW examined eighteen key management factors and seventeen risk attitude and adoption criteria within the same production year (2005) to minimize the impact of annual changes. It focused solely on wheat growers, and used a diverse range of population selection methods irrespective of size, training, or background experiences.

Five marketing methods (National/export pool, cash sales at harvest, storage, forward contracting, and private pools) and six hedging/pricing strategies (futures broker, merchant, bank, futures adviser, private pool manager, or did not hedge/forward price) were selected for analyses. By including the whole range of marketing and hedging alternatives in Australia, this provided more depth and scope to the findings.

5.5. Pilot Survey

The survey sample selection for the Pilot Survey was based on those Wimmera/Mallee wheat growers who were participating in the regular cropping performance group meetings under the auspices of the Department of Primary Industries (D.P.I. Victoria). This sample selection was relevant because the group was production focused and not biased towards marketing/pricing, and had been calculating their costs of production over a number of seasons based on a standard D.P.I. format procedure. If any associations were to be tested between variable costs of production and management of price risk, discrepancies caused by differing farm accounting procedures had to be minimized.

The Pilot Survey questionnaire has been included in Appendix A. Mail-out timing coincided with an off-peak period for local farmers, being after the peak 2005 summer harvest period, but before the 2006 winter cropping preparation period. The survey returns were faxed or mailed back during March/April 2006. Fifty-one questionnaires were returned fully completed from a total mail-out of four hundred, representing 13 per cent. The margin of error (Rosenthal, 2006) was 4.9 per cent.

Serious research weaknesses emerged from the Pilot Study that limited its findings regarding a possible association between variables costs of production and price risk management. These
weaknesses included no consideration for fixed costs, no allocation of farm debt to various farm enterprises, alternate farm enterprises (other than wheat) were not fully examined, and inadequate questioning over risk attitudes.

The conclusion from the Pilot Study was that any association between price risk management and cost management had to be determined by direct survey questioning, and not from statistical inference from separate (and possibly mutually exclusive) variables.

5.6. Main Study/Survey in northern N.S.W.

As a result of the outcomes of the Pilot Survey, a survey was designed for wheat growers in northern N.S.W. that asked specific questions on each of the eleven key major issues (management psychology, anxiety, variable costs of production, farm size, age, farm debt, farm experience, training, risk attitude, regret/avoidance, and adoption) relating to the five main marketing methods and six hedging/pricing strategies based on the 2005 production year. In order to standardize survey procedures, only the main decision-maker regarding marketing/pricing was requested to complete the survey.

The NSW study made each question mutually exclusive of every other question, which facilitated profiling analysis. This enabled associations to be tested in the Fisher Exact Test (eighteen management factors and seventeen risk attitude/adoption factors were tested against the five marketing methods and six hedging/pricing strategies).

Questions on management psychology were based on the Myers-Briggs personality traits, but were also expanded to include eighteen key management factors that included attitudes towards costs, debt, and training. The adoption questions were based on Rogers’ (1983) approach, and together with questions on risk attitude, this made another group of seventeen key questions.

The aim of this research method was to develop profiles on wheat growers regarding marketing methods and hedging/pricing strategies, to test for statistical significant differences between users and non-users of each of the methods and strategies, and to determine whether any
positive or negative associations existed. This would then provide the research background to finally test the nine research questions.

Fausti and Gillespie (2006) hypothesized that individual risk preferences depended on such variables as age, income, farm location, and debt levels. All four factors were included in the Main Survey/Study.

Three questions were designed to test consistency of self-ranked risk attitude assessment responses based on the decision outcome, role, time, and circumstance. Consistent responses to risk attitudes could be tested because each of the questions on risk attitude used a different situational construct. Self-ranking merely on risk taking verses risk averseness was avoided.

The design of the questionnaire was based on Dillman (2000). Strength of preference was measured by a seven-point Likert scale from strongly agreeing to strongly disagreeing. There were multiple choice questions where respondents chose the best answer from a given list; there were ordinals where the respondent ranked from 1 being the most important to 7 being the least important; there were categories where the respondent was asked to indicate which category they belonged to; and there were numericals where the respondent was asked a numerical question. Some questions combined a multiple-choice with a 1st, 2nd, and 3rd ordinal ranking.

Problems encountered in the Main Survey included limited research finance and resources, the cost of alternate survey methods were over-budget, the questionnaire was too detailed for telephone interviews, and the questionnaire (96 multiple-choice questions) was unusually lengthy requiring considerable time for respondents to complete (20 - 30 minutes on average).

A draft questionnaire was mailed to three wheat growers for feedback prior to the final design and mail-out. The draft survey indicated some weaknesses including some vagueness over the risk attitude questions (this was overcome by including situational constructs), and there were some issues relating to non-hedging (more detailed questions were included). Other questions were modified based on the grower feedback received.
Industry input into the survey was also invited, and feedback was received from both banks and merchants. Because banks had become important in offering cash-settled pricing products to Australian wheat growers, suggested questions relating to these over-the-counter products were included.

Mail-outs of the Main Survey questionnaire to northern N.S.W. wheat growers commenced in September 2006. It was mailed together with a covering letter detailing the request to complete the survey, reasons why the wheat grower was selected, the rationale of the survey, confidentiality, and support information (Appendix B). The main survey questionnaire has been included in Appendix C.

The original sample size of the Main Survey was 300 wheat growers in northern N.S.W. selected from a number of different data bases (farm advisers, accountants, previous course attendees, random telephone directory selection, referred growers, and growers who had shown interest in undertaking the survey). There were 23 wrong addresses (leaving a net total of 277 growers).

All growers were phoned in a follow-up within 2 - 3 weeks after the initial mail-out. Surveys were again mailed or e-mailed to those growers who had lost or misplaced the original survey.

Factors contributing to grower negativity at the time of the initial mail-out (September-October 2006) included severe drought for 95 per cent (the second serious drought in five years), no crop for 30 percent (in some cases, no crop for 2-3 years), deteriorating crop for 70 percent, early harvest for 40 percent because of the drought (which meant that the grower was too busy to fill out the questionnaire), anxiety issues for 20 percent, individual and/or family depression for 10 percent (usually caused by financial difficulties), suicide rates increased at the time among farmers, and early retirement for 5 percent which was usually associated with being forced out of the industry because of financial circumstances.

Another follow-up occurred in February 2007 with 40 wheat growers targeted within the original sample who were selected on geographic locality gaps, which had been identified from
earlier survey returns during September-October 2006. These growers were phoned first to get their approval; then the questionnaire was either e-mailed or mailed out, and followed up with more e-mails or phone calls.

Forty questionnaires were finally returned fully completed and based on a total mail-out of three hundred, this represented 13 per cent of the original sample with the margin of error (Rosenthal, 2006) being 5.7 percent. It was coincidence that 40 grower survey returns were also received for both the similar Canadian survey (Xu, 2005) and for N.S.W. grain growers in the A.F.F.A. 2002 Australian survey.

Time constraints in filling out the survey questionnaire were stated by 55 percent of the initial grower population surveyed. Harvesting time had been brought forward by 4 - 6 weeks to early October 2006 because the drought had caused early drying out and quick maturity of the grain. This meant that there was no lull prior to the normal busy harvest time (November).

Those wheat growers not directly involved with harvesting the small 2006 crop of wheat were preoccupied with hay-making as a means to supplement farm income in a low-income drought year. This meant that October 2006 was an unusual busy period for northern N.S.W. farmers.

Although drought/weather, early harvesting, Christmas/holidays, and then children returning to school seriously impacted on the survey response rate, there has been precedents where there were serious time gaps in survey responses with no validity consequences. Isengildina and Hudson (2001) indicated that there were no statistical differences in the surveyed variables between the respondents in the first mailing and the follow-up respondents for U.S. cotton growers.

Potential inconsistencies in the survey could be attributable to a lack of understanding the question (Fausti and Gillespie (2000) and situational differences (Weber and Milliman, 1997). Such problems did occur in the survey, including varying interest and motivation of wheat growers to complete the questionnaire, time recollection factors (based on the 2005 wheat crop), not having the interviewer present during completion of questionnaire, difficulty in achieving
good cooperation by phone, difficulty for growers in understanding the question, and lack of knowledge by growers regarding some questions.

Dillman (2000) indicated sampling error (the result of surveying only some growers and not all the survey population), coverage error (the result of not allowing all growers to have an equal chance of being sampled for participation in the survey), measurement error (the result of poor question wording or questions being presented in such a way that inaccurate or un-interpretable answers are obtained), and non-response error (the result of growers who responded to the survey being different from growers who did not respond), as survey limitations. All of the errors were detected to some extent in the survey.

There may have been bias in the survey towards those northern N.S.W. wheat growers who were more positive about their own financial circumstances and about the wheat industry in general. Broad-acre farmers who were generally negative about wheat or cropping were extremely unlikely to fill out the questionnaire.

Fowler (2002) indicated bias in mail-out surveys when people who have an interest or are more informed on the subject matter were more likely to complete and return the survey, compared to those who were less interested or less informed. Also, low response rates with mail-out surveys may have significant bias based on the purpose of the survey. As the survey occurred with a background of uncertainty regarding the future of single-desk export wheat selling in Australia, informed farmers who were interested in the future of marketing wheat were more likely to fill out the questionnaire compared to growers who were less informed and less interested.

Although the Cole Enquiry into governance and ethical issues relating to the management of the Australian wheat export monopoly (single-desk) had essentially finished, the Final Report was due for release in November 2006. This may have caused some marketing choice uncertainty amongst wheat growers who traditionally delivered/sold into the National/export pool at harvest time. However, the impact of the Cole Enquiry was considered to be political in nature that more affected the grower’s shareholder value in A.W.B. Ltd. than any major choice considerations between competing wheat marketing alternatives.
In order to minimize any repercussions or bias arising from the Cole Enquiry, there was neutrality over the choice of marketing method in the questionnaire. As well, the N.S.W survey sample did not discriminate against farm size or previous training.

However, the sample population was skewed towards the large swath of northern broad-acre farming land from the Macquarie Valley in the south-west, through to Walgett/Burren Junction/Wee Waa to the north-west and center, and then to Moree/North Star/Mungindi in the north. These regions were selected because they were broad-acre specialist cropping areas that were not near major end-use activities. Proximity to main end-users might have caused bias towards forward contracting in the survey results.

The surveyed area minimized bias on decision-making caused by end-user proximity by excluding the south-east of the region (especially the Liverpool Plains, which was close to lot-feeders, pig/poultry/dairy farmers), and the north-east (close to major lot-feeders). The New England highland was excluded because of its diversified smaller acreage farming that could not be considered specialist broad-acre cropping.

5.7. Comparative surveys

Results from the Main Survey/Study in northern N.S.W. were followed up with the same grower questionnaire in South Australia (Upper Yorke Peninsula) and Victoria (Wimmera/Mallee) with the same 2005 production year to minimize annual differences. The aim of the comparative surveys was to test the analytical results from the Main Survey/Study across different regions of Australia.

The Upper Yorke Peninsula comparative survey was conducted in September 2007 with 11 survey returns (one incomplete) and followed up again in February 2008 with 10 survey returns. The final number of completed returns was twenty.
Another survey using the same questionnaire was conducted in late February 2008 with wheat growers from the Wimmera/Mallee district in Victoria. The result was five completed returns. Because growers were beginning to have difficulty in recalling events for the 2005 production year, it was decided to discontinue the survey beyond February 2008. This accounted for the small survey size.

Although the survey size was not great, this Victorian questionnaire added depth to the Main Survey/Study by confirming the diversity (heterogeneity) of wheat growers, and it complemented the initial Pilot Study. Also, it did provide some consistency with the Main Survey/Study in some key areas, more so than for the South Australian survey. Explanations for this may include closer proximity to major end-users along the east coast of Australia, compared to South Australian growers.

5.8. Data compilation

Data from the Main Survey in northern NSW was coded, prepared and entered into Asteroid software from Roy Morgan Research. This software was chosen because of its ability to cross-analyse different variables and develop profiles of survey respondents. The Asteroid program was also used to compile and analyse the 2002 A.F.F.A. survey data. Because of budget cost and time restraints, both sets of data from the comparison surveys (South Australia and Victoria) were manually compiled and analysed based on the comparative requirements to test the Main Study findings.

5.9. Analytical method selection

The NSW Main Survey response results were divided into users and non-users and tested for significant differences between those who used the particular marketing method or hedging/pricing strategy with those that did not use the method/strategy. By adopting the user verses non-user approach, the scope of the NSW research was broadened and more questions could be analysed together, thereby integrating complexity into the study.
In contrast to Xu (2005), each of the main survey questions were profiled, ranked in order of highest and lowest differences, and then analysed using the Fisher Exact Test to establish those with significant differences. The Fisher Exact Test (a variation of the Chi-square test) was adopted in the Main Study because all the other quantitative approaches were deemed unsuitable in the data analysis from a statistical validity perspective.

The small response rate was ultimately suited to profiling which led to ranking of key variables and then testing these key variables for significant differences using Fisher Exact Test. A profiling analyses was conducted on each of the eleven key major issues (management psychology, anxiety, variable costs of production, farm size, age, farm debt, farm experience, training, risk attitude, regret/avoidance, and adoption) relating to the five marketing methods and six hedging/pricing strategies.

Whilst respondents were better able to scale many of their replies using a 1 - 7 Likert scale which added depth to the questioning, statistical analyses was restricted because of the mutual exclusivity of the questions.

Regression analysis which sought factor dependence on several Likert questions (variables) was rejected for statistical validity and soundness for the reason that the data was not continuous. However, by collapsing the data into two categories (Likert scale 1-3 and Likert scale 4-7), this enabled the use of the Fisher Exact Test. The downside was that the positive aspects of a 1-7 scaling were initially lost. However, the Likert Scale was used to test each of the findings.

Segmenting growers into groups (clusters) was used in the Pilot Study analysis. Wheat growers were profiled based on district, cost of production, debt levels, and training. Although this developed an understanding of grower groups, this cluster analyses was discontinued in the Main Study because the difficulty in establishing the validity of statistical differences. There were too many variables for levels of significant difference to be established. Dividing growers into users and non-users of particular marketing methods and pricing strategies was a better statistical method.
Xu (2005) used the mean of each Likert question and compared this mean over three years. This assumed that each of the three years was similar in terms of weather and production, otherwise these variables might have negated the statistical validity of the outcome. However, the Main Study used only one year, on the assumption that each year in Australia is completely different to the previous year. In such research analyses, the only method to utilize the mean of each Likert question was in comparison with other survey questions. However, this would assume some question dependency when mutual exclusivity existed for each survey question.

The Chi-Square Test was the only appropriate statistical test when comparing categorical groups (rows) across different independent groups (columns) when there is mutual exclusivity. Because the rows are mutually exclusive (e.g. different management and risk/adoption questions) across different independent columns (e.g. marketing methods and hedging/pricing strategies) for non-continuous categorical data (users and non-users), the Chi-Square Test was therefore considered.

However, while Chi-Square can test for significant differences within the row and the difference between the two highest categories, in this case there were only two mutually exclusive categories (users and non-users). Therefore, the Chi-Squared testing method was rejected. Other rejection issues included the small sample size (40), the problem of having more than 10 percent of expected frequencies being less than 5, and the uneven and unequally distributed data. The Chi-Squared Test was more appropriate for larger samples with no large variations in the data.

The Fisher Exact Test is a more exact version of the Chi-Square analyses, which is used when there are two categories for comparison (users verses non-users) having a small sample size. Even with a larger sample size, the Fisher Exact Test would still be used because of the two category groups for comparison.

The Fisher Exact Test was selected for analyses because the sample size was small, the data was categorical rather than continuous, the unevenness of the response data, the appropriateness of a
2 x 2 contingency table, the number degrees of freedom was always one, and its usage regardless of the sample characteristics.

Analyses such as t-testing and z-testing were excluded because there was no continuous data comparing the means between the groups where the rows are dependent.

5.10. Fisher's Exact Test

The aim of using the Fisher Exact Test was to identify areas of significant difference between users and non-users (two categories in the contingency table) based on management/risk attitude-adoption in a series of survey questions (categorical variables). The analyses therefore involved testing for significant differences between users and non-users of marketing methods and hedging/pricing strategies across different independent management and risk attitude/adoption variables.

The critical P value selected was 0.1 because this is a common level for determining statistical differences in this type of research. The initial hypotheses tested the following:

H₀ : There is no significant difference between the user and non-user groups
     (equal or greater than a P value of 0.10)

H₁ : There is significant difference between the user and non-user groups
     (less than a P value of 0.10)

This Fisher Exact Test analysed only the Main Survey results in northern N.S.W. There would have been too many variables and much complexity if the different regions of South Australia and Victoria had also been introduced into the Fisher Exact Test.

It did not matter if some growers used more than one marketing method or hedging/pricing strategy because the Fisher Exact Test considered each method or strategy separately and
compared those who used the strategy or method with those who didn't. For each method or strategy tested, growers were classified as either users or non-users to establish mutual exclusivity.

A 2-tailed test was done to determine whether the users and non-users were equal or non-equal. The P value was always positive because the probability was between 0 and 1. At 0, there was no difference between the user and non-user.

The 2-Tail test for P-values was also used because there was no indication of prior negative or positive association between the independent variables. This meant that User > Non-User was tested as well as Non-User > User. Because the P-values are all positive (0 to 1), there was a need to be careful in the interpretation of each result given the significance that occurred.

Because of the small data size in some categories, the tests of significance with the Fisher Exact Test may not have been very 'powerful' in all instances. For example, the small percentage of growers using some of the hedging/pricing strategies compared to those using a marketing method (major difference in group sizes) meant that there was not a high probability of detecting significant differences between the users and non-users even though they might have existed. If there was a true underlying difference, the small data sample size had limited ability/power to detect the statistical significant differences.

5.11. Issues relating to sample size

A research credibility problem might exist with such small survey response numbers. However, Keeter et al. (2000) compared the results from a low response rate survey based on a telephone survey with those from a high response survey and found similar results. Graubard and Korn (1987) indicated that different statistics and approximations can give quite different results, even for very large samples.

Koehler and Larntz (1980) indicated that there are few guidelines to indicate when large sample sizes are adequate. Haberman (1988) studied large sample sizes and found that large sample
approximations can be very poor when the contingency table contains both small and large expected frequencies. In other words, large sample sizes are more suitable when the expected frequencies are in the middle range.

The expected frequencies resulting from the Main Survey in northern N.S.W. would be both small and large, given the type of questions relating to management and risk attitude/adoption. Any middle-range frequency was therefore not apparent in the surveys undertaken in this Australian study, which were characterised by heterogeneity. In this type of asymptotic analyses, the sample size sometimes has less relevance than the discreteness of the sampling distribution (Agresti, 1992).

Because Australian wheat growers use different combinations of marketing methods and different combinations of hedging/pricing strategies in different years, the analyses had to assume mutual exclusivity of each method and each strategy. This assumption of mutual exclusivity methods/strategies, as well as the mutual exclusivity of the survey questions, prevented convenient grouping of answers, which might have simplified interpretation. A larger sampling size would not have overcome this research problem, and most likely would have merely introduced a greater combination of methods/strategies, each of which would have been assumed to have mutual exclusivity for the purpose of analyses.

Small samples sizes are used for categorical data (not continuous) when relatively large probabilities occur in the distribution of the data (Agresti, 1992). It was for this reason that Fisher (1925) advocated exact procedures for small sample sizes. In order to devise a statistical process more suited to the needs of practical research, Fisher introduced the Fisher Exact Test for 2 x 2 contingency tables in 1934. Exact inferences for contingency tables based on categorical data could then be developed (Agresti, 1992).

Because the Main Study was based on categorical non-continuous data, the small sample size was not a statistically limiting factor, provided that a suitable exact testing method such as the Fisher Exact Test was used.
5.12. Issues with the targeted wheat growers

Despite all of the northern N.S.W. growers who responded to the Main Survey producing wheat in 2005, there was the problem of defining who was a wheat grower and actual targeting these growers in the survey. This was because of regular drought conditions resulting in intermittent wheat production, and more frequent changes in farm enterprise diversification compared to other cropping countries. Water allocation might preclude wheat production in any one or more years in preference to other more profitable farm enterprises. Northern N.S.W. is characterized by both summer and winter cropping, and opportunistic farming (only producing what is currently in high demand).

Isengildina and Hudson (2001) questioned whether surveys based on hedging workshop or conference participants such as those from Shapiro and Brorsen (1988) and Patrick et al. (1998) were representative of all growers in the locality. To avoid this problem, wheat growers in the northern N.S.W. Main Study were selected from a number of different data sources (farm advisers, accountants, previous course attendees, random telephone directory selection, referred growers, and growers who had shown interest in undertaking the survey). This minimized bias that might have been caused by their prior training, preferences for particular marketing methods, and usage of hedging/pricing strategies.

5.13. Issues with risk attitude measurement

One of the problems in researching risk attitude was that different methods to measure risk attitude have resulted in different classifications (Weber and Milliman, 1997). Even with the same assessment method, individual responses to risk behaviour under different circumstances and time frames have not been consistent (MacCrimmon and Wehrung, 1986; Weber and Milliman, 1997). Despite this, Weber and Milliman (1997) argued that differences in individual risk attitudes could still be measured.

Both Dyer and Sarin (1982) and Weber and Milliman (1997 indicated that designing questions relating to risk attitude provided greater consistency provided that the strength of preference and
risk attitude were measured separately. Choosing risk alternatives should be tested on several dimensions (Weber and Milliman, 1997).

Bard and Barry (2001) indicated that risk attitude research based on self-ranking techniques was inconsistent and biased towards less risk averseness. However, Fausti and Gillespie (2006) concluded that self-ranking was the simplest method, and when combined with situational constructs, it could perform relatively well. The survey cost of alternative methods such as simulation analysis of actual risk and the development of indices of risk preference and interval coefficients of risk averseness often precluded these methods.

Learning effects could occur regarding a sequence of questions regarding risk attitude (Fausti and Gillespie, 2006), or indeed during any sequence of questioning. Research tends to suggest that this 'learning effect' would lead to improved response consistency. If no consistency was found, Fausti and Gillespie (2006) claimed that it would be doubtful if this could have been remedied by asking the questions in separate formats or at different times.

The final design of the Main Survey tested risk alternatives on several dimensions (Weber and Milliman, 1997) under different situational constructs (Fausti and Gillespie, 2006). As well, series of questions were designed in a learning sequence (Fausti and Gillespie, 2006) to test the same factor several times in several dimensions (Weber and Milliman, 1997) so as to validate research outcome consistency and reliability (Nuthall, 2001).

5.14. Issues with the analyses

Wheat growers are difficult to categorize for the purpose of analyses. Instead of using just one farm enterprise, one marketing method and one pricing/hedging strategy, many use a range of farm enterprises, methods and strategies and they might be expected to change these combinations and selections according to the season/circumstance and over time. The statistical outcome is therefore diluted because wheat growers belong to many categories despite rigorous design methods. Increasing the sample size would not be expected to overcome this research problem.
Results were therefore tested from a mutually exclusive perspective. Regardless of the combination of marketing methods and hedging/pricing strategies used, growers were tested on each marketing method and hedging/pricing strategy used. This meant that some growers were tested several times because of multiple usage of different methods and strategies.

Only limited analyses could be performed on the whole Likert Scale results because of its unsuitability to analyze several variables together. The Likert Scale was used to test Research Objective 8. However, for all other analyses, the Likert Scale of 1 - 7 was condensed into 1 - 3 agreeing with the particular question while 4 - 7 disagreed with the question.
6. RESULTS

6.1. Introduction

This section focuses on the Main Survey research conducted on NSW wheat growers and on the results from the Fisher Exact Test. The results are summarized under four key sections:

Wheat decision-making: marketing - management
- risk attitude and adoption

Wheat decision-making: hedging/pricing - management
- risk attitude and adoption

Based on these results, each of the eight research questions will be evaluated in Section 7. The alignment of each research question with the Fisher Exact Test and the relevant survey question is summarized in Table 6.1.1.

Table 6.1.1. Alignment of each research question with each section tested

<table>
<thead>
<tr>
<th>Research question regarding wheat growers</th>
<th>Alignment with key section tested in the Fisher Exact Test</th>
<th>Relevant survey questions</th>
</tr>
</thead>
</table>
| 1. Does the management approach to decision-making affect a wheat grower's choice of marketing method or hedging/pricing strategy? | Marketing - management  
Hedging/pricing - management | 25 - 35 |
| 2. Do wheat growers experience anxiety when choosing marketing methods or hedging/pricing strategies?   | Marketing - management  
Hedging/pricing - management | 33 |
| 3. Does the cost of production influence price risk management decisions for wheat growers?            | Hedging/pricing - management | 59, 60, 61 |
| 4. Does price risk management lead to better production cost control for wheat growers?                 | Hedging/pricing - management | 58 |
| 5. Does the wheat grower's farm size, age, debt, farming experience, or training influence the choice of marketing method or hedging/pricing strategy? | Marketing - management  
Hedging/pricing - management | 41, 42, 48 |
| 6. Do bad decisions in the past over marketing methods or hedging/pricing strategies lead to regret and avoidance by wheat growers, or to learning and seeking more knowledge? | Marketing - management | 45, 46, 47 |
| 7. Do Roger's adoption criteria have any influence on decision-making regarding marketing method and hedging/pricing strategy? | Hedging/pricing - risk attitude/adoption | 36 - 40 |
| 8. Is the 'certainty effect' (defined by Kahneman and Tversky as the tendency for an individual to be risk averse when certain gains are known to eventuate, but a risk taker when losses occur) relevant? | Hedging/pricing - risk attitude/adoption | 20, 21, 22 |
6.2. Wheat marketing decision-making - management

Eighteen management characteristics were analysed against five different marketing methods using the Fisher Exact Test to test for significant differences between User versus Non-User of the particular marketing method. The five marketing methods were the National/export pool (otherwise known as the Australian single-desk), storage, forward contract, cash sale at harvest, and private pool.

Table 6.2.1 indicates the questions in the survey that were relevant from a managerial perspective. The management characteristics included how decisions were made, the level of emotional anxiety, responsibilities, personal attributes, and farm management practices of wheat growers making acreage, marketing, and pricing decision-making.

The Likert 1 - 7 scale determined whether the wheat grower agreed or disagreed with the survey question. Agreement with the particular management question was based on a 1 - 3 response, whereas disagreement with the management question was based on a 4 - 7 response.

Total Users and Non-Users of each marketing method are included at the top of each column. Fifteen N.S.W. growers used the National/export pool (38 percent), sixteen growers used storage (40 percent), seven growers (18 percent) used forward contracts, twenty-four growers (60 percent) used cash sales at harvest time, and five growers (13 percent) used private pools. Usage was mutually exclusive because many growers used more than one marketing method.

The response of each User and Non-User of the marketing method towards each management question are summarized in Table 6.2.1. Seven growers who used the National/export pool (47 percent) made acreage/marketing/pricing decisions alone. This contrasts with the ten growers (40 percent) who made decisions alone but did not use the National/export pool. Ten out of the sixteen NSW wheat growers (63 percent) who used storage methods (on-farm or warehouse) made acreage/marketing/pricing decisions alone. This contrasts with the seven out of twenty-four growers (29 percent) who made decisions alone but did not use storage.
Associations between the marketing method and particular management characteristics were established by testing for significant difference between the User and Non-User of each marketing method for each management question. If a significant difference occurred between Users of a particular marketing method and Non-Users for a particular management question, then this indicated an association for that management characteristic with the user of the particular marketing method.

A positive association occurred when the percentage of growers who used the marketing method agreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the marketing method. A negative association occurred when the percentage of growers who used the marketing method disagreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the marketing method.
### Table 6.2.1. Marketing method and management decisions relating to acreage/marketing/pricing - NSW 2005

<table>
<thead>
<tr>
<th>Growers who agreed with the question on management decisions</th>
<th>Export pool</th>
<th>Storage</th>
<th>Marketing method</th>
<th>Cash Sale</th>
<th>Private Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used</td>
<td>Non-used</td>
<td>Used</td>
<td>Non-used</td>
<td>Used</td>
</tr>
<tr>
<td>Number of growers who used marketing strategy</td>
<td>15</td>
<td>25</td>
<td>16</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Q. 25. Make decisions alone</td>
<td>7</td>
<td>10</td>
<td>10</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Q. 26. Make decisions with business partner</td>
<td>8</td>
<td>12</td>
<td>6</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Q. 27. Make decisions with external adviser</td>
<td>8</td>
<td>12</td>
<td>8</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Q. 28. External adviser is important</td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Q. 29. Make decisions in orderly/structured/organized approach</td>
<td>10</td>
<td>15</td>
<td>9</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>Q. 30. Make decisions spontaneously, taking risk &amp; being flexible</td>
<td>2</td>
<td>8</td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Q. 31. Take time &amp; examine all aspects of when making decisions</td>
<td>10</td>
<td>20</td>
<td>13</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Q. 32. Need data/information, &amp; analyse strengths/weaknesses before making decisions</td>
<td>8</td>
<td>20</td>
<td>12</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>Q. 33. Experience emotional anxiety when making decisions</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Q. 34. My decisions are my responsibility</td>
<td>13</td>
<td>24</td>
<td>16</td>
<td>21</td>
<td>7</td>
</tr>
<tr>
<td>Q. 35. My decisions are the responsibility of other people</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Q. 41. Age influences decisions</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Q. 42. Farming experience influences decisions</td>
<td>13</td>
<td>21</td>
<td>13</td>
<td>21</td>
<td>5</td>
</tr>
<tr>
<td>Q. 48. More training would have contributed to a better performance</td>
<td>7</td>
<td>10</td>
<td>5</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Q. 58. Locking in forward price is incentive to lower variable costs of production</td>
<td>5</td>
<td>10</td>
<td>6</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Q. 59. Knowledge of variable costs leads to locking in a profit</td>
<td>7</td>
<td>11</td>
<td>9</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Q. 60. Target more realistic price levels when there are known variable costs of production</td>
<td>7</td>
<td>14</td>
<td>9</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Q. 61. Targeted wheat price was realistic</td>
<td>7</td>
<td>18</td>
<td>14</td>
<td>11</td>
<td>4</td>
</tr>
</tbody>
</table>
Associations between the marketing method and particular management characteristics were established by testing for significant difference between the User and Non-User of each marketing method for each management question. If a significant difference occurred between Users of a particular marketing method and Non-Users for a particular management question, then this indicated an association for that management characteristic with the user of the particular marketing method.

Six management issues were significantly different at the P < 0.10 level between Users and Non-Users of four out of the five particular marketing methods using the Fisher Exact Test. There were no significant differences between users and non-users of forward contracts. The results are indicated in Table 6.2.2.

Table 6.2.2. Marketing method and management decisions: Fisher Exact Test results

| Growers who agreed with the question (all questions on decisions related to acreage/marketing/pricing) | Fisher Exact Test P values |
|---|---|---|---|---|
| Export Pool | Storage | Forward contracted | Cash Sale | Private Pool |
| Q. 25. Make decisions alone | 0.7 | 0.05 | 0.7 | 1 | 1 |
| Q. 26. Make decisions with business partner | 1 | 0.3 | 1 | 1 | 1 |
| Q. 27. Make decisions with external adviser | 1 | 1 | 1 | 0.7 | 1 |
| Q. 28. External adviser is important | 1 | 0.18 | 1 | 0.7 | 1 |
| Q. 29. Make decisions in orderly/structured/organized approach | 0.7 | 0.5 | 0.2 | 0.3 | 1 |
| Q. 30. Make decisions spontaneously, taking risk & being flexible | 0.3 | 0.06 | 1 | 0.5 | 0.6 |
| Q. 31. Take time & examine all aspects of when making decisions | 0.5 | 0.7 | 0.7 | 0.16 | 0.09 |
| Q. 32. Need data/information, & analyse strengths/weaknesses before making decisions | 0.09 | 0.7 | 0.7 | 0.7 | 0.6 |
| Q. 33. Experience emotional anxiety when making decisions | 0.5 | 1 | 1 | 1 | 1 |
| Q. 34. My decisions are my responsibility | 0.5 | 0.3 | 1 | 0.3 | 1 |
| Q. 35. My decisions are the responsibility of other people | 1 | 1 | 1 | 1 | 1 |
| Q. 41. Age influences decisions | 0.5 | 1 | 0.7 | 0.5 | 0.6 |
| Q. 42. Farming experience influences decisions | 1 | 0.7 | 0.3 | 1 | 1 |
| Q. 48. More training would have contributed to a better performance | 0.7 | 0.3 | 1 | 0.5 | 1 |
| Q. 58. Locking in forward price is incentive to lower variable costs of production | 0.7 | 1 | 0.4 | 0.5 | 0.06 |
| Q. 59. Knowledge of variable costs leads to locking in a profit | 1 | 1 | 0.7 | 0.3 | 0.6 |
| Q. 60. Target more realistic price levels when there are known variable costs of production | 0.7 | 0.8 | 1 | 0.8 | 1 |
| Q. 61. Targeted wheat price was realistic | 0.18 | 0.01 | 1 | 0.3 | 1 |

(Note: The results with significant differences are highlighted in bold type.)
Addendum: Positive and negative values of P have been avoided because this could be interpreted as a positive or negative response to the question. The P values are based on the relative percentage differences between users and non-users.

The positive and negative associations are summarised in Table 6.2.3 based on the relative percentage differences between users and non-users of the particular marketing method (Table 6.2.1). Positive associations reflect users of the particular marketing methods have a higher percentage agreement with the question than non-users. Negative associations reflect non-users of the particular marketing methods have a higher percentage agreement with the question than users.

**Table 6.2.3. Summary of significance using the Fisher Exact Test: management-marketing**

<table>
<thead>
<tr>
<th>Question with significant difference</th>
<th>User-type</th>
<th>P value</th>
<th>Association</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q. 25. Make decisions alone</td>
<td>Storage-user</td>
<td>0.05</td>
<td>Positive</td>
<td>Storage users are more likely to make decisions alone, relative to non-users</td>
</tr>
<tr>
<td>Q. 30. Make decisions spontaneously, taking risk and being flexible</td>
<td>Storage-user</td>
<td>0.06</td>
<td>Positive</td>
<td>Storage users are more likely to make decisions spontaneously, taking risk and being flexible, relative to non-users</td>
</tr>
<tr>
<td>Q. 61. Targeted wheat price was realistic</td>
<td>Storage-user</td>
<td>0.01</td>
<td>Positive</td>
<td>Storage users are more likely to have realistic targeted wheat prices relative to non-users</td>
</tr>
<tr>
<td>Q. 32. Need data/information, and analyze strengths and weaknesses before making decisions</td>
<td>National export pool user</td>
<td>0.09</td>
<td>Negative</td>
<td>National export pool users are less likely to need data/information and analyze before making decisions, relative to non-users</td>
</tr>
<tr>
<td>Q. 31. Take time &amp; examine all aspects first when making decisions</td>
<td>Private pool user</td>
<td>0.09</td>
<td>Negative</td>
<td>Private pool users are less likely to take time and examine all aspects first when making decisions, relative to non-users</td>
</tr>
<tr>
<td>Q. 58. Locking in a forward price acts as incentive to lower variable costs of production</td>
<td>Private pool user</td>
<td>0.06</td>
<td>Positive</td>
<td>Private pool users are more likely to agree that locking in a forward price acts as incentive to lower variable costs of production, relative to non-users</td>
</tr>
</tbody>
</table>

There were three positive associations for storage users. Relative to non-users, they are more likely to make decisions alone compared to non-users (0.05), more likely to make decisions spontaneously, taking risk and being flexible (0.06), and more likely to have a more realistic target price for their wheat (0.01).
One positive association occurred for privately managed pool users. Relative to non-users, they were more likely to acknowledge that locking in a forward price acted as an incentive to lower variable costs of production (0.06). The one negative association for privately managed pool users was that they were less likely to take time and examine all aspects first when making decisions (0.09), relative to non-users.

There was one negative association regarding management characteristics for users of the National/export pool. Relative to non-users, they were less likely to need data and information before making decisions, and were less likely to analyze decisions (0.09).

6.3. Wheat marketing decision-making - risk attitude and adoption

Seventeen risk attitude and adoption characteristics were analysed against five different marketing methods using the Fisher Exact Test to test for significant differences between User versus Non-User of the particular marketing method. The five marketing methods were again the National/export pool (otherwise known as the Australian single-desk), storage, forward contract, cash sale at harvest, and private pool.

Table 6.3.1 indicates the seventeen questions in the survey that were relevant from a risk attitude and adoption perspective. The risk attitude characteristics included risk response psychology, management of risk, and how changes occurred to the risk profile of wheat growers making acreage/marketing/pricing decision-making. Adoption characteristics were largely formulated based on Rogers’ (1983) five major adoption categories - venturesome, follow quickly, deliberate, very reluctant, and major delays.

Table 6.3.1 indicates the seventeen questions in the survey that were relevant from a risk attitude and adoption perspective. The risk attitude characteristics included risk response psychology, management of risk, and how changes occurred to the risk profile of wheat growers making acreage/marketing/pricing decision-making. Adoption characteristics were largely formulated based on Rogers’ (1983) five major adoption categories - venturesome, follow quickly, deliberate, very reluctant, and major delays.

The number of Users and Non-Users of each marketing method are included at the top of each column. Fifteen N.S.W. growers used the National/export pool (38 percent), sixteen growers used storage (40 percent), seven growers (18 percent) used forward contracts, twenty-four growers (60 percent) used cash sales at harvest time, and five growers (13 percent) used private pools. Usage was mutually exclusive because many growers used more than one marketing method.
In Table 6.3.1, four growers who used the National/export pool (27 percent) were risk averse when the decision outcome was correct, but a risk taker when the decision outcome was incorrect. This contrasts with the ten growers (40 percent) who were risk averse when the decision outcome was correct, and a risk taker when the decision outcome was incorrect, but did not use the National/export pool.

Associations between the marketing method and particular risk attitude/adoptions characteristics were established by testing for significant difference between the User and Non-User of each marketing method for each risk attitude/adoptions question. If a significant difference occurred between Users of a particular marketing method and Non-Users for a particular attitude/adoptions question, then this indicated an association for that risk attitude/adoptions characteristic with the user of the particular marketing method.

A positive association occurred when the percentage of growers who used the marketing method agreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the marketing method. A negative association occurred when the percentage of growers who used the marketing method disagreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the marketing method.

The response of each User and Non-User of the marketing method towards each risk attitude and adoption question are summarized in Table 6.3.1.
Table 6.3.1. Marketing method and risk attitude/adoption decisions relating to acreage/marketing/pricing - NSW 2005

<table>
<thead>
<tr>
<th>Growers who agreed with the question on risk attitude/adoption decisions</th>
<th>Export pool</th>
<th>Storage</th>
<th>Marketing method</th>
<th>Cash Sale</th>
<th>Private Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of growers who used marketing strategy</td>
<td>Used 15</td>
<td>Non-used 25</td>
<td>Used 16</td>
<td>Non-used 24</td>
<td>Used 7</td>
</tr>
<tr>
<td>Q. 20. Risk averse when correct in decisions &amp; risk taker when incorrect in decisions</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Q. 21. Change risk profile depending on role in family, farm and business</td>
<td>7</td>
<td>18</td>
<td>13</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Q. 22. Attitude towards risk changes with production/marketing/price circumstance</td>
<td>11</td>
<td>20</td>
<td>12</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>Q. 36. Venturesome &amp; take innovative risks when new ideas have been perceived</td>
<td>6</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Q. 37. Follow quickly after innovators when new marketing/pricing ideas are perceived</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Q. 38. Deliberate before adopting a new marketing/pricing idea</td>
<td>9</td>
<td>19</td>
<td>11</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Q. 39. Very reluctant &amp; skeptical in adoption of new marketing/pricing ideas</td>
<td>1</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Q. 40. Major delays in adoption of new marketing/pricing ideas</td>
<td>1</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Q. 43. React to price movement rather than analyse scenarios in advance</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Q. 44. Hope for high final prices rather than take advantage of earlier good pricing</td>
<td>4</td>
<td>9</td>
<td>4</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Q. 45. Bad decisions in the past have led to regret/avoidance of repeating the decision</td>
<td>5</td>
<td>10</td>
<td>7</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Q. 46. Bad in the past have led to learning &amp; searching for more knowledge</td>
<td>10</td>
<td>21</td>
<td>12</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Q. 47. Bad decisions have led to greater challenges to do it differently next time</td>
<td>12</td>
<td>20</td>
<td>12</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Q. 49. Management of price risk was important to farm income</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Q. 51. Separating physical marketing from pricing/hedging is important</td>
<td>3</td>
<td>13</td>
<td>9</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Q. 53. Management of currency risk was important to farm income</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Q. 54. Management of basis risk was important to farm income</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>
The Fisher Exact Test results are indicated in Table 6.3.2. Nine risk attitude and adoption issues were significantly different at the P < 0.10 level between Users and Non-Users of four out of the five particular marketing methods. There were no significant differences between Users and Non-Users of private pools.

**Table 6.3.2. Risk issues relating to marketing methods: Fisher Exact Test results**

<table>
<thead>
<tr>
<th>Growers who agreed with the question (all questions on decisions related to acreage/marketing/pricing)</th>
<th>Fisher Exact Test P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing method</td>
<td>Export Pool</td>
</tr>
<tr>
<td>Q. 20. Risk averse when correct in decisions &amp; risk taker when incorrect in decisions</td>
<td>0.5</td>
</tr>
<tr>
<td>Q. 21. Change risk profile depending on role in family, farm and business</td>
<td>0.18</td>
</tr>
<tr>
<td>Q. 22. Attitude towards risk changes with production/marketing/price circumstance</td>
<td>0.7</td>
</tr>
<tr>
<td>Q. 36. Venturesome &amp; take innovative risks when new ideas have been perceived</td>
<td>1</td>
</tr>
<tr>
<td>Q. 37. Follow quickly after innovators when new marketing/pricing ideas are perceived</td>
<td>0.5</td>
</tr>
<tr>
<td>Q. 38. Deliberate before adopting a new marketing/pricing idea</td>
<td>0.3</td>
</tr>
<tr>
<td>Q. 39. Very reluctant &amp; skeptical in adoption of new marketing/pricing ideas</td>
<td>0.06</td>
</tr>
<tr>
<td>Q. 40. Major delays in adoption of new marketing/pricing ideas</td>
<td><strong>0.03</strong></td>
</tr>
<tr>
<td>Q. 43. React to price movement rather than analyse scenarios in advance</td>
<td>0.18</td>
</tr>
<tr>
<td>Q. 44. Hope for high final prices rather than take advantage of earlier good pricing</td>
<td>0.7</td>
</tr>
<tr>
<td>Q. 45. Bad decisions in the past have led to regret/avoidance of repeating the decision</td>
<td>0.7</td>
</tr>
<tr>
<td>Q. 46. Bad in the past have led to learning &amp; searching for more knowledge</td>
<td>0.2</td>
</tr>
<tr>
<td>Q. 47. Bad decisions have led to greater challenges to do it differently next time</td>
<td>1</td>
</tr>
<tr>
<td>Q. 49. Management of price risk was important to farm income</td>
<td>0.3</td>
</tr>
<tr>
<td>Q. 51. Separating physical marketing from pricing/hedging is important</td>
<td><strong>0.06</strong></td>
</tr>
<tr>
<td>Q. 53. Management of currency risk was important to farm income</td>
<td>0.7</td>
</tr>
<tr>
<td>Q. 54. Management of basis risk was important to farm income</td>
<td>0.5</td>
</tr>
</tbody>
</table>

(Note: The results with significant differences are highlighted in bold type.)

The positive and negative associations are summarised in Table 6.3.3 based on the relative percentage differences between users and non-users of the particular marketing method (Table 6.2.1). Positive associations reflect users of the particular marketing methods have a higher percentage agreement with the question than non-users. Negative associations reflect non-users of the particular marketing methods have a higher percentage agreement with the question than users.
Table 6.3.3. Summary of significance using the Fisher Exact Test: risk/adoption-marketing

<table>
<thead>
<tr>
<th>Question with significant difference</th>
<th>User-type</th>
<th>P value</th>
<th>Association</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.21. Change risk attitude depending on role in family, farm and business</td>
<td>Storage user</td>
<td>0.06</td>
<td>Positive</td>
<td>Storage users are more likely to change their risk attitude depending on role in family, farm and business, relative to non-users</td>
</tr>
<tr>
<td>Q.39. Very reluctant &amp; skeptical in adoption of new marketing/pricing ideas</td>
<td>National export pool user</td>
<td>0.06</td>
<td>Negative</td>
<td>National export pool users are less likely to be very reluctant &amp; skeptical in adoption of new marketing/pricing ideas, relative to non-users</td>
</tr>
<tr>
<td>Q.39. Very reluctant &amp; skeptical in adoption of new marketing/pricing ideas</td>
<td>Storage user</td>
<td>0.06</td>
<td>Positive</td>
<td>Storage users are more likely to be very reluctant &amp; skeptical in adoption of new marketing/pricing ideas, relative to non-users</td>
</tr>
<tr>
<td>Q.39. Very reluctant &amp; skeptical in adoption of new marketing/pricing ideas</td>
<td>Cash sale user</td>
<td>0.06</td>
<td>Negative</td>
<td>Cash sale users are less likely to be very reluctant &amp; skeptical in adoption of new marketing/pricing ideas, relative to non-users</td>
</tr>
<tr>
<td>Q.40. Major delays in adoption of new marketing/pricing ideas</td>
<td>National export pool user</td>
<td>0.03</td>
<td>Negative</td>
<td>National export pool users are less likely to experience major delays in adoption of new marketing/pricing ideas, relative to non-users</td>
</tr>
<tr>
<td>Q.44. Hope for high final prices rather than take advantage of earlier good pricing</td>
<td>Forward contract user</td>
<td>0.07</td>
<td>Negative</td>
<td>Forward contract users are less likely to hope for high final prices rather than take advantage of earlier good pricing, relative to non-users</td>
</tr>
<tr>
<td>Q.45. Bad decisions in the past have led to regret/avoidance of repeating the decision</td>
<td>Cash sale user</td>
<td>0.02</td>
<td>Negative</td>
<td>Cash sale users are less likely to have bad decisions in the past leading to regret/avoidance of repeating the decision, relative to non-users</td>
</tr>
<tr>
<td>Q.51. Separating physical marketing from pricing/hedging is important</td>
<td>National export pool user</td>
<td>0.06</td>
<td>Negative</td>
<td>National export pool users are less likely to acknowledge that separating physical marketing from pricing/hedging is important, relative to non-users</td>
</tr>
<tr>
<td>Q.54. Management of basis risk was important to farm income</td>
<td>Cash sale user</td>
<td>0.06</td>
<td>Negative</td>
<td>Cash sale users are less likely to acknowledge that management of basis risk was important to farm income, relative to non-users</td>
</tr>
</tbody>
</table>

There were two positive associations for storage users. Relative to non-users, they were more likely to change their risk attitude depending on role in family, farm, and business (0.06), and were more likely to be very reluctant and skeptical in the adoption of new marketing/pricing ideas (0.06).

The Fisher Exact Test detected three negative associations for users of the National/export pool. Relative to non-users, they were less reluctant or skeptical in the adoption of new ideas (0.06), they were less likely to experience major delays in the adoption of new ideas (0.03), and they
were less likely to acknowledge that separation of physical marketing from hedging was important (0.06).

There were some negative associations for users of cash sale at harvest and forward contracting. Relative to non-users, cash sale users were less likely to be very reluctant and skeptical in the adoption of new marketing/pricing ideas (0.06), less likely to have regret and avoidance about previous bad decisions (0.02), and less likely to acknowledge that the management of basis risk was important to farm income (0.06). Relative to non-users, forward contract users were less likely to hope for high final prices, but more likely to take advantage of earlier good pricing (0.07).

6.4. Wheat hedging/pricing decision-making - management

Eighteen management characteristics were analysed against six different hedging/pricing strategies using the Fisher Exact Test to test for significant differences between User versus Non-User of the particular hedging/pricing strategy. The six hedging/pricing strategies were based on the usage of futures brokers, merchants, bank pricing products, futures advisers, private pool managers, and no hedging/forward pricing.

Table 6.4.1 indicates the eighteen questions in the survey that were relevant from a managerial perspective. The management characteristics included how decisions were made, the level of emotional anxiety, responsibilities, personal attributes, and farm management practices of wheat growers making acreage, marketing, and pricing decision-making.

The number of Users (fully or partially) and Non-Users of each hedging/pricing strategy are included at the top of each column. Two N.S.W. growers (5 percent) used futures brokers, nine growers (23 percent) used merchants, eight growers (20 percent) used bank pricing products, six growers (15 percent) used futures advisers, one grower (3 percent) used a private pool manager, and twenty growers (50 percent) did not hedge or forward price. Again, usage was mutually exclusive because some growers used more than one pricing method.
The response of each User and Non-User of the hedging/pricing strategy towards each management question are summarized in Table 6.4.1. One grower who used a futures broker (50 percent) made acreage/marketing/pricing decisions alone. This contrasts with the sixteen growers (42 percent) who made decisions alone but did not use a futures broker.

Associations between the hedging/pricing strategies and particular management characteristics were established by testing for significant difference between the User and Non-User of each hedging/pricing strategy for each management question. If a significant difference occurred between Users of a particular hedging/pricing strategy and Non-Users for a particular management question, then this indicated an association for that management characteristic with the user of the particular pricing/hedging strategy.

A positive association occurred when the percentage of growers who used the pricing/hedging strategy agreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the pricing/hedging strategy. A negative association occurred when the percentage of growers who used the pricing/hedging strategy disagreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the pricing/hedging strategy.
<table>
<thead>
<tr>
<th>Growers who agreed with the question on management decisions</th>
<th>Hedging/pricing strategy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of growers who used hedging/pricing strategy</td>
<td>Used futures broker</td>
<td>Used merchant</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>--------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Used</td>
<td>Non-used</td>
<td>Used</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>9</td>
</tr>
<tr>
<td>Q. 25. Make acreage/marketing/pricing decisions alone</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Q. 26. Make acreage/marketing/pricing decisions with business partner</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Q. 27. Make acreage/marketing/pricing decisions with external adviser</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Q. 28. External adviser is important when making decisions</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Q. 29. Make decisions in an orderly, structured and organized approach</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>Q. 30. Make decisions spontaneously, taking risk &amp; being flexible</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Q. 31. Take time &amp; examine all aspects of when making decisions</td>
<td>1</td>
<td>29</td>
</tr>
<tr>
<td>Q. 32. Need data/information, and analyse before making decisions</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>Q. 33. Experience emotional anxiety when making decisions</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Q. 34. My acreage/marketing/pricing decisions are my responsibility</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>Q. 35. My decisions are the responsibility of other people</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Q. 41. Age influences acreage, marketing/pricing decisions</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Q. 42. Farming experience influences acreage, marketing/pricing decisions</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>Q. 48. More training would have contributed to a better performance</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Q. 58. Locking in a forward price acts as incentive to lower variable costs</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Q. 59. Knowledge of variable costs leads to using price risk management to lock in a profit</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Q. 60. Target more realistic price levels when there are known variable costs of production</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Q. 61. Targeted wheat price was realistic</td>
<td>1</td>
<td>24</td>
</tr>
</tbody>
</table>
Four management issues were significantly different at the P < 0.10 level between Users and Non-Users of three out of the six particular hedging/pricing methods using the Fisher Exact Test. There were no significant differences between Users and Non-users of futures brokers, merchants, and private pools. The results are indicated in Table 6.4.2.

**Table 6.4.2. Hedging strategies and management decisions: Fisher Exact Test results**

| Growers who agreed with the question (all questions on decisions related to acreage/marketing/pricing) | Fisher Exact Test P values |
|---|---|---|---|---|---|
| | Futures broker | Merchant | Bank | Futures adviser | Private pool | No hedge/forward pricing |
| Q. 25. Make acreage/marketing/pricing decisions alone | 1 | 1 | 1 | 0.4 | 1 | 0.523 |
| Q. 26. Make acreage/marketing/pricing decisions with business partner | 0.5 | 0.5 | 0.7 | 0.7 | 1 | 0.752 |
| Q. 27. Make acreage/marketing/pricing decisions with external adviser | 1 | 0.5 | 0.7 | 0.18 | 1 | 0.752 |
| Q. 28. External adviser is important when making decisions | 0.12 | 0.7 | **0.001** | 0.0008 | 1 | **0.006** |
| Q. 29. Make decisions in an orderly, structured and organized approach | 1 | 1 | 1 | 0.7 | 0.4 | 1 |
| Q. 30. Make decisions spontaneously, taking risk & being flexible | 0.4 | 0.7 | 0.4 | 0.6 | 0.2 | 1 |
| Q. 31. Take time & examine all aspects of when making decisions | 0.4 | 0.7 | 0.7 | 0.6 | 0.2 | 1 |
| Q. 32. Need data/information, and analyse before making decisions | 1 | 0.7 | **0.08** | 0.15 | 0.3 | **0.082** |
| Q. 33. Experience emotional anxiety when making decisions | 0.5 | 0.5 | 0.4 | 1 | 1 | 0.751 |
| Q. 34. My acreage/marketing/pricing decisions are my responsibility | 1 | 1 | 0.5 | 1 | 1 | 1 |
| Q. 35. My decisions are the responsibility of other people | 1 | 1 | 0.4 | 1 | 1 | 1 |
| Q. 41. Age influences acreage, marketing/pricing decisions | 0.5 | 1 | 0.2 | 1 | 1 | 0.105 |
| Q. 42. Farming experience influences acreage, marketing/pricing decisions | 0.3 | 0.6 | 0.6 | 1 | 1 | 0.661 |
| Q. 48. More training would have contributed to a better performance | 0.17 | 0.5 | 0.2 | **0.07** | 1 | **0.054** |
| Q. 58. Locking in a forward price acts as incentive to lower variable costs | 0.5 | 1 | 1 | 0.7 | 0.4 | 0.514 |
| Q. 59. Knowledge of variable costs leads to using price risk management to lock in a profit | 1 | 0.7 | 0.4 | 0.4 | 1 | 0.751 |
| Q. 60. Target more realistic price levels when there are known variable costs of production | 1 | 1 | 0.2 | 0.7 | 1 | 0.527 |
| Q. 61. Targeted wheat price was realistic | 1 | 1 | **0.02** | 0.4 | 0.5 | **0.048** |

(Note: The results with significant differences are highlighted in bold type.)

The positive and negative associations are summarised in Table 6.4.3 based on the relative percentage differences between users and non-users of the particular hedging/pricing strategy (Table 6.4.1). Positive associations reflect users of the particular hedging/pricing strategy have a higher percentage agreement with the question than non-users. Negative associations reflect non-users of the particular hedging/pricing strategy have a higher percentage agreement with the question than users.
Table 6.4.3. Summary of significance using the Fisher Exact Test: management-hedging

<table>
<thead>
<tr>
<th>Question with significant difference</th>
<th>User-type</th>
<th>P value</th>
<th>Association</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q. 28. External adviser is important when making decisions</td>
<td>Bank product user</td>
<td>0.001</td>
<td>Positive</td>
<td>Bank product users are more likely to acknowledge that an external adviser is important when making decisions, relative to non-users</td>
</tr>
<tr>
<td>Q. 28. External adviser is important when making decisions</td>
<td>Futures adviser user</td>
<td>0.0008</td>
<td>Positive</td>
<td>Futures adviser users are more likely to acknowledge that an external adviser is important when making decisions, relative to non-users</td>
</tr>
<tr>
<td>Q. 28. External adviser is important when making decisions</td>
<td>User of no hedge/forward pricing</td>
<td>0.006</td>
<td>Negative</td>
<td>Users of no hedge/forward pricing are less likely to acknowledge that an external adviser is important when making decisions, relative to non-users</td>
</tr>
<tr>
<td>Q. 32. Need data/information, &amp; analyze before making decisions</td>
<td>Bank product user</td>
<td>0.08</td>
<td>Positive</td>
<td>Bank product users are more likely to acknowledge that they need data/information, &amp; analyze before making decisions, relative to non-users</td>
</tr>
<tr>
<td>Q. 32. Need data/information, &amp; analyze before making decisions</td>
<td>User of no hedge/forward pricing</td>
<td>0.082</td>
<td>Negative</td>
<td>Users of no hedge/forward pricing are less likely to need data/information, &amp; analyze before making decisions, relative to non-users</td>
</tr>
<tr>
<td>Q. 48. More training would have contributed to a better performance</td>
<td>Futures adviser user</td>
<td>0.07</td>
<td>Positive</td>
<td>Futures adviser users are more likely to acknowledge that more training would have contributed to a better performance, relative to non-users</td>
</tr>
<tr>
<td>Q. 48. More training would have contributed to a better performance</td>
<td>User of no hedge/forward pricing</td>
<td>0.054</td>
<td>Negative</td>
<td>Users of no hedge/forward pricing are less likely to acknowledge that more training would have contributed to a better performance, relative to non-users</td>
</tr>
<tr>
<td>Q. 61. Targeted wheat price was realistic</td>
<td>Bank product user</td>
<td>0.02</td>
<td>Positive</td>
<td>Bank product users are more likely to acknowledge that their targeted wheat price was realistic, relative to non-users</td>
</tr>
<tr>
<td>Q. 61. Targeted wheat price was realistic</td>
<td>User of no hedge/forward pricing</td>
<td>0.048</td>
<td>Negative</td>
<td>Users of no hedge/forward pricing are less likely to acknowledge that their targeted wheat price was realistic, relative to non-users</td>
</tr>
</tbody>
</table>

There were three positive associations for users of bank pricing products. Relative to non-users, they were more likely to perceive an external adviser as being important when making decisions (0.001), more likely to need data/information and analyse decisions beforehand (0.08), and were more likely to achieve a realistic target price (0.02).
Two positive associations were found for users of futures advisers. Relative to non-users, users of futures advisers were more likely to perceive an external adviser as being important when making decisions (0.0008), and more likely to acknowledge that more training would have contributed to a better performance (0.07).

There were four negative associations for those growers who did not hedge/forward price. Relative to those who did hedge/forward price, they were less likely to acknowledge that an external adviser was important when making hedging/pricing decisions (0.006), less likely to acknowledge a need for data/information or to analyse decisions (0.082), less likely to acknowledge that training would have contributed to a better performance (0.054), and less likely to acknowledge that their target price was realistic (0.048).

6.5. Wheat hedging/pricing decision-making - risk attitude and adoption

Seventeen risk attitude and adoption characteristics were analysed against six hedging/pricing strategies using the Fisher Exact Test to test for significant differences between User versus Non-User of the particular hedging/forward pricing method. The six hedging/pricing strategies were based on the usage of futures brokers, merchants, bank-pricing products, futures advisers, private pool managers, and no hedging/forward pricing.

Table 6.5.1 indicates the seventeen questions in the survey that were relevant from a risk attitude and adoption perspective. The risk attitude characteristics included risk response psychology, management of risk, and how changes occurred to the risk profile of wheat growers making acreage/marketing/pricing decision-making. Adoption characteristics were largely chosen based on Rogers’ (1983) five major adoption categories - venturesome, follow quickly, deliberate, very reluctant, and major delays.

The number of Users and Non-Users of each hedging/pricing method are included at the top of each column. Two N.S.W. growers (5 percent) used futures brokers, nine growers (23 percent) used merchants, eight growers (20 percent) used bank pricing products, six growers (15 percent)
used futures advisers, one grower (3 percent) used a private pool manager, and twenty growers (50 percent) did not hedge/forward price.

The response of each User and Non-User of the hedging/pricing method towards each risk attitude and adoption question are summarized in Table 6.5.1. One grower (50 percent) who used a futures broker was risk averse when the decision outcome was correct, but a risk taker when the decision outcome was incorrect. This contrasts with the thirteen growers (34 percent) who were risk averse when the decision outcome was correct, and a risk taker when the decision outcome was incorrect, but did not use a futures broker.

Associations between the hedging/pricing strategy and particular risk attitude/adoption characteristics were established by testing for significant difference between the User and Non-User of each hedging/pricing strategy for each risk attitude/adoption question. If a significant difference occurred between Users of a particular hedging/pricing strategy and Non-Users for a particular attitude/adoption question, then this indicated an association for that risk attitude/adoption characteristic with the user of the particular hedging/pricing strategy.
Table 6.5.1. Hedging/pricing strategies and risk attitude/adoption decisions relating to acreage/marketing/pricing - NSW 2005

<table>
<thead>
<tr>
<th>Growers who agreed with the question on risk attitude/adoption decisions</th>
<th>Hedging/pricing strategy</th>
<th>Used futures broker</th>
<th>Used merchant</th>
<th>Used bank</th>
<th>Used futures adviser</th>
<th>Used private pool manager</th>
<th>No hedge/forward price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of growers who used hedging/pricing strategy</td>
<td>Used</td>
<td>Non-used</td>
<td>Used</td>
<td>Non-used</td>
<td>Used</td>
<td>Non-used</td>
<td>Used</td>
</tr>
<tr>
<td>Q. 20. Risk averse when making correct decisions &amp; risk taker when making incorrect decisions</td>
<td>1</td>
<td>13</td>
<td>4</td>
<td>10</td>
<td>3</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Q. 21. Change risk attitude depending on role in family, farm and business</td>
<td>2</td>
<td>23</td>
<td>7</td>
<td>18</td>
<td>7</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Q. 22. Attitude towards risk changes with production/marketing/price circumstance</td>
<td>2</td>
<td>29</td>
<td>6</td>
<td>25</td>
<td>8</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>Q. 36. Venturesome and take innovative risks when new ideas have been perceived</td>
<td>1</td>
<td>14</td>
<td>4</td>
<td>11</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Q. 37. Follow quickly after innovators when new marketing/pricing ideas are perceived</td>
<td>1</td>
<td>15</td>
<td>4</td>
<td>12</td>
<td>5</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Q. 38. Deliberate before adopting a new marketing/pricing idea</td>
<td>1</td>
<td>27</td>
<td>5</td>
<td>23</td>
<td>5</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>Q. 39. Very reluctant &amp; skeptical in adoption of new marketing/pricing ideas</td>
<td>0</td>
<td>19</td>
<td>1</td>
<td>9</td>
<td>0</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Q. 40. Major delays in adoption of new marketing/pricing ideas</td>
<td>0</td>
<td>11</td>
<td>1</td>
<td>10</td>
<td>0</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Q. 43. React to price movement rather than analyse scenarios in advance</td>
<td>0</td>
<td>17</td>
<td>5</td>
<td>12</td>
<td>4</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Q. 44. Hope for high final prices rather than take advantage of earlier good pricing</td>
<td>0</td>
<td>13</td>
<td>1</td>
<td>12</td>
<td>2</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Q. 45. Bad decisions in the past have led to regret and avoidance of repeating the decision</td>
<td>1</td>
<td>14</td>
<td>4</td>
<td>11</td>
<td>1</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Q. 46. Bad decisions in the past have led to learning &amp; searching for more knowledge</td>
<td>2</td>
<td>29</td>
<td>8</td>
<td>23</td>
<td>7</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Q. 47. Bad decisions have led to greater challenges to do it differently next time</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>24</td>
<td>7</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td>Q. 49. Management of price risk was important to farm income</td>
<td>1</td>
<td>16</td>
<td>4</td>
<td>13</td>
<td>4</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Q. 51. Separating physical marketing from pricing/hedging is important</td>
<td>2</td>
<td>14</td>
<td>3</td>
<td>13</td>
<td>6</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Q. 53. Management of currency risk was important to farm income</td>
<td>1</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Q. 54. Management of basis risk was important to farm income</td>
<td>0</td>
<td>10</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>
Eleven risk attitude/adoption issues were significantly different at the P < 0.10 level between Users and Non-Users of four out of the six particular hedging/pricing methods using the Fisher Exact Test. There were no significant differences between Users and Non-Users of futures brokers and private pools. The results are indicated in Table 6.5.2.

Table 6.5.2. Risk attitude/adoption issues relating to pricing strategies: Fisher Test results

<table>
<thead>
<tr>
<th>Growers who agreed with the question</th>
<th>Fisher Exact Test P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>(all questions on decisions related to acreage/marketing/pricing)</td>
<td>Futures broker</td>
</tr>
<tr>
<td>Q. 20. Risk averse when correct in decisions &amp; risk taker when incorrect in decisions</td>
<td>1</td>
</tr>
<tr>
<td>Q. 21. Change risk profile depending on role in family, farm and business</td>
<td>0.5</td>
</tr>
<tr>
<td>Q. 22. Attitude towards risk changes with production/marketing/price circumstance</td>
<td>1</td>
</tr>
<tr>
<td>Q. 36. Venturesome &amp; take innovative risks when new ideas have been perceived</td>
<td>1</td>
</tr>
<tr>
<td>Q. 37. Follow quickly after innovators when new marketing/pricing ideas are perceived</td>
<td>1</td>
</tr>
<tr>
<td>Q. 38. Deliberate before adopting a new marketing/pricing idea</td>
<td>0.5</td>
</tr>
<tr>
<td>Q. 39. Very reluctant &amp; skeptical in adoption of new marketing/pricing ideas</td>
<td>1</td>
</tr>
<tr>
<td>Q. 40. Major delays in adoption of new marketing/pricing ideas</td>
<td>1</td>
</tr>
<tr>
<td>Q. 43. React to price movement rather than analyse scenarios in advance</td>
<td>0.5</td>
</tr>
<tr>
<td>Q. 44. Hope for high final prices rather than take advantage of earlier good pricing</td>
<td>1</td>
</tr>
<tr>
<td>Q. 45. Bad decisions in the past have led to regret/avoidance of repeating the decision</td>
<td>1</td>
</tr>
<tr>
<td>Q. 46. Bad in the past have led to learning &amp; searching for more knowledge</td>
<td>1</td>
</tr>
<tr>
<td>Q. 47. Bad decisions have led to greater challenges to do it differently next time</td>
<td>1</td>
</tr>
<tr>
<td>Q. 49. Management of price risk was important to farm income</td>
<td>1</td>
</tr>
<tr>
<td>Q. 51. Separating physical marketing from pricing/hedging is important</td>
<td>0.15</td>
</tr>
<tr>
<td>Q. 53. Management of currency risk was important to farm income</td>
<td>0.4</td>
</tr>
<tr>
<td>Q. 54. Management of basis risk was important to farm income</td>
<td>1</td>
</tr>
</tbody>
</table>

(Note: The results with significant differences are highlighted in bold type.)

The positive and negative associations are summarised in Table 6.5.3 based on the relative percentage differences between users and non-users of the particular hedging/pricing strategy (Table 6.5.1). Positive associations reflect users of the particular hedging/pricing strategy have a higher percentage agreement with the question than non-users. Negative associations reflect non-users of the particular hedging/pricing strategy have a higher percentage agreement with the question than users.
<table>
<thead>
<tr>
<th>Question with significant difference</th>
<th>User-type</th>
<th>P value</th>
<th>Association</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.20. Risk averse in correct decisions &amp; risk taker in incorrect decisions</td>
<td>User of no hedge/forward pricing</td>
<td>0.096</td>
<td>Negative</td>
<td>Users of no hedge/forward pricing are less likely to be risk averse in correct decisions &amp; risk takers in incorrect decisions, relative to non-users</td>
</tr>
<tr>
<td>Q.21. Change risk attitude depending on role in family, farm and business</td>
<td>Futures adviser user</td>
<td>0.07</td>
<td>Positive</td>
<td>Futures adviser users are more likely to change their risk attitude depending on their role in family, farm and business, relative to non-users</td>
</tr>
<tr>
<td>Q.21. Change risk attitude depending on role in family, farm and business</td>
<td>User of no hedge/forward pricing</td>
<td>0.048</td>
<td>Negative</td>
<td>Users of no hedge/forward pricing are less likely to change their risk attitude depending on role in family, farm and business, relative to non-users</td>
</tr>
<tr>
<td>Q.36. Venturesome &amp; take innovative risks when new ideas perceived</td>
<td>Futures adviser user</td>
<td>0.02</td>
<td>Positive</td>
<td>Futures adviser users are more likely to be venturesome &amp; take innovative risks when new ideas are perceived, relative to non-users</td>
</tr>
<tr>
<td>Q.36. Venturesome &amp; take innovative risks when new ideas perceived</td>
<td>User of no hedge/forward pricing</td>
<td>0.048</td>
<td>Negative</td>
<td>User of no hedge/forward pricing are less likely to be venturesome &amp; take innovative risks when new ideas perceived, relative to non-users</td>
</tr>
<tr>
<td>Q.39. Very reluctant/skeptical in adoption of new marketing/pricing ideas</td>
<td>User of no hedge/forward pricing</td>
<td>0.065</td>
<td>Positive</td>
<td>Users of no hedge/forward pricing are more likely to be very reluctant/skeptical in adoption of new marketing/pricing ideas, relative to non-users</td>
</tr>
<tr>
<td>Q.40. Major delays in adoption of new marketing/pricing ideas</td>
<td>Bank product user</td>
<td>0.08</td>
<td>Negative</td>
<td>Bank product users are less likely to experience major delays in adoption of new marketing/pricing ideas, relative to non-users</td>
</tr>
<tr>
<td>Q.40. Major delays in adoption of new marketing/pricing ideas</td>
<td>User of no hedge/forward pricing</td>
<td>0.031</td>
<td>Positive</td>
<td>Users of no hedge/forward pricing are more likely to experience major delays in adoption of new marketing/pricing ideas, relative to non-users</td>
</tr>
<tr>
<td>Q.51. Separating physical marketing from pricing/hedging is important</td>
<td>Bank product user</td>
<td>0.04</td>
<td>Positive</td>
<td>Bank product users are more likely to acknowledge that separating physical marketing from pricing/hedging is important, relative to non-users</td>
</tr>
<tr>
<td>Q.51. Separating physical marketing from pricing/hedging is important</td>
<td>Futures adviser user</td>
<td>0.03</td>
<td>Positive</td>
<td>Futures adviser users are more likely to acknowledge that separating physical marketing from pricing/hedging is important, relative to non-users</td>
</tr>
<tr>
<td>Q.53. Management of currency risk was important to farm income</td>
<td>User of merchants</td>
<td>0.03</td>
<td>Positive</td>
<td>Users of merchants are more likely to acknowledge that the management of currency risk was important to farm income, relative to non-users</td>
</tr>
</tbody>
</table>
Positive associations reflect users of the particular hedging/pricing strategy have a higher percentage agreement with the question than non-users. Negative associations reflect non-users of the particular hedging/pricing strategy have a higher percentage agreement with the question than users.

A positive association occurred when the percentage of growers who used the pricing/hedging strategy agreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the pricing/hedging strategy. A negative association occurred when the percentage of growers who used the pricing/hedging strategy disagreed with the survey question significantly more (as determined by the Fisher Exact Test) than the percentage of growers who did not use the pricing/hedging strategy.

There was one positive association for users of merchants regarding hedging/forward pricing. Relative to non-users, they were more likely to agree that the management of currency was important to farm income (0.03).

One positive association was found for users of bank pricing products. Relative to non-users, they were more likely to perceive importance in separating physical marketing from hedging/pricing (0.04). The one negative association was that users of bank pricing products were less likely to have major delays when adopting new ideas (0.08), relative to non-users.

Users of futures advisers had three positive associations. Relative to non-users, they were more likely to change their risk profile depending on their role in family, farm, and business (0.07); they were more likely to be venturesome and take risks when new ideas had been perceived (0.02); and more likely to acknowledge that the separation of physical marketing from pricing was important (0.03).

Two positive associations were found for those growers who did not hedge/forward price, but these were for negatively framed questions. Relative to those growers that hedged, non-hedgers were more likely to be very reluctant and skeptical in the adoption of new ideas (0.065), and more likely to incur major delays in the adoption of new ideas (0.031).
There were three negative associations for those growers who did not hedge/forward price. Relative to non-users, they were less likely to acknowledge that they changed their risk attitude depending on the outcome of decisions (0.096) or their role in family/farm/business (0.048), and were less likely to acknowledge that they were venturesome or took innovative risks when new ideas had been perceived (0.048).
7. ELABORATION OF RESULTS TO RESEARCH QUESTIONS

Significant differences between NSW Users and Non-Users of the five main marketing methods and six main hedging/pricing strategies were identified over a range of eighteen management factors and seventeen risk attitude/adoption characteristics from the Main Study. The findings are summarized in Tables 6.2.3., 6.3.3, 6.4.3, and 6.5.3.

The alignment of each research question with the Fisher Exact Test and the relevant survey question was summarized in Table 6.1.1. Each of the eight research questions were individually tested using the Fisher Exact Test.

To generalize the NSW Main Study results for all regions of Australia could be invalid because of major differences in climate, weather, topography, demographic, farm enterprise mix, farm size, age, risk attitude/behaviour between the regions. Therefore, there was a need to compare the NSW findings with other regions of Australia to test the validity of the outcomes.

The findings of the Victorian Pilot Study did have relevance to some of the research questions. Wherever applicable, the research questions were evaluated against the outcomes from the Pilot Study as well as the Main Study.

To add depth to the evaluation of the research questions, follow-up questionnaires using the same 2005 survey were conducted in South Australia (20 growers in the Upper Yorke Peninsular in September 2007) and Victoria (five growers in the Wimmera/Mallee in March 2008). Because the Wimmera/Mallee growers had difficulty in recalling decisions made in 2005, the decision was made not to pursue any further grower surveys during 2008. The ideal in terms of statistical numbers was not achieved, however inter-regional comparisons added depth to the findings, which would have been absent if these other regional surveys had not been conducted.

The Upper Yorke Peninsula of South Australia was characterized by specialized medium sized wheat growers with little end-usage activity in the surrounding region, while the
The Wimmera/Mallee district of Victoria was characterized by diversified small sized wheat growers with some end-usage activity in the surrounding region. All follow-up surveys remained focused on the 2005 year to avoid major annual variations which might have affected the survey responses.

No suitable statistical analysis could be applied to test for significant differences for variables between the three diverse geographical regions. The complexity of examining many independent variables over three locations with small sample sizes with data that was non-continuous and unequally distributed prevented tests for significant difference. The comparative analytical approach was the most suitable under the complex circumstances.

The Likert Scale survey results were again compressed for the comparative analysis for Research Questions 1 - 7. However, there was a need to examine the results more closely in Research Question 8, and the Likert scale results were re-examined by reverting back to the original non-compressed results.

7.1. Research Question One

*Does the management approach to decision-making affect a wheat grower's choice of marketing method or hedging/pricing strategy?*

It is hypothesized that the wheat grower’s management approach does influence the choice of marketing method or hedging/pricing strategy. The hypothesis will be examined using a number of methods including the Pilot Study, Main Study, comparative studies, and the Fisher Exact Test.

**Management and marketing - Pilot Study**

The Pilot Survey conducted in the Wimmera/Mallee district of Victoria was an important prerequisite in formulating the management questions in the Main Survey. Results from the 51 survey respondents were based on the 2005 year, which met time validity, and they did have relevance to the research question.
Wheat growers responded in the Victorian Pilot Survey (2005) to a specific question on the reasons for using each marketing method. The results have been tabulated in Table 7.1.1 against the five most common marketing methods indicated by growers - National/export pool, cash sale at harvest, store/warehouse, private pooling, and forward contracting.

Table 7.1.1. Reasons for using marketing methods for Victorian growers - 2005 (Pilot)

<table>
<thead>
<tr>
<th>Reasons for using wheat marketing method</th>
<th>National/ export pool %</th>
<th>Cash Sale at harvest %</th>
<th>Store/warehouse %</th>
<th>Private Pool ** %</th>
<th>Forward Contract %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of total growers who used the marketing method</td>
<td>69</td>
<td>63</td>
<td>75</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Insufficient storage facilities</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Transport, storage, marketing cost</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Seed or feed</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Best price for higher grades</td>
<td>5</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Speculative price rise benefits</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hope for better price</td>
<td>18</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cash flow needs/pay off over-draft</td>
<td>18</td>
<td>73</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Confidence in method, less worries</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lack confidence/trust in other methods</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Price averaging/risk spreading</td>
<td>18</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Business/planning decision</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Cover production costs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Early pricing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Less cost</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Provided time to think</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lower quality</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Better coordination at harvest time</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Last resort</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Best advice received</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Achieve ‘fair’ price</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Consistently ‘good’ price</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flexibility</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: John Williams, Pilot Survey (2005)

* Mutual exclusive - many growers used more than one marketing method and provided more than one reason for using each method

** Growers using private pools did not provide any reasons for using the method.

Note: Percentages refer to those growers who used the particular marketing method and who provided the particular reason for using the marketing method.
Apart from the 73 percent of Victorian wheat growers who used cash sales at harvest time to meet cash flow needs, the Pilot Survey (2005) found that there were few major reasons from a management perspective for Victorian wheat growers to use a particular marketing method. This overall low and inadequate response was the main reason why this line of major questioning was discontinued in the Main Survey.

Table 7.1.1 indicated that apart from cash flow needs, wheat growers used cash sales at harvest to achieve the best price for higher grades (14 percent), or lacked confidence/trust in other marketing methods (5 percent). Both indicated that growers who used cash sales at harvest did so because of performance and psychology, rather than as last-resort selling during harvest time.

The Pilot Survey (2005) found that 18 percent of wheat growers in Victoria who used the National/export pool cited hope for a better price, cash flow, and averaging (risk spreading) as the main reasons for using the method. Confidence in the marketing method and less worries (14 percent), best price for higher grades (5 percent), and consistently ‘good’ price (9 percent) and ‘fair’ price (5 percent) were other positive attributes. Growers used the National/export pool if there were insufficient storage facilities (9 percent), if they lacked confidence/trust in other marketing methods (5 percent), if it was the best advice received (5 percent), if they had lower quality (5 percent), or used it as a last resort (5 percent).

The Pilot Survey (2005) found that wheat growers who stored/warehoused often expected (30 percent) or hoped (4 percent) for speculative price rise benefits, while 17 percent indicated that storage had price averaging or risk spreading benefits. Storage was sometimes used for seed or feed purposes (13 percent), or to provide growers with the time to think about marketing method selection (13 percent). A few storage users (4 percent) perceived positive benefits through more control, less cost (transport, storage, and marketing), and the provision of flexibility. Others indicated that storage provided better coordination at harvest time (9 percent), while 4 percent used storage when they had lower quality wheat.

Table 7.1.1 indicated that 25 percent of Victorian wheat growers who used forward contracts indicated early pricing and business planning benefits, with the same percentage indicating that
they used forward contracting to cover their cost of production. These forward contract users were the only growers to associate a particular marketing method with business planning decision-making. This association did not occur for any other marketing method (except for 2 percent of surveyed storage users).

**Management and marketing - Fisher Exact Test**

The Fisher Exact Test examined significant differences between users and non-users of marketing methods for eleven of the Main Survey questions (Q. 25 - 35) that related to different management approaches. In contrast with the Pilot Study, the Main Study focused on direct management questions. From these questions, four areas of significant difference were identified for marketing methods (Table 6.2.2).

The Fisher Exact Test (Table 6.2.3) found that NSW users of the National/export pool were less likely to need data and information (P = 0.09), and less likely to analyse strengths and weaknesses of alternate marketing methods before making decisions (P = 0.09). This is consistent with the theory that growers use pools because of simplicity and the transference of selling responsibilities to a selling agent. It is also consistent with the research question.

There were no significant differences between users and non-users of cash sales at harvest in the P-test values. Because there was no specific question in the Main Study on the need for cash flow in management, the Fisher Exact Test did not add to the Pilot Study findings that users of cash sales at harvest needed cash flow at that time. In this case, the need for cash flow dictated the management approach, and this management approach led to using cash sales at harvest. Again, the research question could be upheld.

Storage users were found to be more likely to make decisions alone (P = 0.5), and more likely to make decisions spontaneously, taking risk and being flexible (P = 0.06). These management characteristics (alone, spontaneous, risk-taking, and flexibility) might be aligned with the general classification of speculators. This supposition was supported in the Pilot Study (2005) with 30 percent of storage users using storage for price speculation. If price speculation can be
categorized as a management approach, then the desire for price speculation led many growers to use storage. Based on this categorization, the research question can be upheld.

The Pilot Study (2005) found that 25 percent of Victorian wheat growers used forward contracts for business planning, to cover their cost of production, and for early pricing benefits. The Fisher Exact Test on NSW growers did not add to these findings from a management perspective, with no significant differences between users and non-users of forward contracts over a range of management factors. However, the questioning on forward contracts in the Main Study was not as direct as in the Pilot Study. Given these research limitations, the results might suggest that a management approach that involved planning, covering costs, and early pricing might lead to choosing forward contracting as a marketing method. This would uphold the research question.

Whilst the Pilot Survey (2005) indicated no major reasons why wheat growers use private pools, the Fisher Exact Test identified one negative association between users and non-users of private pools that related directly to a management approach. Users of privately managed pools in NSW were less likely to take time and examine all aspects first before making decisions (P = 0.09). This finding was consistent with the theory that wheat growers choose to appoint a private pool manager to pass responsibility for marketing to an external manager. For users to allocate external responsibility and then to undertake the decision-making themselves might be considered unnecessary duplication. If not wanting to take time and examine all aspects first is considered a management approach, then this approach can be deduced as leading to the appointment of an external pool manager. The research question is upheld.

**Management and hedging/pricing - comparative studies**

The percentages of wheat growers who hedged are summarised by State in Table 7.1.2 which compared the Main Study results with those in South Australia and Victoria. South Australian wheat growers were slightly less likely to hedge 100 percent of the wheat crop compared to NSW and Victorian growers, but otherwise, the hedging ratios (amount hedged to estimated total production) were comparable.
Table 7.1.2. Wheat growers who hedged by State - 2005

<table>
<thead>
<tr>
<th>Hedging activity</th>
<th>N.S.W. %</th>
<th>South Australia %</th>
<th>Victoria %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growers who 100% hedged</td>
<td>22</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Growers who part hedged</td>
<td>28</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total growers who hedged</strong></td>
<td><strong>50</strong></td>
<td><strong>35</strong></td>
<td><strong>40</strong></td>
</tr>
<tr>
<td>Growers who did no hedging</td>
<td>50</td>
<td>65</td>
<td>60</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Survey and comparative SA and Victorian surveys (2005)

There were more NSW wheat growers who hedged 100 percent of their crop (22 percent) compared to South Australia (15 percent) and Victoria (20 percent), and more NSW growers who had part of their crop hedged (28 percent compared to 20 percent for both South Australia and Victoria). More wheat growers in NSW (50 percent) were likely to hedge compared to either South Australia (35 percent) or Victoria (40 percent). These results are depicted in Figure 7.1.2.

**Figure 7.1.2. Wheat growers and their hedging percentages by State - 2005**

There may have been some subjective determination by surveyed growers as to the interpretation of ‘hedging’. Some growers who forward contracted in their marketing method might not have understood that this also should have been included under price hedging. This might have caused the hedge ratios to be understated, given that forward contracting may have been excluded from hedging by some survey respondents.

Under part hedging, the results do not distinguish between those growers who hedged less than 50 percent, and growers who might have hedged more than 50 percent. If there were many more
growers below 50 percent compared to growers above 50 percent, this might indicate that the hedge ratios are overstated.

**Management and hedging/pricing - Fisher Exact Test**

The Fisher Exact Test examined significant differences between users and non-users of hedging/pricing strategies for eleven of the Main Survey questions (Q. 25 - 35) that related to different management approaches. From these questions, five areas of significant difference were identified (Table 6.2.2).

In relation to the management approach to hedging/pricing decision-making, NSW users of bank pricing products were more likely to acknowledge that an external adviser was important when making decisions (P = 0.001). This P-value was expected because of the mandatory signature by an external adviser that is required before a grower can use the bank pricing product.

Users of bank pricing products in NSW were more likely to need data and information before making decisions and to analyze strengths and weaknesses of each pricing method (P = 0.08). This contrasts with the analysis of users of marketing methods which found that there was no positive association between users and non-users regarding the requirement for data, information, or analysis of strengths and weaknesses before making a decision.

The research issue is did the management approach that required data, information, and analysis before making a decision lead directly to usage of bank pricing products, or did the desire to use bank pricing products lead to the requirement for data, information, and analysis. If a price risk was perceived, and if bank pricing products were chosen as the preferred hedging/pricing strategy, then it might be presumed that the risks associated with some bank pricing products (such as grower settlement payout for swaps when prices rise above the swap price) would lead to the grower requiring data, information, and analysis before making a decision. The research question would not be upheld in this situation.

Users of futures advisers in NSW were more likely to acknowledge that an external adviser was important when making decisions (P = 0.0008). This question was tautological (futures advisers
are external advisers), but it did test for consistency in the survey questioning (it resulted in an extremely small P-value).

In contrast, growers who did not hedge/price were unlikely to consider an external adviser important (P = 0.006), and were unlikely to perceive the need for data, information, and analysis of strengths and weaknesses (P = 0.082). The question is whether this can be considered as a particular management approach and did it lead to a decision not to hedge/price, or did the decision not to hedge lead to the perception that an external adviser was unimportant and there was no need for data, information, or analysis. Weighing of evidence might suggest that the decision not to hedge/price led to the particular management approach. This would be contrary to the research question.

Conclusions:

1. The hypothesis that the wheat grower’s management approach does influence the choice of marketing method or hedging/pricing strategy was partially upheld. Management approaches to decision-making by wheat growers are more likely to affect the chosen marketing method, but less likely to affect any decision to hedge/price.

2. Other factors such as the perception of risk need to be considered in hedging/pricing decision-making, rather than the management approach.

7.2. Research question 2

Do wheat growers experience anxiety when choosing marketing methods or hedging/pricing strategies?

It was hypothesized that some wheat growers do experience anxiety when choosing marketing methods or hedging/pricing strategies. The hypothesis was examined using a number of methods including the Pilot Study, Main Study, comparative studies, and the Fisher Exact Test. No attempt was made to investigate the extent of the anxiety or the remedy.
**Experiencing emotional anxiety and marketing method - Pilot Study**

Emotional anxiety was not directly asked in the Pilot Survey (2005). However, the study did find that 14 percent of National/export pool users used this method because of more confidence and less worries (Table 7.1.1). The percentage with less worries was low and this may have implied that the majority of users of the National/export pool may have incurred more worries.

**Experiencing emotional anxiety and marketing method - Main Study**

This question that linked emotional anxiety with the marketing method was directly asked in the Main Study. However, apportioning anxiety into separate acreage, marketing, and pricing decision categories did not occur in the survey questioning.

Table 7.2.1 indicates that 40 - 53 percent of NSW users of the various marketing methods experience emotional anxiety when making acreage/marketing/pricing decisions, while 40 - 46 percent of non-users also experienced emotional anxiety. This implies that emotional anxiety for wheat growers occurs irrespective of the marketing method, and regardless of whether a specific marketing method is used or not.

The biggest difference in emotional anxiety occurred between the users of the National/export pool (53 percent) and non-users of the National/export pool (40 percent) as well as the users of private pools (40 percent). Price was averaged over 18 months after harvest with the National/export pool, and this price averaging risk was combined with the uncertainty over hedging/pricing after delivery occurred into the pool. This usually contrasted with private pools that actively manage hedging/pricing before delivery, with managers selling the pool within three - six months after harvest. The lengthier period of the National/export pool with hedging/pricing uncertainty and delayed final cash flow might have contributed to the higher emotional anxiety.

This evidence was supported by non-users of the National/export pool having lower emotional anxiety (40 percent), whereas non-users of private pools had a higher emotional anxiety (46 percent). It is this inverseness of the results that supports the evidence.
Users of cash sales at harvest may have had slightly higher emotional anxiety for users (46 percent) compared to non-users (44 percent), however, there was 7 percent less emotional anxiety than the users of the National/export pool. This might be explained through improved cash flow (usually within 30 days) and the associated earlier repayment of farm debt.

The other marketing methods had users with lower emotional anxiety than non-users. Storage users (44 percent) were 2 percent lower than non-users (46 percent); private pool users (40 percent) were 6 percent lower than non-users (46 percent); whereas forward contract users (43 percent) were 2 percent below non-users (45 percent). Despite the price speculation associated with storage, and despite the risk of delivery default and cash settlement payout associated with forward contracts, the users of both of these marketing methods indicated that they experienced less emotional anxiety compared to both users of the National/export pool (53 percent) as well as users of cash sales at harvest time (46 percent).

**Experiencing emotional anxiety and marketing method - comparative studies**

The NSW Main Study results have been compared to the results from South Australia and Victoria in Table 7.2.1. Earlier conclusions were upheld both for South Australian and Victorian wheat growers in that emotional anxiety for wheat growers occurs irrespective of the marketing method, and regardless of whether a specific marketing method is used or not. Percentages of growers with emotional anxiety never fell below 40 percent.

**Table 7.2.1. Percentage of wheat growers with emotional anxiety against marketing method 2005**

<table>
<thead>
<tr>
<th>Marketing Method</th>
<th>NSW</th>
<th>SA</th>
<th>Victoria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>User %</td>
<td>Non-user %</td>
<td>User %</td>
</tr>
<tr>
<td>National/export pool</td>
<td>53</td>
<td>40</td>
<td>78</td>
</tr>
<tr>
<td>Cash sale at harvest</td>
<td>46</td>
<td>44</td>
<td>60</td>
</tr>
<tr>
<td>Storage</td>
<td>44</td>
<td>46</td>
<td>67</td>
</tr>
<tr>
<td>Private pool</td>
<td>40</td>
<td>46</td>
<td>*</td>
</tr>
<tr>
<td>Forward contract</td>
<td>43</td>
<td>45</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: John Williams Main Study and comparative studies (2005)

* Only one surveyed grower was in this category

** No surveyed grower was in this category
The National/export pool again had the highest emotional anxiety for South Australian growers (78 percent) and was the only marketing method to experience higher emotional anxiety for its users compared to its non-users. Uncertainty over price averaging and hedging/pricing, as well as the delayed final cash flow, could again be possible explanations.

Those South Australian growers who did not use cash sales at harvest experienced the highest emotional anxiety, which supports the evidence that cash flow might be a major contributing factor that leads to emotional anxiety.

In contrast, users of forward contracts in South Australia experienced the lowest emotional anxiety (40 percent) compared to other marketing methods as well as for Victorian growers. This is despite the risk of contract delivery default and large settlement payouts. It compares favourably with the 43 percent of NSW growers who experienced emotional anxiety when using forward contracts. This evidence is supported by the relatively high emotional anxiety (87 percent) with growers who do not use forward contracts.

The small sample size in Victoria limited its usefulness, except to confirm the overall high level of emotional anxiety regardless of the marketing method or its usage.

**Experiencing emotional anxiety and marketing method - Fisher Exact Test**

With the percentage differences between users and non-users for marketing methods, it might have been expected that there would have been some significant differences between users and non-users in the Fisher Exact Test based on $P < 0.01$ level. However, the Fisher Exact Test results found no statistically significant difference between users and end-users for any of the five marketing methods based on experiencing emotional anxiety.

**Experiencing emotional anxiety and hedging/pricing strategy - Main Study**

The linkage between emotional anxiety of NSW wheat growers and hedging/pricing strategies was then examined in the Main Study and the results are summarized in Table 7.2.2.
Emotional anxiety was highest for NSW users of bank pricing products (63 percent), presumably because they are cash settled at maturity and financial payout risk exists. This contrasts with users of both futures brokers and private pool managers (both zero percent based on 5 percent of surveyed NSW growers using futures brokers and 5 percent using private pool managers).

The low percentage of anxiety for users of futures brokers might be explained by the ability to exit a non-deliverable futures market position at any time based on the futures market daily margin settlement.

While 13 percent of survey respondents in the Main Study used private pools to market their crop, only 5 percent used private pools for the purpose of hedging/pricing. When growers used private pools for selling their crop, 40 percent of them experienced emotional anxiety. However, when growers used private pools to hedge/price their crop, then their anxiety levels fell to zero. This agreed with the theory of using private pools to transfer responsibility of hedging/pricing to a manager who is perceived to have more experience in such matters.

When growers used forward contracting (with either merchants or end-users) to market their wheat, 43 percent experienced emotional anxiety compared to 45 percent who did not use forward contracting. However, when growers used merchants to hedge/price (usually this can only be done through a forward contract), the percentage who experienced emotional anxiety fell to 33 percent (but it rose to 48 percent for non-users).

Perceptions of emotional anxiety for users of forward contracts therefore depended on how the particular marketing method or hedging/pricing strategy was examined. Growers perceived more anxiety when delivery risk was considered, and less emotional anxiety when hedging/pricing was considered. Overall, forward contract users experienced less emotional anxiety than non-users.

Half of those growers (50 percent) who used a futures adviser experienced emotional anxiety, compared to 44 percent for non-users. Some hedging/pricing strategies (such as bank pricing products and some merchant contracts) require the mandatory use of a futures adviser to authorize the transaction. Therefore, it might be expected that the anxiety levels for users of
futures advisers (50 percent) might approach the levels of anxiety experienced by users of bank pricing products (63 percent).

There is also some complexity in this analysis because many futures brokers and private pool managers are also futures advisers, whilst some bank and merchant staff are also futures advisers. Therefore, there is no clear demarcation in hedging/pricing strategies to clearly identify the category of futures adviser, compared to other categories.

No hedging/pricing is no panacea for curing emotional anxiety. Those growers who did not hedge/price experienced a higher anxiety level (41 percent) compared to a deliverable forward contract with a merchant (33 percent), which presumably would have had some production/delivery risk attached. However, the anxiety level for growers who did not hedge/price (41 percent) was less than for those growers who used bank pricing products (63 percent).

The only positive result for non-hedging/pricing was that non-users (those that did hedge/price) experienced the highest anxiety levels (54 percent) relative to all the hedging/pricing strategies. However, the majority of this percentage of anxiety came from the users of bank pricing products.

**Experiencing emotional anxiety and hedging/pricing strategy - comparative studies**

The incidence of climate risk and weather variability has always been relatively high in different regions of Australia. It might be assumed that high levels of climate risk and weather variability impacting on both yields and quality would increase the emotional anxiety for some growers.

The NSW Main Study results relating to hedging/pricing strategies have been compared to the results from South Australia and Victoria in Table 7.2.2.
**Table 7.2.2. Percentage of wheat growers with emotional anxiety against hedging/pricing strategies in 2005**

<table>
<thead>
<tr>
<th>Hedging/Pricing Strategy</th>
<th>NSW</th>
<th>SA</th>
<th>Victoria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>User</td>
<td>Non-user</td>
<td>User</td>
</tr>
<tr>
<td>Futures Broker</td>
<td>0%</td>
<td>47%</td>
<td>**</td>
</tr>
<tr>
<td>Merchant</td>
<td>33%</td>
<td>48%</td>
<td>57</td>
</tr>
<tr>
<td>Bank</td>
<td>63%</td>
<td>41%</td>
<td>100</td>
</tr>
<tr>
<td>Futures Adviser</td>
<td>50%</td>
<td>44%</td>
<td>**</td>
</tr>
<tr>
<td>Private Pool Manager</td>
<td>0%</td>
<td>46%</td>
<td>67</td>
</tr>
<tr>
<td>No hedging/pricing</td>
<td>41%</td>
<td>54%</td>
<td>85</td>
</tr>
</tbody>
</table>

Source: John Williams Main Study and comparative studies (2005)

** No surveyed grower was in this category

Earlier conclusions were upheld both for South Australian and Victorian wheat growers in that emotional anxiety for wheat growers was the highest for bank pricing products (100 percent). For South Australian users of forward contracts with merchants, again they experienced the lowest emotional anxiety (57 percent), whilst non-users of forward contracts had the highest emotional anxiety (85 percent).

Contrary to NSW growers, South Australia had 85 percent of growers who did not hedge/price experiencing emotional anxiety compared to a lower percentage (57 percent) for those who did hedge/price. Theory would suggest that growers who did not hedge should experience high emotional anxiety over price risk, but only the South Australian results supported that theory. Users of bank pricing products in all surveyed regions (NSW, SA, and Victoria) also contradicted this theory, despite the theoretical lower price risk.

The small sample size in Victoria limited its usefulness, except that the percentage of growers incurring emotional anxiety when either using or not using hedging/pricing strategies was relatively high (100 percent for users of bank pricing products and forward contracts with merchants, and 33 - 60 percent of non-users). One exception to the overall findings was the relatively high experience of emotional anxiety for Victorian users of forward contracting with merchants (100 percent) which contrasted with the results from both NSW (33 percent) and South Australia (57 percent).
Experiencing emotional anxiety and hedging/pricing strategy - Fisher Exact Test

With the percentage differences between users and non-users for hedging/pricing strategies, it might have been expected that there would have been some significant differences between users and non-users in the Fisher Exact Test based on $P < 0.01$ level. However, the Fisher Exact Test results found no statistically significant difference between users and end-users for any of the six hedging/pricing strategies.

Conclusions:

1. The hypothesis that some wheat growers do experience anxiety when choosing marketing methods or hedging/pricing strategies was more than upheld. Wheat growers generally experience high levels of emotional anxiety whenever they make decisions relating to acreage, marketing, or pricing, usually irrespective of the marketing method or hedging/pricing strategy, and regardless of whether usage occurred. Perhaps because of this, there was no significant difference in emotional anxiety levels between users or non-users at $P < 0.01$ for any of the marketing methods or hedging/pricing strategies.

2. National/export pool users had the highest emotional anxiety for NSW and South Australian growers when comparing the marketing methods, and was generally the only marketing method to experience higher emotional anxiety for its users compared to its non-users. Users of bank pricing products incurred the highest emotional anxiety when comparing the hedging/pricing strategies.

3. There is some evidence to suggest that cash flow might be a greater contributing factor leading to emotional anxiety than either the marketing method or hedging/pricing strategy.

7.3. Research question 3

Does the knowledge of variable cost of production influence price risk management decisions for wheat growers?
It is hypothesized that those growers who know their costs of production are more likely to manage their price risk. There was a focus on this research question in all four 2005 surveys (Pilot, Main, SA and Victoria), as well as the Fisher Exact Test.

There are inherent weaknesses with this research question. It assumes that variable cost of production can be known in advance of the price risk management decision, when the reality is that final costs can only be known in hindsight. Despite this weakness, the Main Study in NSW and the subsequent comparative studies in South Australia and Victoria asked the direct question, and did not attempt to discover how the grower knew the variable cost of production in advance of making price risk management decisions.

**Cost: price linkage - Pilot Study**

The Pilot Study (2005) had survey design faults. Cost of production questions did not account for fixed costs, there was no allocation of farm debt to various farm enterprises, and alternate farm enterprises (other than wheat) were not fully examined. There was also the problem of calculating variable costs per tonne from variable costs per hectare through an average yield calculation which varied widely between paddocks, varieties, seasons, and under different management approaches. The advantage of the Pilot Study was that the survey was done within a Cost of Production Group in the Wimmera/Mallee which had standardized their cost calculation methods under the guidance of the Department of Primary Industries (Victoria).

Usage of pricing/hedging by Victorian wheat growers was examined against variable cost of production categories in the Pilot Study (2005) and summarized in Table 7.3.1.

**Table 7.3.1. Usage of hedging/pricing against variable cost: Victorian wheat growers - 2005**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Variable cost of production for wheat per tonne</th>
<th>Don’t know</th>
<th>&lt; $80/t</th>
<th>$81 - $100/t</th>
<th>$101 - $120/t</th>
<th>$121 - $140/t</th>
<th>&gt; $140/t</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of surveyed growers</td>
<td>111</td>
<td>5</td>
<td>17</td>
<td>17</td>
<td>9</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Percentage of growers</td>
<td>10%</td>
<td>3%</td>
<td>33%</td>
<td>33%</td>
<td>18%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>Used forward pricing/hedging *</td>
<td></td>
<td>0%</td>
<td>29%</td>
<td>6%</td>
<td>0%</td>
<td>50%</td>
<td>0%</td>
</tr>
</tbody>
</table>

* Percentage of growers in each cost category who undertook forward pricing/hedging

Source: John Williams, Pilot Study (2005)
If the higher cost results (above $100 per tonne) in Table 7.3.1 were negatively weighted because of so few growers, then the results might suggest that growers with lower variable costs of production were more likely to forward price/hedge (29 percent in the under $80 per tonne cost of production group, and 6 percent for growers in the $80 – $100 per tonne cost of production group).

**Cost: price linkage - Main Study**
The Main Study was designed to ask direct questions in the survey on cost-price associations, rather than attempting to surmise outcomes from profiling analyses. Experience gained in the Pilot Study (2005) suggested that the Main Study should avoid questioning how growers knew their cost of production or the accuracy of this knowledge. It was assumed that growers’ acknowledgement of knowing their cost of production was sufficient in the Main Study.

Results from the Main Survey indicated that 45 percent of NSW wheat growers agreed that knowledge of variable costs led to price risk management, while 55 percent did not agree. These results supported the hypothesis that knowing variable costs of production was likely to lead to managing price risk.

**Cost: price linkage - comparative studies**
These NSW Main Study results were then tested in the comparative surveys against South Australia and Victoria results (using the same survey questionnaire for the same 2005 crop year). Figure 7.3.1 summaries the results of the three surveys.

In South Australia, 60 percent of surveyed growers agreed that knowledge of variable costs led to price risk management, while 40 percent did not agree. The Victorian wheat grower survey indicated that 40 percent agreed that knowledge of variable costs led to price risk management, while 60 percent did not agree.

It might be concluded that a relatively large number of growers across very different geographic localities and farming conditions perceived a positive relationship between knowledge of variable costs of production and price risk management. This was supported by the findings in
the Pilot cy (2005) that growers with lower costs of production were more likely to forward price/hedge.

**Figure 7.3.1. Percentage of wheat growers who agreed that knowledge of variable costs of production led to managing price risk by State – 2005**

![Percentage of wheat growers who agreed that knowledge of variable costs of production led to managing price risk by State – 2005](image)

Source: John Williams, Main Study and comparative studies (2005)

This relationship (knowledge of variable costs of production leading to price risk management) was then examined using the three States against particular hedging/pricing strategies (which were mutually exclusive in that growers often used more than one hedging/pricing strategy) in Table 7.3.2.

**Table 7.3.2. Hedging strategies and cost-price risk management relationship – 2005**

<table>
<thead>
<tr>
<th>Hedging/pricing strategy</th>
<th>Knowledge of variable costs leads to managing price risk</th>
<th>Knowledge of variable costs did not lead to managing price risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
</tr>
<tr>
<td>Through a futures adviser/broker</td>
<td>67%</td>
<td>*</td>
</tr>
<tr>
<td>Through a merchant</td>
<td>50%</td>
<td>57%</td>
</tr>
<tr>
<td>Through a bank</td>
<td>62%</td>
<td>100%</td>
</tr>
<tr>
<td>Through a private pool manager</td>
<td>0%</td>
<td>67%</td>
</tr>
<tr>
<td>Did not hedge or forward price</td>
<td>40%</td>
<td>62%</td>
</tr>
</tbody>
</table>

* No grower in the survey used this strategy

Source: John Williams, Main Study and comparative studies (2005)

Those NSW growers who used futures advisers/brokers were 67 percent in agreement that knowledge of variable costs of production led to price risk management. Growers who used
merchants had 50 – 57 percent in agreement across three States. The 62 percent of NSW growers using bank pricing products who agreed that knowledge of variable costs of production led to price risk management was supported by 100 percent of growers from SA and Victoria. Except for the inconclusiveness of the results for those who hedged/-priced through private pools, there was evidence that growers across very different geographic localities and farming conditions perceived a positive relationship between knowledge of variable costs of production and price risk management.

This cost: price positive relationship was then tested again in Table 7.3.2 for those growers who did not hedge/forward price. Even for those growers who did not hedge/forward price, 40 percent of NSW growers and 62 percent of South Australian growers agreed that knowledge of variable costs of production led to price risk management.

The only exception to the cost: price relationship was the zero percent for Victoria. Victorian wheat farmers could be characterized as being from small diversified and more marginal production farms. Except for Victorian wheat growers who did not hedge/forward price, the results suggested that growers were more likely to perceive that knowledge of variable costs of production led to price risk management, regardless of whether or not they undertook hedging/pricing.

**Cost: price linkage - Fisher Exact Test**

This cost: price relationship was confirmed using the Fisher Exact Test on users and non-users of marketing methods and hedging/pricing strategies. There was no significant difference between users and non-users of marketing methods and hedging/pricing strategies regarding the acceptance of knowledge of variable costs of production leading to price risk management. This supported the findings in that knowledge of variable costs of production lead to price risk management for many growers regardless of the marketing method or hedging/pricing strategy.

**Cost: price linkage - Effect of variable costs on targeting price**

The theory that growers target more realistic price levels in risk management when variable costs are known was then examined. A majority of NSW wheat growers (53 percent) agreed that they
target more realistic price levels in risk management when variable costs are known (Figure 7.3.2). South Australian wheat growers were 60 percent in agreement, while Victorian wheat growers had 40 percent agreement.

**Figure 7.3.2. Percentage of wheat growers who agreed that they target more realistic price levels in risk management when variable costs are known by State - 2005**

It might be concluded that a relatively large number of growers across very different geographic localities and farming conditions perceive a positive relationship between knowledge of variable costs of production and targeting a more realistic price in risk management.

This relationship (targeting more realistic price levels in risk management when variable costs are known) was then examined using the three States against particular hedging/pricing strategies (which were mutually exclusive in that growers often used more than one hedging/pricing strategy) in Table 7.3.3.

Those NSW growers who used futures advisers/brokers were 67 percent in agreement that they target more realistic price levels in risk management when variable costs are known. Growers who used merchants were 50 – 100 percent (across three States) in agreement that they target more realistic price levels in risk management when variable costs are known.
NSW and South Australian wheat growers who used bank pricing products were 75-100 percent in agreement that they target more realistic price levels in risk management when variable costs are known. The one exception was Victorian growers who used bank pricing products (zero percent in agreement, but this was a small sample size). Those NSW and South Australian wheat growers who used private pool managers were 50-67 percent in agreement that they target more realistic price levels in risk management when variable costs are known.

There were a large percentage of NSW and South Australian growers (45 – 54 percent) who did not hedge/forward price but still were in agreement that they target more realistic price levels in risk management when variable costs are known. Again, the only exception was Victoria (zero percent), whose wheat farmers could be characterized as being from small diversified and more marginal production farms.

Except for Victorian wheat growers who did not hedge/forward price or hedged using bank pricing products, the results suggested growers were more likely to perceive that they target more realistic price levels in risk management when variable costs are known, regardless of whether or not they undertook hedging/forward pricing.

These results were then tested using the Fisher Exact Test on users and non-users of marketing methods and hedging/pricing strategies. There was no significant difference between users and non-users of marketing methods and hedging/pricing strategies regarding the acceptance of targeting more realistic price levels in risk management when variable costs are known. This supported the findings that growers targeted more realistic price levels in risk management when variable costs are known, regardless of whether or not they undertook hedging/forward pricing.
Conclusions:

1. The hypothesis that those growers who know their costs of production are more likely to manage their price risk was generally upheld. Except for those NSW growers who hedged/priced through private pools and for Victorian wheat growers who did not hedge/forward price, the results suggested growers were more likely to perceive that knowledge of variable costs of production led to price risk management, regardless of whether or not they undertook hedging/ pricing.

2. Except for Victorian wheat growers who did not hedge/forward price or hedged using bank pricing products, the results also suggested growers were more likely to perceive that they target more realistic price levels in risk management when variable costs are known, regardless of whether or not they undertook hedging/forward pricing.

3. The exception to the conclusions for Victorian growers can be explained because they have much smaller wheat acreages, greater farm enterprise diversification, and higher production risk. Because of these considerations, it might be assumed that despite knowing their variable costs of production, this did not lead to price risk management in all cases.

7.4. Research question 4

Does price risk management act as an incentive to lower variable costs of production for wheat growers?

It is hypothesized that price risk management does act as an incentive to lower variable costs of production for wheat growers. The theory suggests that producers who are pro-active towards managing price risk are more likely to be those producers who achieve significant on-farm cost reductions.

There were no inherent weaknesses with this research question because the decisions to manage price can be implemented before the variable cost of production decisions are made. The Main
Study in NSW and the subsequent comparative studies in South Australia and Victoria again asked the direct question, and did not attempt to discover how the grower calculated the variable cost of production.

It might be suggested that it is not until growers understand the positive price skewness of wheat, and the low probability of wheat prices going up, that they become more proactive in price risk management and the need to reduce on-farm costs. The alternative suggestion might be that any belief by wheat growers that prices go up more in time than they go down (negative price skewness) may reinforce their psychological outlook that they can afford to be less active in price risk management with little need to decrease their on-farm expenditure.

Graph 7.4.1 depicts the positive skewness of wheat prices. They are skewed towards lower prices for longer periods of time, relative to the period of time for higher prices.


![Graph 7.4.1. Positive skewness of C.B.O.T. wheat prices: Nov. 1979 – Sept. 2008](source)

Source: John Williams compiled from Data Tools price data (2008)

When the Chicago Board of Trade (C.B.O.T.) wheat price is U.S. 200 cents per bushel, there is 100 percent probability that prices will rise higher than 200 cents per bushel. At U.S. 300 cents per bushel, there is 75 percent probability that prices will rise higher than 300 cents per bushel.
However, at U.S. 500 cents per bushel, there is only 5 percent probability that prices will rise higher than 500 cents per bushel.

The positive skewness of wheat prices is summarized in Table 7.4.1.

**Table 7.4.1. C.B.O.T. soft wheat price skewness: November 1979 - September 2008**

<table>
<thead>
<tr>
<th>C.B.O.T. soft wheat price U.S. cents per bushel</th>
<th>Probability that prices will rise above this price</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>100%</td>
</tr>
<tr>
<td>300</td>
<td>75%</td>
</tr>
<tr>
<td>400</td>
<td>25%</td>
</tr>
<tr>
<td>500</td>
<td>5%</td>
</tr>
<tr>
<td>600</td>
<td>4%</td>
</tr>
<tr>
<td>700</td>
<td>4%</td>
</tr>
<tr>
<td>800</td>
<td>3%</td>
</tr>
<tr>
<td>900</td>
<td>1%</td>
</tr>
<tr>
<td>1000</td>
<td>1%</td>
</tr>
<tr>
<td>1100</td>
<td>0%</td>
</tr>
<tr>
<td>1200</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: John Williams compiled from Data Tools price data (2008)

**Price: cost relationship - Main Study**

Recognition of price skewness was considered too difficult for wheat growers to answer in a survey question. A direct question that tested the link between managing price and subsequent lowering of variable cost of production was asked in the Main Study. The results indicated that 38 percent of NSW wheat growers agreed that price risk management acted as an incentive to lower variable costs of production.

**Price: cost relationship - comparative studies**

The NSW results were then tested in the subsequent comparative studies in South Australia and Victoria, focusing on whether a relationship existed between price risk management and cost reduction. Results are summarized in Figure 7.4.1.
The comparative studies provided similar results to the Main Study. A large number of South Australian (45 percent) and Victorian (40 percent) wheat growers agreed that price risk management acted as an incentive to lower variable costs of production.

It might be concluded that a relatively large number of growers across very different geographic localities and farming conditions perceived a positive relationship between price risk management and lower variable costs of production.

This positive relationship (price risk management leading to lower variable costs of production) was then tested using growers in the three States against each of the hedging/pricing strategies (which were mutually exclusive in that growers often used more than one hedging/pricing strategy).

Generally, South Australian and Victorian growers tended to agree with the research question more than NSW growers. The results are summarized in Table 7.4.2.
Table 7.4.2. Hedging/pricing strategies and price-cost management by State - 2005

<table>
<thead>
<tr>
<th>Hedging/pricing strategy</th>
<th>NSW</th>
<th>SA</th>
<th>Vic.</th>
<th>NSW</th>
<th>SA</th>
<th>Vic.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through a futures adviser/broker</td>
<td>50%</td>
<td>*</td>
<td>*</td>
<td>50%</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Through a merchant</td>
<td>40%</td>
<td>71%</td>
<td>50%</td>
<td>60%</td>
<td>29%</td>
<td>50%</td>
</tr>
<tr>
<td>Through a bank</td>
<td>38%</td>
<td>100%</td>
<td>100%</td>
<td>62%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Through a private pool manager</td>
<td>50%</td>
<td>67%</td>
<td>*</td>
<td>50%</td>
<td>33%</td>
<td>*</td>
</tr>
<tr>
<td>Did not hedge or forward price</td>
<td>25%</td>
<td>31%</td>
<td>0%</td>
<td>75%</td>
<td>69%</td>
<td>100%</td>
</tr>
</tbody>
</table>

* No grower in the survey used this strategy

Source: John Williams, Main Study and comparative studies (2005)

Those NSW growers who used futures advisers/brokers were 50 percent in agreement that price risk management acted as an incentive to lower variable costs of production. Growers who used merchants were 40 - 71 percent in agreement that price risk management acted as an incentive to lower variable costs of production.

All South Australian and Victorian growers who hedged/priced through banks agreed that price risk management acted as an incentive to lower variable costs of production, compared with only 38 percent for NSW growers. Those NSW and South Australian growers who used private pool managers had 50 – 67 percent in agreement that price risk management acted as an incentive to lower variable costs of production.

For those growers who did not hedge/forward price, the percentages in agreement that price risk management acted as an incentive to lower variable costs of production (25 - 31 percent) decreased relative to those growers who hedged/priced (38 - 100 percent). In Victoria, the percentage fell to zero, possibly due to the previous identifiable reasons (much smaller wheat acreages, greater farm enterprise diversification, and higher production risk).

Except for Victorian wheat growers who did not hedge/forward price, the results suggested that many growers perceive that price risk management acted as an incentive to lower variable costs of production, regardless of whether or not they undertook hedging/pricing.

**Price: cost relationship - Fisher Exact Test**

These findings were then tested using the Fisher Exact Test on users and non-users of marketing methods and hedging/pricing strategies. The results indicated that only private pool users had a
significant difference \( (P = 0.06) \) when all marketing methods were analysed. There was no significant difference between users and non-users for any of the hedging/pricing strategies.

Private pool users are more likely to agree that locking in a forward price acts as an incentive to lower variable costs of production, relative to non-users. Whilst users of private pools may have had some reluctance to indicate reasons for using this marketing method in the Pilot Study (Table 7.1.1), the ability to lower variable costs of production might be one major reason.

In examining the Main Study results for private pool users, there may have appeared a discrepancy between private pools perceived for the purpose of marketing, and private pools perceived for the purpose of hedging/pricing. If the Fisher Exact Test detected significant difference between users and non-users of private pools as a marketing method, then it might have been expected that there might have been a significant difference between users and non-users for private pools as a hedging/pricing strategy.

There were 13 percent of NSW growers in the Main Study who used private pools as a marketing method and 80 percent of these indicated that price risk management acted as an incentive to lower variable costs of production (20 percent did not). This explains the significant difference between users and non-users in the Fisher Exact Test for private pools as a marketing method.

When NSW growers used private pools to hedge/price, the percentage agreeing that price risk management acted as an incentive to lower variable costs of production decreased to 50 percent (Table 7.4.2). This explains why the Fisher Exact Test found no significant differences between users and non-users of private pools when used for the purpose of hedging/pricing.

Conclusions:

1. The hypothesis that price risk management acted as an incentive to lower variable costs of production was generally upheld. Except for Victorian growers who did not hedge/price, many growers agreed that price risk management acted as an incentive to lower variable costs of production.
2. Private pool users were more inclined to agree that price risk management acted as an incentive to lower variable costs of production when they perceived private pools as a marketing method. This farm management benefit may be one reason why growers use private pools.

7.5. Research question 5

Does the wheat grower's farm size, age, debt, farming experience, or training influence the choice of marketing method or hedging/pricing strategy?

Farm size

It was hypothesized that a wheat grower would increase their forward contracting and hedging/pricing activity as farm size increased. Results from the Pilot Study, Main Study, comparative studies, as well as the A.F.F.A. (2002) study (because of its relevance to grain growers in Australia) were used to examine the hypothesis.

Farm size and forward selling - A.F.F.A. study

The A.F.F.A. (2002) survey examined the link between farm size and either marketing method or hedging/pricing strategy for grain growers. It is assumed that ‘forward selling’ referred to forward contracting. However, no crop year was specified in the survey question, which was a major limitation to the results depicted in Table 7.5.1.

Table 7.5.1. Farm size and forward selling for grain producers by State - 2002

<table>
<thead>
<tr>
<th>Enter into any forward selling arrangements</th>
<th>Farm size</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 1500 ha</td>
<td>1500 – 5000 ha</td>
<td>&gt; 5000 ha</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
<td>Vic.</td>
<td>NSW</td>
</tr>
<tr>
<td>Yes to forward selling</td>
<td>53%</td>
<td>46%</td>
<td>48%</td>
<td>100%</td>
</tr>
<tr>
<td>No to forward selling</td>
<td>47%</td>
<td>54%</td>
<td>52%</td>
<td>0%</td>
</tr>
</tbody>
</table>

* No surveyed grower in this category

Table 7.5.1 indicates that 46 - 53 percent of grain growers in three Australian States (NSW, South Australia, and Victoria) with farm sizes of less than 1500 hectares forward sold their grain. Between 1500 - 5000 hectares, the results diverged with all NSW grain growers forward selling, compared to 73 percent in Victoria but only 29 percent in South Australia (falling to zero for growers above 5000 ha).

It might be deduced that as NSW and Victoria growers increased in farm size, they were more likely to undertake forward selling. However, the outcome could not be applied to growers above 5000 ha (none surveyed), or to South Australian growers who were more likely to decrease forward selling activity as farm size increased. One possible explanation for this South Australian outcome is that larger farm sizes tend to exist near the Goyder drought line, and these marginal growers probably have a decreased inclination to forward sell.

Farm size and marketing method - Main Study
Usage of a particular marketing method was examined in the Main Study for NSW wheat growers across four farm size categories in Table 7.5.2. There was mutual exclusivity because each marketing method was considered separately within each farm size category.

NSW wheat growers above 10,000 ha used storage (100 percent), cash sales (50 percent), forward contracting (50 percent), and privately managed pools (25 percent). No NSW grower above 10,000 ha used the National/export pool. However, for farm sizes between 5000 - 9999 ha, the percentages fell considerably in storing/warehousing (100 percent back to 43 percent), privately managed pool (25 percent to 14 percent), and forward contracting (50 percent to 14 percent), while both usage of the National/export pool (zero to 43 percent) and cash sales (50 to 57 percent) increased.

NSW wheat growers with farm sizes from under 2000 ha to 5000 ha increased their usage of the National/export pool (38 to 46 percent) as farm size increased. However, above 5000 ha, usage of the National/export pool fell away as farm size increased. Cash sales at harvest were strongly used by NSW wheat growers in all farm size categories (50 to 69 percent). On-farm storage and warehousing were also strongly used by NSW wheat growers (23 - 100 percent).
Over the full range of farm sizes, the percentage of NSW wheat growers who forward contracted increased from 6 percent for a farm size under 2000 ha to 50 percent for farm sizes above 10,000 ha. The usage of private pooling also showed an increase over the same farm size range, from 6 percent to 25 percent.

**Farm size and marketing method - comparative studies**

Results from the NSW Main Study were then compared for South Australia and Victoria across the four farm size categories (Table 7.5.2). The Pilot Study results for Victoria were used because of their relevancy, the larger sample size, and the smaller farm size relative to NSW and South Australia.

Table 7.5.2. Users of wheat marketing method based on farm size by State - 2005

<table>
<thead>
<tr>
<th>Marketing method</th>
<th>Farm size **</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 2000 ha</td>
<td>2000 – 4999 ha</td>
<td>5000 - 9999 ha</td>
<td>&gt;10,000 ha</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National/export pool</td>
<td>NSW</td>
<td>SA</td>
<td>Vic.</td>
<td>NSW</td>
<td>SA</td>
<td>Vic.</td>
<td>NSW</td>
</tr>
<tr>
<td></td>
<td>38%</td>
<td>88%</td>
<td>69%</td>
<td>46%</td>
<td>100%</td>
<td>*</td>
<td>43%</td>
</tr>
<tr>
<td>Cash sale near harvest</td>
<td>56%</td>
<td>53%</td>
<td>63%</td>
<td>69%</td>
<td>33%</td>
<td>*</td>
<td>57%</td>
</tr>
<tr>
<td>Store/warehouse</td>
<td>31%</td>
<td>6%</td>
<td>63%</td>
<td>23%</td>
<td>67%</td>
<td>*</td>
<td>43%</td>
</tr>
<tr>
<td>Privately managed pool</td>
<td>6%</td>
<td>6%</td>
<td>10%</td>
<td>15%</td>
<td>0%</td>
<td>*</td>
<td>14%</td>
</tr>
<tr>
<td>Forward contract</td>
<td>6%</td>
<td>29%</td>
<td>22%</td>
<td>23%</td>
<td>0%</td>
<td>*</td>
<td>14%</td>
</tr>
</tbody>
</table>

* No surveyed grower had this farm size  
** Victorian data based on the 2005 Victorian Pilot Survey  

As farm size increased from under 2000 ha up to 5000 ha, South Australian wheat growers were more likely to increase their usage of the National/export pool (from 88 to 100 percent) and storage (from 6 to 67 percent). The usage of cash sales by South Australian wheat growers decreased from 53 to 33 percent as farm size increased over the same range, while private pool usage (6 percent to zero) and forward contract usage (29 percent to zero) fell.

Victorian wheat growers could not be compared over a range of farm sizes because they were all less than 2000 ha. These small farm size growers were more likely to use a wide combination of marketing methods including the National/export pool (69 percent), cash sales at harvest (63 percent), storage (63 percent), private pools (10 percent) and forward contracting (22 percent).
It might be concluded that some of their differences in usage of marketing methods by South Australian and Victorian wheat growers compared with NSW growers might be explained by their smaller size (below 5000 ha). Some of the differences between South Australia and Victoria might be explained through more specialized grain farming for the former and more farm enterprise diversification for the latter.

**Farm size and hedging/pricing strategy - Main Study**

Farm size was then examined against the different hedging/pricing strategies. As farm size increased from below 2000 ha to 10,000 ha, wheat growers in NSW increased their usage of merchants and bank pricing products from 40 to 100 percent (Table 7.5.3). NSW growers were more likely to use futures advisers/brokers (100 percent) when their acreages were above 5000 ha, and privately managed pools (50 percent) when their acreages were above 10,000 ha.

**Farm size and hedging/pricing strategy - comparative and Pilot studies**

The results from the NSW Main Study examining farm size against the hedging/pricing strategies were then compared for South Australia and Victoria across the four farm size categories (Table 7.5.3).

<table>
<thead>
<tr>
<th>Hedging/pricing strategy</th>
<th>Farm size</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
<td>Vic.</td>
<td>NSW</td>
<td>SA</td>
<td>Vic.</td>
<td>NSW</td>
<td>SA</td>
<td>Vic.</td>
<td>NSW</td>
<td>SA</td>
</tr>
<tr>
<td>Through a futures</td>
<td>40%</td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>0%</td>
<td>*</td>
<td>100%</td>
<td>*</td>
<td>*</td>
<td>100%</td>
<td>*</td>
</tr>
<tr>
<td>adviser/broker</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through a merchant</td>
<td>40%</td>
<td>100%</td>
<td>50%</td>
<td>60%</td>
<td>0%</td>
<td>*</td>
<td>100%</td>
<td>*</td>
<td>*</td>
<td>100%</td>
<td>*</td>
</tr>
<tr>
<td>Through a bank</td>
<td>40%</td>
<td>17%</td>
<td>50%</td>
<td>60%</td>
<td>0%</td>
<td>*</td>
<td>100%</td>
<td>*</td>
<td>*</td>
<td>100%</td>
<td>*</td>
</tr>
<tr>
<td>Through a private pool</td>
<td>0%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>*</td>
<td>0%</td>
<td>*</td>
<td>*</td>
<td>50%</td>
<td>*</td>
</tr>
<tr>
<td>manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* No surveyed grower had this farm size

Source: John Williams, Main Study and comparative studies (2005)

Under 2000 ha, South Australian wheat growers were more likely to hedge using merchants (100 percent), banks (17 percent), and private pools (50 percent). This compared with Victorian growers less than 2000 ha who hedged using merchants (50 percent) and banks (50 percent).
The results from the Pilot Study in Victoria were then examined. Table 7.5.4 indicates that no grower fully hedged. However, part-hedging/pricing activity increased from 14 to 33 percent as farm size increased from the below 2000 ha range to the 2000 – 2999 ha range, but then decreased to zero for farm size ranges above 3000 ha.

Table 7.5.4. Farm size and hedging/pricing activity for Victorian wheat growers – 2005

<table>
<thead>
<tr>
<th>Hedging activity</th>
<th>Farm size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 2000 ha</td>
</tr>
<tr>
<td>100% hedged</td>
<td>0%</td>
</tr>
<tr>
<td>Part hedged</td>
<td>14%</td>
</tr>
<tr>
<td>Total hedged</td>
<td>14%</td>
</tr>
<tr>
<td>No hedging</td>
<td>86%</td>
</tr>
</tbody>
</table>

Source: John Williams, Pilot Study (2005)

These hedging/pricing results were then compared with those from the Main Study and comparative studies (Table 7.5.5). There was a relatively high proportion (14 - 31 percent) of NSW growers who had 100 percent hedge ratios across all farm sizes. NSW wheat growers are more likely to increase the usage of overall hedging/pricing as farm size increases. Below 2000 ha farm size, only 31 percent wheat growers were likely to hedge their wheat crop, compared to 100 percent above 10,000 ha farm size. Those NSW wheat growers below 2000 ha who did hedge were more likely to have a hedge ratio of 100 percent. This contrasts with only 25 percent of the larger (above 10,000 ha) growers who were fully hedged.

Table 7.5.5. Farm size and hedging activity for wheat producers by State - 2005

<table>
<thead>
<tr>
<th>Hedging activity</th>
<th>Farm size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 2000 ha</td>
</tr>
<tr>
<td></td>
<td>NSW  SA  Vic.</td>
</tr>
<tr>
<td>100% hedged</td>
<td>31%  12%  20%</td>
</tr>
<tr>
<td>Part hedged</td>
<td>0%   24%  20%</td>
</tr>
<tr>
<td>Total hedged</td>
<td>31%  36%  40%</td>
</tr>
<tr>
<td>No hedging</td>
<td>69%  64%  60%</td>
</tr>
</tbody>
</table>

* No surveyed grower had this farm size

Source: John Williams, Main Study and comparative studies (2005)
Medium sized northern NSW wheat growers (2000 – 10,000 ha) were more likely to hedge (43 – 54 percent of growers), compared with smaller size growers (31 percent). This supports the theory that increasing farm size results in increasing hedging/pricing. The NSW results are depicted in Figure 7.5.1).

Figure 7.5.1. NSW farm size and wheat grower hedging percentages - 2005

![Bar chart showing hedging percentages by farm size for NSW growers in 2005.](source: John Williams, Main Study (2005))

However, there was no evidence that larger farm sizes resulted in increased usage of hedging/pricing for South Australian wheat growers. All surveyed growers above 2000 ha undertook no hedging activity. South Australian wheat growers were more likely to hedge when they were less than 2000 ha in farm size.

The results from Victoria were inconclusive because no growers surveyed in the main study were above 2000 ha. Only 40 percent of surveyed Victorian wheat growers hedged, but the percentages were above South Australia for both the total percentage who hedged and in the number of growers who were fully hedged.

Conclusion:

1. The hypothesis was upheld, but only for NSW growers. As farm size increased, NSW wheat growers generally increased their hedging/pricing activity. However, there was a relatively high
proportion (14 - 31 percent) of NSW growers who had 100 percent hedge ratios across all farm sizes.

2. In contrast, South Australian wheat growers decreased their hedging/pricing activity as farm size increased. This may possibly be explained by larger farm sizes existing near the Goyder drought line with higher risk-taking marginal farmers. The results were inconclusive for Victorian growers because of their smaller sized farms.

3. There was a strong propensity for NSW wheat growers for cash sales and storage/warehouse across all farm sizes. Usage of the National/export pool decreased with increasing farm size, while usage of private pools and forward contracting increased with increasing farm size. As farm size increased, South Australian wheat growers increased their usage of both the National/export pool and storage, while usage of all other marketing methods decreased. The results were inconclusive for Victorian growers because of their smaller sized farms.

Age

It was hypothesized that age does not affect the decision-making of wheat growers regarding marketing methods and hedging/pricing strategies. The age of the grower was determined in the Pilot Study, but correlating age with marketing methods and hedging/pricing strategies did not prove that age affected decision-making unless there was a specific question. Age was examined in the Main Study and the comparative studies as a direct question on whether age influences marketing/pricing decision making, and then statistical tested in the Fisher Exact Test.

Age and marketing method - Main Study

The results of examining the age of NSW wheat growers against the different marketing methods in the Main Study are summarized in Table 7.5.6.

There was no difference in age for those NSW wheat growers using the National/export pool. However, for those NSW wheat growers using cash sales at harvest time and privately managed
pools (67 percent compared to 33 percent), storage (56 percent compared to 44 percent), and forward contracts (75 percent compared to 25 percent), growers tended to be older.

**Age and marketing method - comparative studies**

The NSW Main Study results examining the age of wheat growers against the different marketing methods were then compared to both South Australia and Victoria (Table 7.5.6).

**Table 7.5.6. Age of wheat grower and wheat marketing methods used by State - 2005**

<table>
<thead>
<tr>
<th>Age</th>
<th>National/export pool</th>
<th>Cash sale at harvest</th>
<th>Storage</th>
<th>Privately managed pool</th>
<th>Forward contract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW %</td>
<td>SA %</td>
<td>Vic %</td>
<td>NSW %</td>
<td>SA %</td>
</tr>
<tr>
<td>Age &lt; 45 yr</td>
<td>50</td>
<td>44</td>
<td>50</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>Age ≥ 45 yr</td>
<td>50</td>
<td>56</td>
<td>50</td>
<td>67</td>
<td>70</td>
</tr>
</tbody>
</table>

* No grower in the survey used this method

Source: John Williams, Main Study and comparative studies (2005)

Older South Australian wheat growers tended to use the National/export pool (56 percent compared to 44 percent), but the same conclusion might be reached for cash sales at harvest time (70 percent compared to 30 percent), storage (67 percent compared to 33 percent), and all privately managed pools users. However, those South Australian wheat growers who used forward contracts were all younger.

For those Victorian wheat growers who used the National/export pool, again there was no difference in age. Older Victorian wheat growers tended to use storage (67 percent compared to 33 percent). However, all wheat growers who used cash sales at harvest time tended to be younger.

**Age and hedging/pricing strategies - Main Study and comparative studies**

If age was to be a factor in hedging/pricing decision making, it would be expected to have some consistency for those growers who undertook no hedging/pricing. The effect of age for those wheat growers who did not use any hedging/pricing is summarized in Table 7.5.7.
From Table 7.5.7, the age of the wheat grower influenced marketing/pricing decision-making more in Victoria (100 percent) compared with NSW (44 percent) and SA (50 percent). However, the outcome was inconclusive with no consistent results.

**Table 7.5.7. Effect of age on wheat growers who did not hedge (by State) - 2005**

<table>
<thead>
<tr>
<th>Age characteristic</th>
<th>Growers who did not hedge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
</tr>
<tr>
<td>Age influences marketing/pricing decision-making</td>
<td>44%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

As a general conclusion, the results on age were inconclusive, thus supporting the original hypothesis that age does not affect the decision-making of wheat growers regarding marketing methods or hedging/pricing strategies.

**Age and marketing method and hedging/pricing strategy - Fisher Exact Test**

The results of age affecting NSW growers on decision-making regarding marketing methods and hedging/pricing strategies was tested in the Fisher Exact Test and summarized in Table 6.2.2 and Table 6.4.2. There was no significant difference at the P < 0.10 level between users and non-users for any of the five marketing methods or for the six hedging/pricing strategies on the effect of age on decision making.

**Conclusion:**

*The age of the wheat grower has little influence over decision-making regarding marketing methods and hedging/pricing strategies.*

**Debt**

It was hypothesized that as farm debt levels increase, there would less probability of growers using high cash flow risk marketing methods (such as storage) and more likely to use risk management in hedging/pricing strategies. Farm debt was measured in the Main Study as average overdraft and short/long-term debt as a percentage of current farm value.
Debt and the influence on marketing and hedging/pricing - A.F.F.A. study

The association between debt and forward selling was tested in the A.F.F.A. 2002 survey with grain growers in NSW, South Australia, and Victoria. Table 7.5.8 tested the statement ‘family debt is our biggest problem’ against the question ‘do you enter into any forward selling arrangements for the farm produce’.

Table 7.5.8. Debt and forward selling by grain producers by State - 2002

<table>
<thead>
<tr>
<th>Forward selling</th>
<th>NSW Agree</th>
<th>NSW Disagree</th>
<th>SA Agree</th>
<th>SA Disagree</th>
<th>Victoria Agree</th>
<th>Victoria Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes to forward selling</td>
<td>73%</td>
<td>55%</td>
<td>57%</td>
<td>38%</td>
<td>73%</td>
<td>50%</td>
</tr>
<tr>
<td>No to forward selling</td>
<td>27%</td>
<td>45%</td>
<td>43%</td>
<td>62%</td>
<td>27%</td>
<td>50%</td>
</tr>
</tbody>
</table>


A large proportion (73 percent) of grain growers in NSW and Victoria who had debt as their biggest problem undertook forward selling (Table 7.5.8.). In South Australia, the percentage of grain growers with debt problems who forward sold fell to 57 percent. Production risk combined with the high level of grain specialization (little farm enterprise diversification) might have lowered the result in South Australia. It might be concluded that perceived high debt grain growers in NSW, South Australia, and Victoria undertake some forward selling in the majority of cases.

Debt and the influence on marketing method - Main Study

Farm debt levels (average overdraft and short-term debt as a percentage of current farm value) were then tested against the marketing method using the NSW Main Study (Table 6.6.5.9).

High debt wheat growers in NSW were more likely to speculate with storage/warehousing (100 percent) than undertake any forward contracting (zero percent) or private managed pooling (zero percent). This contradicted the A.F.F.A. (2002) findings. There was little immediate cash flow for many of these high debt growers with only 33 percent using cash sales at harvest or delivering into the National/export pool (which facilitated some advanced payment cash flow within a short period).
Given that forward contracting decreased as debt levels increased, and given that high debt NSW wheat growers tended to use storage/warehousing in preference to more cash flow marketing methods, this suggests that increasing debt levels may result in less hedging/pricing and greater reliance on price speculation. The results suggest that high risk indebted growers may prefer high risk marketing methods, which would indicate consistency in the risk attitude of growers.

One major difference between Table 7.5.8 and Table 7.5.9 is in the perception of whether high debt is ‘the biggest farm problem’. For the larger NSW wheat growers, high debt may not be perceived to be a ‘problem’, in which case, storing/warehousing is undertaken despite the lack of cash flow and high opportunity costs. Smaller growers in South Australia and Victoria may be more likely to perceive debt as a ‘problem’, but it does not explain why a large majority would still use the National/export pool under high debt situations (except for convenience and cash flow).

**Debt and the influence on marketing method - comparative studies**

Farm debt levels for NSW were then tested against the marketing methods for wheat growers in South Australia and Victoria using the comparative studies (Table 6.6.5.9). The percentages of wheat growers in each debt category are also indicated.

**Table 7.5.9. Farm debt levels and marketing method by State - 2005**

<table>
<thead>
<tr>
<th>Marketing method</th>
<th>Farm debt levels *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low debt (0 – 19%)</td>
</tr>
<tr>
<td></td>
<td>NSW</td>
</tr>
<tr>
<td>National/export pool</td>
<td>33%</td>
</tr>
<tr>
<td>Cash sale near harvest</td>
<td>58%</td>
</tr>
<tr>
<td>Store/warehouse</td>
<td>25%</td>
</tr>
<tr>
<td>Privately managed pool</td>
<td>17%</td>
</tr>
<tr>
<td>Forward contract</td>
<td>25%</td>
</tr>
</tbody>
</table>

* Farm debt calculated as average overdraft and short-term debt as a percentage of current farm value

Source: John Williams, Main Study and comparative studies (2005)
More NSW wheat growers were in the medium debt category (63 percent) compared to South Australian or Victorian growers (20 – 40 percent). In contrast, a higher percentage of wheat growers from South Australia and Victoria were in the low debt category (55 – 60 percent) compared with NSW growers (30 percent). Victoria had the highest percentage in the high debt category (20 percent) compared to NSW or South Australia (5 – 7 percent).

The results indicated that wheat growers in South Australia and Victoria used the National/export pool when debt levels rose. On the assumption that growers used this pool because of income protection, this may have been contrary to past evidence that suggested this pool was less than 40 percent hedged (Bond et al, 1985).

Forward contracting decreased as debt levels increased for both NSW and South Australian wheat growers. At lower debt levels, wheat growers were more likely to use a range of marketing methods compared to higher debt levels.

**Debt and the influence on hedging/pricing strategy - Pilot Study**
The results regarding farm debt were tested against hedging activity in the Victorian Pilot Study (2005) and summarized in Table 7.5.10. A majority of wheat growers (61 percent) were in the low debt category, which may have reflected diversified farm income sources, with 27 percent in the medium debt category and only 8 percent classified as high debt.

<table>
<thead>
<tr>
<th>Hedging activity</th>
<th>Farm debt levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low debt (61%)</td>
</tr>
<tr>
<td></td>
<td>&lt; $300,000</td>
</tr>
<tr>
<td>Hedging activity</td>
<td>10%</td>
</tr>
<tr>
<td>No hedging activity</td>
<td>90%</td>
</tr>
</tbody>
</table>

Source: John Williams, Pilot Study (2005)

The majority of growers in Victoria (75 - 90 percent) undertook no hedging activity, which might reflect their higher production risk and their risk spreading activities such as farm
enterprise diversification. This lower usage of hedging might be also explained because the surveyed group may have been more production-orientated rather than marketing-orientated.

However, the percentage of high-debt Victoria growers who undertook hedging activity (25 percent) was much higher that the percentage of low debt growers who hedged (10 percent). This might have suggested a positive association between hedging activity and increased debt levels.

**Debt and the influence on hedging/pricing strategy - Main Study**

The Pilot Study results which identified a possible positive association between hedging activity and increased debt levels were then tested with the Main Study. The NSW Main Study results for debt levels and hedging activity are summarized in Table 7.5.11.

In contrast to the Victorian Pilot Study results, the NSW Main Study found that hedging activity was the highest (42 percent) at the low debt level, and decreased for higher debt levels (18 percent for medium debt levels, and 33 percent for high debt levels). The reversal of the results may reflect the increased farm size. As farm size increases, the proportion of cash flow to debt might be expected to increase, thus lowering the perception of debt-related risk. This may explain why hedging activity tended to decrease as debt levels increased for larger sized NSW growers.

**Debt and the influence on hedging/pricing strategy - comparative studies**

This negative association NSW finding was then tested with comparatives studies on South Australian and Victorian growers. The results are summarized in Table 7.5.11.

**Table 7.5.11. Farm debt levels and hedging activity by State - 2005**

<table>
<thead>
<tr>
<th>Hedging activity</th>
<th>Farm debt levels *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low debt (0 – 19%)</td>
</tr>
<tr>
<td></td>
<td>NSW</td>
</tr>
<tr>
<td>Hedging activity</td>
<td>42%</td>
</tr>
<tr>
<td>No hedging activity</td>
<td>58%</td>
</tr>
</tbody>
</table>

* Farm debt calculated as average overdraft and short-term debt as a percentage of current farm value

Source: John Williams, Main Study and comparative studies (2005)
Table 7.5.11 indicates that at least for Victorian wheat growers, higher debt levels were associated with more hedging activity. This agreed with the Pilot Study findings, and indicated research consistency. In contrast, both NSW and South Australian growers were more likely to have either less hedging activity (NSW) or no hedging activity (South Australia) with high debt levels. Again, the size of the farm might explain the reversal from positive association (Victoria) to a negative association (NSW and South Australia).

There was no hedging activity for low-debt Victorian growers. This contrasted with NSW and South Australian wheat growers who had the highest hedging activity in low-debt situations. It might therefore be concluded that a positive association occurs between debt levels and hedging activity for smaller size growers (which would be consistent with the A.F.F.A. results), and a negative association occurs for larger size growers.

Table 7.5.12 analyses farm debt levels and the importance of price risk management to farm income across the three States (NSW, South Australia, and Victoria).

<table>
<thead>
<tr>
<th>Importance of price risk management to farm income</th>
<th>Farm debt levels *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low debt (0 – 19%)</td>
</tr>
<tr>
<td></td>
<td>NSW</td>
</tr>
<tr>
<td>Agree</td>
<td>42%</td>
</tr>
<tr>
<td>Disagree</td>
<td>58%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* Farm debt calculated as average overdraft and short-term debt as a percentage of current farm value

Table 7.5.12 indicates that more NSW wheat growers who have low/medium debt levels agree on the importance of price risk management to farm income (42 – 44 percent) compared to growers with high debt levels (33 percent). This supports the research finding (negative association) for larger size growers. Both hedging activity and perceiving the importance or price risk management occur more for lower debt growers.

However, South Australian wheat growers had a much higher perception of the importance of price risk management to farm income (55 - 100 percent) than NSW growers (33 - 44 percent).
This might be explained because they were more specialized in wheat growing than their NSW counterparts, and their farm income was more likely to have a higher dependency on wheat prices.

South Australian wheat growers also had a positive association between debt levels and agreement that price risk management was important to farm income. However, while this agreement might be perceived, the reality in terms of hedging activity was the opposite (negative association between hedging activity and debt levels). This difference between perception and reality for South Australian growers might be explained through production risk, which reduces the ability to undertake hedging activity.

There was some evidence that Victorian wheat growers have more agreement that price risk management was important to farm income when debt levels rise (67 percent for low debt growers and 100 percent for medium debt growers). This supports the previous research finding that hedging activity for Victorian growers increases as farm debt levels increase. There was consistency in the research results for Victorian growers.

Conclusion:

1. A positive association is likely to occur between debt levels and hedging activity for smaller size growers, and a negative association is likely to occur for larger size growers.

2. NSW wheat growers (larger size farms) had a negative association between debt levels and agreement that price risk management was important to farm income. This was consistent with their negative association between hedging activity and debt levels. In contrast, Victoria (smaller size farms) had a positive association between debt levels and agreement that price risk management was important to farm income. This again was consistent with their positive association between hedging activity and debt levels. Alternatively, South Australian growers (medium size farms) had a negative association between debt levels and hedging activity, but a positive association between debt levels and agreement that price risk management was important to farm income. This inconsistency might be explained through greater specialization and high production risk.
**Farming experience**

It was hypothesized that farming experience does not affect the decision-making of wheat growers regarding marketing methods and hedging/pricing strategies. The marketing experience of the grower was determined in the Pilot Study, but this may not have been the same as farming experience. Also, correlating marketing experience with marketing methods and hedging/pricing strategies did not prove that marketing experience affected decision-making. The effect of farming experience on decision-making regarding marketing methods was therefore asked directly in the subsequent surveys.

**Farming experience and the effect on marketing method - Main Study**

Results that examined farm experience against the five marketing methods for NSW growers in the Main Study are summarized in Table 7.5.13.

Growers with more than 20 years farming experience were more likely to use storage (75 percent), forward contracting (75 percent), and privately managed pools (83 percent), compared to the National/export pool (56 percent) and cash sales at harvest (58 percent). Growers with less than 20 years farming experience were more likely to use the National/export pool (44 percent) and cash sales at harvest (42 percent), compared to storage (25 percent), forward contracting (25 percent), and privately managed pools (17 percent).

**Farming experience and the effect on marketing method - comparative studies**

The NSW results that examined farm experience against the five marketing methods for NSW growers in the Main Study were then tested against South Australian and Victorian growers in the comparative studies. Outcomes are summarized in Table 7.5.13.

The comparative studies indicated some consistency in that South Australian growers with more than 20 years farming experience were more likely to use storage (67 percent) and privately managed pools (100 percent), compared to the National/export pool (50 percent) and cash sales at harvest (60 percent). The major difference was for forward contracting (40 percent), which
might be explained by older growers understanding the high production/delivery risks involved with forward contracting in marginal production regions when they were highly specialized in wheat. South Australian growers with less than 20 years farming experience were more likely to use the National/export pool (50 percent) and cash sales at harvest (40 percent), compared to storage (33 percent) and privately managed pools (zero percent). More inexperienced growers tended to have a higher percentage usage of forward contracting (60 percent).

Table 7.5.13. Farm experience and wheat marketing methods used by State - 2005

<table>
<thead>
<tr>
<th>Farm experience</th>
<th>National/export pool</th>
<th>Cash sale at harvest</th>
<th>Storage</th>
<th>Privately managed pool</th>
<th>Forward contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW</td>
<td>44</td>
<td>42</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>SA</td>
<td>50</td>
<td>40</td>
<td>33</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Vic</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>≥ 20 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW</td>
<td>56</td>
<td>58</td>
<td>75</td>
<td>83</td>
<td>25</td>
</tr>
<tr>
<td>SA</td>
<td>50</td>
<td>60</td>
<td>75</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>Vic</td>
<td>75</td>
<td>100</td>
<td>60</td>
<td>100</td>
<td>75</td>
</tr>
</tbody>
</table>

* No grower in the survey used this method

Source: John Williams, Main Study and comparative studies (2005)

More experienced Victorian wheat growers were slightly more inclined to use cash sales at harvest time and storage (100 percent), compared to the National/export pool (75 percent). Less experiences growers were more inclined to use the National/export pool (25 percent), relative to the other marketing methods.

As a very general conclusion, growers with more than 20 years farming experience were more likely to use storage and privately managed pools, and less likely to use the National/export pool and cash sales at harvest (except for Victorian growers). Growers with less than 20 years farming experience were more likely to use the National/export pool and cash sales at harvest (except for Victorian growers), and less likely to use storage and privately managed pools. More experienced NSW growers were more likely to use forward contracting, while more experienced South Australian growers were less likely to use forward contracting.

Farming experience and the effect on marketing method - Fisher Exact Test

Results relating to farm experience were tested between the users and non-users of the five marketing methods in the Fisher Exact Test, and summarized in Table 6.2.2. There was no significant difference at the P < 0.10 level between users and non-users for any of the five marketing methods that related to farming experience.
If there was a significant difference between users and non-users of the various marketing methods, then it would have been expected to have shown in the Fisher Exact Test. This no significant difference outcome from the Fisher Exact Test somewhat weakened the findings in the Main Study and the comparative studies that farming experience influenced decisions regarding marketing methods.

**Farming experience and the effect on hedging/pricing strategy - Main Study**

The effect of farming experience on decisions relating to hedging/pricing strategies was then examined for NSW growers in the Main Study in two ways. Farming experience was firstly examined against growers who did not hedge/price. Then the direct question as to whether farming experience influences marketing/pricing decision-making for growers who did not hedge/price was examined. The results are summarized in Table 7.5.14.

NSW growers who did not hedge were more likely to have more than 20 years experience (75 percent). This outcome was supported by 85 percent of NSW growers who did not hedge agreeing that farming experience influences marketing/pricing decision-making.

**Farming experience and the effect on hedging/pricing strategy - comparative studies**

The NSW Main Study results were then tested against the results for South Australian and Victorian growers in the comparatives studies. Outcomes are summarized in Table 7.5.14.

**Table 7.5.14. Effect of farming experience on wheat growers who did not hedge - 2005**

<table>
<thead>
<tr>
<th>Farm experience characteristic</th>
<th>Growers who did not hedge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
</tr>
<tr>
<td>Growers with &lt; 20 years farming experience</td>
<td>25</td>
</tr>
<tr>
<td>Growers with &gt; 20 years farming experience</td>
<td>75</td>
</tr>
<tr>
<td>Farming experience influences marketing/pricing decision-making</td>
<td>85</td>
</tr>
<tr>
<td>Farming experience does not influence marketing/pricing decision-making</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)
Generally, there was consistency in the comparative results. Victorian growers who did not hedge were more likely to have more than 20 years experience (100 percent). This outcome was supported by 100 percent of Victorian growers who did not hedge agreeing that farming experience influences marketing/pricing decision-making.

South Australian growers did not have a clear majority between farming experience and not hedging (50 percent), possibly due to wheat specialization in marginal regions. However, when the direct question (did farming experience influence marketing/pricing decision-making) was asked, the majority of South Australian growers (86 percent) agreed that farming experience did influence marketing/pricing decision-making.

**Farming experience and the effect on hedging/pricing strategy - Fisher Exact Test**

The question (farming experience influences marketing/pricing decision-making) was then tested between the users and non-users of the six hedging/pricing strategies in the Fisher Exact Test, with the results summarized in Table 6.4.2. There was no significant difference at the P < 0.10 level between users and non-users for any of the six hedging/pricing strategies that related to farming experience.

If there was a significant difference between users and non-users regarding growers who did not hedge, then it would have been expected to have shown in the Fisher Exact Test. This no significant difference outcome from the Fisher Exact Test somewhat weakened the findings in the Main Study and the comparative studies that farming experience influenced hedging/pricing strategy.

**Conclusions:**

1. Growers with more than 20 years farming experience were more likely to use storage and privately managed pools, and less likely to use the National/export pool and cash sales at harvest (except for Victorian growers). Growers with less than 20 years farming experience were more likely to use the National/export pool and cash sales at harvest (except for Victorian growers), and less likely to use storage and privately managed pools. More experienced NSW
growers were more likely to use forward contracting, while more experienced South Australian growers were less likely to use forward contracting.

2. There was some evidence that the farming experience of the wheat grower had some influence over decision-making regarding marketing method and hedging/pricing strategy. However, there were no significant differences detected in the Fisher Exact Test between users and non-users either for marketing methods or hedging/pricing strategies.

**Training**

It was hypothesized that relevant training might affect the decision-making of wheat growers regarding marketing methods and hedging/pricing strategies. The A.F.F.A. (2002) survey had no specific question asked on price risk management training courses. To address this hypothesis, there was a need to closely examine training course participation that was specific to marketing and price risk management.

There was no attempt made to test dependency on third factors, such as belonging to a support group. The Pilot Study sample was taken from a group that was focused on production cost management, so there may have had a bias against marketing and pricing. However, the sample group for NSW wheat growers in the Main Study included both known attendees from previous relevant training courses as well those who had not been recorded as attending relevant training programs, in order to minimize sample biasness.

There was no attempt made to distinguish between individual farmer decision-making and corporate farm management, which would have introduced other issues such as the education and skills of corporate managers. None of the survey questions defined what was meant by ‘relevant training’. It was assumed that the individual respondent could decide whether or not relevant training had been undertaken.
Training and its effect on marketing methods - Pilot Study

Relevant training course participation by Victorian wheat growers is analysed against the marketing methods in Table 7.5.15 using the Pilot Study.

Table 7.5.15. Relevant training and marketing method for Victoria - 2005 (Pilot Study)

<table>
<thead>
<tr>
<th>Relevant training course attendance</th>
<th>National/export pool</th>
<th>Cash sale at harvest</th>
<th>Storage</th>
<th>Privately managed pool</th>
<th>Forward contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>76%</td>
<td>55%</td>
<td>59%</td>
<td>7%</td>
<td>31%</td>
</tr>
<tr>
<td>No</td>
<td>59%</td>
<td>73%</td>
<td>68%</td>
<td>14%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Source: John Williams, Pilot Study (2005)

Victorian wheat growers who had relevant training were more likely to deliver into the National/export pool (76 percent) compared to growers with no relevant training (59 percent). Similarly, wheat growers who had relevant training were more likely to forward contract (31 percent) compared to growers with no relevant training (9 percent).

In contrast, wheat growers who had relevant training were less likely to make cash sales at harvest compared to growers who had no relevant training (55 percent compared to 73 percent), less likely to store compared to growers who had no relevant training (59 percent compared to 68 percent), and less likely to use privately managed pools compared to growers who had no relevant training (7 percent compared to 14 percent).

Training and its effect on marketing methods - Main Study

Attendance at two days of relevant training was then examined against the marketing method in the Main Study (Table 7.5.16).

NSW wheat growers who attended two days of relevant training were more likely to deliver into the National/export pool (40 percent compared to 25 percent), have cash sales at harvest (63 percent compared to 50 percent), and forward contract (22 percent compared to zero percent) compared to growers with no relevant training. There were no substantial differences between attendees and non-attendees for users of storage (28 to 25 percent) and private managed pools (13 percent each).
Training and its effect on marketing methods - comparative studies

The NSW results from the Main Study were then examined against South Australian and Victorian growers in the comparative studies. These are also summarized in Table 7.5.16.

Table 7.5.16. Relevant training and marketing method by State - 2005

<table>
<thead>
<tr>
<th>Training course attendance</th>
<th>National/export pool</th>
<th>Cash sale at harvest</th>
<th>Storage</th>
<th>Privately managed pool</th>
<th>Forward contract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
<td>Vic</td>
<td>NSW</td>
<td>SA</td>
</tr>
<tr>
<td>Yes</td>
<td>40%</td>
<td>93%</td>
<td>80%</td>
<td>63%</td>
<td>47%</td>
</tr>
<tr>
<td>No</td>
<td>25%</td>
<td>80%</td>
<td>*</td>
<td>50%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* All surveyed Victorian wheat growers had attended two days of relevant training

South Australian wheat growers who attended two days of relevant training were more likely to deliver into the National/export pool (93 percent compared to 80 percent), undertake storage (20 percent compared to zero percent), and use privately managed pools (7 percent compared to zero percent). They were less likely to use cash sales at harvest (47 percent compared to 60 percent) and forward contract (20 percent compared to 40 percent) compared to growers with no relevant training.

The Victorian results were limited by all the surveyed growers having attended relevant training programs. Those who had attended two days of relevant training used the National/export pool (80 percent), storage (60 percent), and cash sales at harvest (20 percent).

Training and its effect on marketing methods - Fisher Exact Test

There was one survey question which tested training against the marketing methods used. The question as to whether more training would have contributed to a better marketing/pricing performance was tested for significant differences between users and non-users of each marketing method at P < 0.10 in the Fisher Exact Test. Results are summarized in Table 6.2.2. There was no significant difference at the P < 0.10 level between users and non-users for any of the five marketing methods on whether more training would have contributed to a better marketing/pricing performance.
In comparing the overall results of the Pilot Study, Main Study, comparative studies, and the Fisher Exact Test, there was little conclusiveness in the outcome. The only consistency was that wheat growers who attended two days of relevant training were more likely to deliver into the National/export pool compared to growers with no relevant training. However, usage of the National/export pool varied widely between regions.

There may have been some evidence of linkage between relevant training and usage of forward contracts in NSW where there were larger farms, less wheat specialization, and less marginality. However, in South Australia and Victoria, there was no evidence of any such linkage, presumably because of higher production/delivery risk.

Therefore, any findings that there were associations between relevant training and the marketing method used were inconclusive.

**Training and its effect on hedging/pricing strategies - Pilot Study**

Attendance by wheat growers at two days of relevant training was then examined against the use of hedging/pricing strategies. Results from the Victorian Pilot Study are summarized in Table 7.5.17.

**Table 7.5.17. Relevant training and hedging activity for Victoria (Pilot Study) – 2005**

<table>
<thead>
<tr>
<th>Hedging/pricing activity</th>
<th>Training course attendance by wheat growers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attended 2 days marketing/hedging training</td>
</tr>
<tr>
<td>Hedging/pricing activity</td>
<td>17%</td>
</tr>
<tr>
<td>No hedging/pricing activity</td>
<td>83%</td>
</tr>
</tbody>
</table>

Source: John Williams, Pilot Study (2005)

Table 7.5.17 indicated that few Victorian wheat growers (17 percent) who had attended two days of relevant training courses undertook any hedging/pricing activity for 2005. The majority (83 percent) did not undertake any hedging/pricing activity.
There was a difference between those wheat growers who attended relevant training and hedged (17 percent), with those who did not attend relevant training and hedged (5 percent). A decrease of 12 percent did not appear significant when 83 percent of growers who attended relevant training undertook no hedging/pricing activity in a year that had relatively good rainfall and production. Because delivery risk and settlement risk were minimal for the 2005 season, the low hedging/pricing activity may have been due to the background of the surveyed sample in the Pilot Study. This suggested another sample was required to test Victorian growers.

The results regarding attendance by wheat growers at two days of relevant training were then analyzed by the type of hedging/pricing strategy. Table 7.5.18 summarizes the results from the Victorian Pilot Study.

**Table 7.5.18. Relevant training and hedging strategy for Victoria (Pilot Study) - 2005**

<table>
<thead>
<tr>
<th>Training course attendance</th>
<th>Hedging/pricing strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hedged through futures broker/adviser</td>
</tr>
<tr>
<td>Yes</td>
<td>60%</td>
</tr>
<tr>
<td>No</td>
<td>0%</td>
</tr>
</tbody>
</table>

* No surveyed Victorian wheat grower hedged through a merchant

Of those Victorian wheat growers who had attended two days of relevant training, 60 percent hedged/priced through futures brokers/advisers, and 40 percent hedged/priced through banks. There were no Victorian wheat growers in the Pilot Study who had two days of training and hedged through a merchant.

All Victorian wheat growers who had not attended two days of relevant training yet still undertook hedging/pricing activity did so through a private pool manager. If it is presumed that growers use a private pool manager to hedge/price on their behalf, then the perception of the need for training might be diminished.
Training and its effect on hedging/pricing strategies - Main Study

NSW wheat growers who had attended at least two days of relevant training were then analyzed in the Main Study against their hedging/pricing activity (Table 7.5.19).

Only 37 percent of those NSW wheat growers who attended at least 2 days of marketing/hedging training undertook any hedging/pricing activity during 2005 (Table 7.5.19). However, non-attendees at relevant course training programs undertook far less hedging (12 percent) compared to the attendees (37 percent) when comparing the two groups within the same 2005 year. There was some evidence that those NSW growers who attended at least 2 days of marketing/hedging training undertook some hedging/pricing activity.

Attendance by wheat growers at two days of relevant training were then analyzed by the type of hedging/pricing strategy in the Main Study (Table 7.5.20).

Of those NSW wheat growers who had attended at least two days of relevant training, 46 percent hedged through futures brokers/advisers, 69 percent through merchants, and 62 percent through banks. All NSW wheat growers who had never attended two days of relevant training yet still hedged/priced did so through a private pool manager.

Training and its effect on hedging/pricing strategies - comparative studies

The results for the NSW wheat growers who had attended at least two days of relevant training were then compared with South Australian and Victorian growers in the comparative studies against their hedging/pricing activity (Table 7.5.19).

Table 7.5.19. Relevant training and hedging activity for wheat growers by State - 2005

<table>
<thead>
<tr>
<th>Hedging/pricing activity</th>
<th>Training course attendance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attended 2 days marketing/hedging training</td>
<td>Not attended 2 days marketing/hedging training</td>
</tr>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
</tr>
<tr>
<td>Hedging/pricing activity</td>
<td>37%</td>
<td>40%</td>
</tr>
<tr>
<td>No hedging/pricing activity</td>
<td>63%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* All surveyed Victorian wheat growers had attended two days of relevant training
The hedging/pricing activity outcomes for South Australia and Victoria growers who had attended at least two days of relevant training were slightly higher (40 percent) than NSW growers. These percentages for Victorian growers were also much higher than those achieved in the Pilot Study, possibly due to the different background of the growers in the survey samples.

A similar situation to NSW occurred for South Australian wheat growers with only 20 percent hedging/pricing for the non-attendees, whilst the attendees had double the hedging activity (40 percent). All Victorian wheat growers had attended relevant training programs, so the comparison could not be made.

Attendance by wheat growers at two days of relevant training were then analyzed by the type of hedging/pricing strategy in the comparative South Australian and Victorian studies (Table 7.5.20).

**Table 7.5.20. Relevant training and hedging strategy by State (mutually exclusive) - 2005**

<table>
<thead>
<tr>
<th>Training course attendance</th>
<th>Hedging/thru futures broker/adviser</th>
<th>Hedging/thru merchant</th>
<th>Hedging/thru bank</th>
<th>Hedging/thru a private pool manager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
<td>Vic</td>
<td>NSW</td>
</tr>
<tr>
<td>Yes</td>
<td>46%</td>
<td>**</td>
<td>0%</td>
<td>69%</td>
</tr>
<tr>
<td>No</td>
<td>0%</td>
<td>**</td>
<td>*</td>
<td>0%</td>
</tr>
</tbody>
</table>

* All surveyed Victorian wheat growers had attended two days of relevant training
** No surveyed South Australian grower hedged through a futures broker/adviser

Those South Australian growers who had attended two days of relevant training were more likely to hedge/price through merchants (100 percent), private pool managers (33 percent) and banks (17 percent). South Australian growers who did not attend two days of relevant training yet still hedged/priced did so through merchants (100 percent) and private pool managers (100 percent).
Those Victorian growers who had attended two days of relevant training hedged/priced either through merchants (50 percent) or banks (50 percent). The Victorian results were limited by all the surveyed growers having attended relevant training programs.

**Training and its effect on hedging/pricing strategies - Fisher Exact Test**

Whether more training would have contributed to a better marketing/pricing performance was then also tested against each of the hedging/pricing strategies. Results from the Fisher Exact Test which tested for significant difference at the P < 0.10 level between users and non-users for each of the six hedging/pricing strategies are summarized in Table 6.2.4. There were areas of significant difference between users and non-users for two of the six hedging/pricing strategies.

Users of futures advisers were more likely (P = 0.07) to acknowledge that more training would have contributed to a better performance, relative to non-users. This might suggest that when wheat growers use futures advisers, they are more likely to acknowledge that more training would have contributed to a better performance.

When wheat growers who undertook no hedging/forward pricing were examined, they were less likely (P = 0.054) to acknowledge that more training would have contributed to a better performance, relative to non-users. However, if growers undertook no hedging/forward pricing because of production risk, then it was highly unlikely for these growers to acknowledge that more training would have contributed to a better performance.

**Motivation to manage price risk - Main Study**

The association between attending two days of relevant training and motivation to undertaken price risk management was examined for NSW wheat growers. Those NSW wheat growers who had undertaken a minimum two days of relevant training were more likely (Table 7.5.21) to be motivated to manage price risk through opportunities to maximize income (25 percent), the expectation of price falling (22 percent), knowledge of past risks (9 percent), as well as loss avoidance and recognition of price volatility (13 percent). There were 31 percent of NSW growers who had attended training but who had no motivation to manage price risk.
Table 7.5.21. Training and factors motivating NSW growers to manage price risk - 2005 *

<table>
<thead>
<tr>
<th>Training characteristic</th>
<th>Main factor motivating NSW wheat growers to manage price risk *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loss avoidance</td>
</tr>
<tr>
<td>Attended training</td>
<td>13%</td>
</tr>
<tr>
<td>No training</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study (2005)

* Some growers indicated more than one main motivating factor, therefore the row percentages may exceed 100 percent.

The growers who had not undertaken relevant training were likely to be motivated to manage price risk through opportunities to maximize income (29 percent) and a knowledge of past risks (14 percent), but less likely to be motivated by loss avoidance, expectation of prices falling, and recognition of price volatility. There were 57 percent of NSW growers who had not attended relevant training and had no motivation to manage price risk.

Factors limiting NSW wheat growers in managing price risk were then analysed against previous attendance at relevant training courses (Table 7.5.22). Theory suggested that production risk should have been a major limitation for NSW wheat growers.

Table 7.5.22. Training and factors limiting NSW growers to manage price risk - 2005 *

<table>
<thead>
<tr>
<th>Training characteristic</th>
<th>Main factor limiting NSW wheat growers to manage price risk *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transaction cost</td>
</tr>
<tr>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Attended training</td>
<td>0%</td>
</tr>
<tr>
<td>No training</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study (2005)

* Some growers indicated more than one main factor, therefore the row percentages may exceed 100 percent.

The analysis indicated that production risk was the major limiting factor, regardless of the training course attendance. However, those wheat growers who had no relevant training in marketing/hedging were more likely to be limited in managing price risk by production risk (71 percent), compared to those growers with relevant training (56 percent). The lack of training in marketing/hedging despite an acknowledgement of a lack of relevant knowledge/skills (14
percent) might therefore be caused by the grower’s perception of high production risk undermining any benefits from price risk management.

For those NSW wheat growers who had training in marketing/hedging, production risk (56 percent) was the major limitation in managing price risk. The lack of volatility/opportunities (19 percent), lack of sufficient knowledge/skills (13 percent), and added hedging risks (3 percent) were minor limitations in managing price risk.

Conclusions:

1. There was inconclusiveness over any association between relevant training and the marketing method used.

2. Production/delivery risk and settlement risk were more likely to explain the reason not to hedge/price than any non-attendance of relevant training.

3. There was some evidence that those growers who attended at least 2 days of relevant marketing/hedging training undertook more hedging/pricing activity than those growers who did not attend at least 2 days of marketing/hedging training.

4. There was some evidence that for NSW wheat growers who had attended at least two days of relevant training, a large percentage hedged/priced through futures brokers/advisers, merchants, and banks. Training may have broadened the type of hedging/pricing strategy used. Those wheat growers who had never attended two days of relevant training yet still hedged/priced generally did so through a private pool manager.

5. Wheat growers are more likely to acknowledge that more training would have contributed to a better performance when they use futures advisers. If growers undertook no hedging/forward pricing because of production risk, then it was highly unlikely for these growers to acknowledge that more training would have contributed to a better performance.
6. Those NSW wheat growers who had undertaken a minimum two days of relevant training were more likely to be motivated to manage price risk by a variety of factors including opportunities to maximize income (25 percent), the expectation of price falling (22 percent), knowledge of past risks (9 percent), as well as loss avoidance and recognition of price volatility (13 percent).

7. Those wheat growers who had no relevant training in marketing/hedging were more likely to be limited in managing price risk by production risk (71 percent), compared to those growers with relevant training (56 percent). The lack of training in marketing/hedging despite an acknowledgement of a lack of relevant knowledge/skills (14 percent) might be caused by the grower’s perception of high production risk undermining any benefits from price risk management.

7.6. Research question 6

Do past bad decisions over marketing methods or hedging/pricing strategies lead to regret and avoidance by wheat growers, or to learning and seeking more knowledge?

It is hypothesized that past bad decisions over marketing methods or hedging/pricing strategies have lead to regret by some wheat growers, which has led to avoidance of some marketing methods or hedging/pricing strategies. It is also hypothesized that for some growers, past bad decisions over marketing methods or hedging/pricing strategies have lead to learning and seeking more knowledge. ‘Bad decisions’ were not defined in the survey but were assumed to have led to financial losses by the grower.

Bad decisions leading to regret and avoidance for marketing methods - Main Study

The question as to whether past bad marketing/pricing decisions led to regret and avoidance of repeating the decision was examined against the five marketing methods in the Main Study for NSW wheat growers. Results are summarized in Table 7.6.1.
It could be assumed that the grower was using the particular marketing method because of past regret and avoidance of other marketing methods. The issue of whether the grower used the current marketing method despite past regret and avoidance was not determined.

The highest NSW incidence of regret and avoidance occurred for storage users (44 percent). But whether growers were using storage because of regret and avoidance of other marketing methods, or whether they were using storage despite regret and avoidance, could not be determined by this survey method and analyses. Users of the National export pool, cash sales at harvest time, and forward contracting all had some growers who had experienced regret and avoidance (21 - 33 percent).

The lowest regret and avoidance for NSW growers (17 percent) occurred for users of privately managed pools. This is consistent with the transference of responsibility from the grower to a pool manager. Whether growers perceived less regret and avoidance because it was not their responsibility, or whether the private pool manager actually provided performance outcomes that resulted in less regret and avoidance was not determined by the survey method or analyses.

**Bad decisions leading to regret and avoidance for marketing methods - comparative studies**
The NSW results as to whether past bad marketing/pricing decisions led to regret and avoidance of repeating the decision was then examined against the five marketing methods for South Australian and Victorian wheat growers in the comparative studies (Table 7.6.1).

**Table 7.6.1. Regret/avoidance and marketing method (mutually exclusive) by State 2005**

<table>
<thead>
<tr>
<th>Decisions led to regret &amp; avoidance</th>
<th>National/export pool</th>
<th>Cash sale at harvest</th>
<th>Storage</th>
<th>Privately managed pool</th>
<th>Forward contract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
<td>Vic</td>
<td>NSW</td>
<td>SA</td>
</tr>
<tr>
<td>Yes</td>
<td>33%</td>
<td>67%</td>
<td>25%</td>
<td>21%</td>
<td>70%</td>
</tr>
<tr>
<td>No</td>
<td>67%</td>
<td>33%</td>
<td>75%</td>
<td>79%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* No surveyed Victorian wheat grower used this marketing method
South Australian wheat growers experienced higher levels of regret and avoidance compared to NSW growers for all marketing methods except for privately managed pools (zero percent). The percentage of South Australian growers with regret and avoidance using either the National export pool, cash sales at harvest time, and storage were approximately double (67 - 70 percent) that realized for NSW growers.

This outcome for South Australian growers might be explained due to greater dependency on wheat (specialization). Regret and avoidance for South Australian users of forward contracting were much lower (25 percent) despite the incurrence of physical delivery risk. Again, there was research outcome consistency with users of privately managed pools having the lowest incidence of regret and avoidance.

Results for Victorian wheat growers varied widely according to the marketing method, which may be explained because of less dependency on wheat (higher levels of farm income diversification). Users of cash sales at harvest had the highest incidence of regret and avoidance (100 percent), followed by storage (67 percent), and then the National/export pool (25 percent).

**Bad decisions leading to regret and avoidance for marketing methods - Fisher Exact Test**

The Fisher Exact Test was then used to test for significant differences in regret and avoidance from past bad marketing method decisions between NSW users and non-users for each of the five marketing methods. There was no significant difference between users and non-users for the National/export pool, storage, privately managed pools and forward contracting (Tables 6.3.2 and 6.3.3).

However, there was a significant difference ($P = 0.02$) between users and non-users of cash sales at harvest for NSW wheat growers. Cash sale users were less likely to have bad decisions in the past leading to regret/avoidance of repeating the decision, relative to non-users.

Growers may be implying that they incur less regret and avoidance with cash sales compared to other marketing methods. Alternatively, they may have been indicating that despite previous bad decisions, they were still prepared to use cash sales as a marketing method. The demands for
other considerations such as cash flow to repay debt may have over-ridden the negative associations of regret and avoidance.

It might be surmised that cash sales at harvest is equivalent to ‘doing nothing’ in that other marketing methods required a deliberate decision to do something about marketing either before or after harvest, but these had been rejected in lieu of immediate spot sales at harvest time. The results of the P test might then suggest that the reason why many growers undertook cash sales at harvest was because of regret and avoidance of other more deliberate marketing methods.

**Bad decisions leading to regret and avoidance for hedging/pricing strategies - Main Study**

The theory that past bad marketing/pricing decisions led to regret and avoidance was then examined in the Main Study for NSW growers who undertook no hedging/pricing activity. The issue of dependency (whether growers undertook no hedging/pricing because of regret and avoidance, or whether regret and avoidance led growers to undertake no hedging/pricing) was not determined. It was hypothesized that wheat growers might avoid all hedging/pricing activity if past bad marketing/pricing decisions have led to regret and avoidance.

Those NSW wheat growers who undertook no hedging/pricing activity were examined against regret and avoidance criteria in the Main Study, with the results summarized in Table 7.6.2. Growers who had no hedging/pricing activity were simply divided into those that agreed that past bad marketing decisions led to regret and avoidance, and those that did not agree.

There was no difference in agreement whether or not past bad marketing decisions led to regret and avoidance for NSW wheat growers who had no hedging/pricing activity. An equal number of growers who had no hedging/pricing activity (50 percent) agreed and disagreed that past bad marketing decisions led to regret and avoidance. However, it might be concluded that 50 percent was a relatively large percentage for growers experiencing regret and avoidance.

Whether past bad decisions leading to regret and avoidance was affected by the type of hedging/pricing strategy was then examined in the Main Study for NSW wheat growers (Table
7.6.3). Again, the issue of whether the grower used the current hedging/pricing strategy despite past regret and avoidance was not determined.

Hedging/pricing strategies that had most regret and avoidance for NSW growers were futures brokers (50 percent), privately managed pools (50 percent) and merchants (40 percent). The results from the latter two hedging/pricing strategies (privately managed pools and merchants) were not consistent with the results from Table 7.6.1 where users of privately managed pools and forward contracting (historically this has been mostly with merchants rather than with end-users) recorded lower percentages of regret and avoidance.

The percentage of regret and avoidance with bank hedging (12 percent) and futures advisers (17 percent) for NSW wheat growers might be considered low in 2005, but there is empirical evidence that regret and avoidance of bank hedging and futures advisers dramatically increased during the 2007 season when another Australian drought occurred and cash settlement payouts were substantial. Regret and avoidance might therefore be also dependent on the season, the size of the financial loss, as well as the ability of the grower to recall the experience.

### Bad decisions leading to regret-avoidance for hedging strategies - Comparative studies

The NSW results for past bad marketing/pricing decisions leading to regret and avoidance were then examined in the comparative studies for South Australian and Victorian growers who did no hedging activity (Table 7.6.2).

#### Table 7.6.2. Regret/avoidance and no hedging activity by State – 2005

<table>
<thead>
<tr>
<th>Past bad marketing/pricing decisions</th>
<th>No hedging/pricing activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
</tr>
<tr>
<td>Led to regret &amp; avoidance</td>
<td>50%</td>
</tr>
<tr>
<td>Did not lead to regret &amp; avoidance</td>
<td>50%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

The hypothesis that wheat growers might avoid all hedging/pricing activity if past bad marketing/pricing decisions have led to regret and avoidance was seemingly upheld for South Australian wheat growers (77 percent), but not for Victorian growers (zero percent). This is
consistent with regret and avoidance impacting greater for more specialized South Australian growers, compared with winter-summer crop diversified NSW growers, and more farm enterprise diversified growers in Victoria.

Table 7.6.3 examined whether past bad decisions leading to regret and avoidance was affected by the type of hedging/pricing strategy between the three States.

Those South Australian wheat growers who hedged using merchants and banks were less likely to agree that past bad decisions led to regret and avoidance (43 percent for those using merchants and zero percent for those who used banks). But this was only for the 2005 season. In contrast, those South Australian wheat growers who hedged using private pool managers were more likely (67 percent) to agree that past bad decisions led to regret and avoidance. This suggests that bad decisions by growers may lead to the transference of hedging/pricing activity to an external private pool manager.

Table 7.6.3. Regret/avoidance and hedging strategy (mutually exclusive) by State - 2005

<table>
<thead>
<tr>
<th>Decisions led to regret &amp; avoidance</th>
<th>Hedged through futures broker</th>
<th>Hedged through futures adviser</th>
<th>Hedged through merchant</th>
<th>Hedged through bank</th>
<th>Hedged through a private pool manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>SA</td>
<td>Vic</td>
<td>NSW</td>
<td>SA</td>
<td>Vic</td>
</tr>
<tr>
<td>Yes</td>
<td>50%</td>
<td>*</td>
<td>*</td>
<td>17%</td>
<td>*</td>
</tr>
<tr>
<td>No</td>
<td>50%</td>
<td>*</td>
<td>*</td>
<td>83%</td>
<td>*</td>
</tr>
</tbody>
</table>

* No surveyed grower hedged using this method

Alternatively, those Victorian growers who hedged using merchants were more likely to agree (100 percent) that past bad decisions led to regret and avoidance. Those Victorian growers who hedged using banks were less likely to agree (zero percent) that past bad decisions led to regret and avoidance. But this was only for the 2005 season. The type of season (or the degree of marginality) might be expected to change the percentages of those growers incurring regret and avoidance.
Bad decisions leading to regret-avoidance for hedging strategies - Fisher Exact Test
There was no significant difference between users and non-users of hedging/pricing strategies in the Fisher Exact Test (Tables 6.5.2 and 6.5.3) regarding regret and avoidance due to past bad hedging/pricing decisions. This may support the finding that there were other factors influencing regret and avoidance other than merely using the hedging/pricing strategy (such as the occurrence of drought), at least for the 2005 season.

Bad decisions leading to learning-knowledge for marketing methods - Main Study
Bad marketing/pricing decisions in the past were then examined more positively. Rather than leading to regret and avoidance, the question as to whether bad past marketing/pricing decisions wheat growers led to learning and searching for more knowledge was then examined for NSW wheat growers in the Main Study against the five marketing methods. Table 7.6.4 summarizes the results.

The NSW results indicated that there was high agreement (67 - 100 percent) across all five marketing methods that bad past marketing/pricing decisions wheat growers led to learning and searching for more knowledge.

Bad decisions leading to learning-knowledge for marketing methods - comparative studies
The NSW results as to whether bad past marketing/pricing decisions wheat growers led to learning and searching for more knowledge were then compared against South Australian and Victorian wheat growers in the comparative studies for the five marketing methods (Table 7.6.4).

Table 7.6.4. Learning/knowledge and marketing method (mutually exclusive) by State 2005

<table>
<thead>
<tr>
<th>Decisions led to learning/knowledge</th>
<th>National/export pool</th>
<th>Cash sale at harvest</th>
<th>Storage</th>
<th>Privately managed pool</th>
<th>Forward contract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW</td>
<td>SA</td>
<td>Vic</td>
<td>NSW</td>
<td>SA</td>
</tr>
<tr>
<td>Yes</td>
<td>67%</td>
<td>89%</td>
<td>75%</td>
<td>75%</td>
<td>100%</td>
</tr>
<tr>
<td>No</td>
<td>33%</td>
<td>11%</td>
<td>25%</td>
<td>25%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* No surveyed Victorian wheat grower used this marketing method
The NSW finding that there was high agreement across all five marketing methods that bad past marketing/pricing decisions wheat growers led to learning and searching for more knowledge was supported by the South Australian (89 - 100 percent) and Victorian (75 - 100 percent) results. The conclusion is that previous bad decisions regarding marketing/pricing have some positive outcomes (learning and searching for more knowledge) for the majority of wheat growers.

**Bad decisions leading to learning-knowledge for marketing methods - Fisher Exact Test**

The finding (previous bad decisions regarding marketing/pricing have some positive outcomes in learning and searching for more knowledge for the majority of wheat growers) was supported by the Fisher Exact Test (Table 6.3.2) which found that there was no significant difference between users and non-users for any of the five marketing methods.

Regardless of the marketing method used, wheat growers across very different and diverse regions were more likely to agree that previous bad decisions regarding marketing/pricing led to learning and searching for more knowledge.

**Bad decisions leading to learning-knowledge for hedging/pricing strategies - Main Study**

Previous bad decisions regarding marketing/pricing leading to learning and searching for more knowledge was then examined against no hedging/pricing activity for NSW growers in the Main Study. Results are summarized in Table 7.6.5. It might be hypothesized that wheat growers who have incurred bad decisions regarding marketing/pricing in the past could be indifferent to learning/knowledge when no hedging/pricing activity occurred.

However, the results indicate that the hypothesis could not be upheld. A majority of NSW wheat growers who undertook no hedging/pricing (65 percent) agreed that past bad decisions regarding marketing/pricing led to learning and searching for more knowledge.

Past bad marketing/pricing decisions that led to learning and searching for more knowledge was then examined against the type of hedging/pricing strategy for NSW wheat growers in the Main Study (Table 7.6.6). The NSW results indicated that there was a higher agreement (83 - 100
percent, compared to 67 - 100 percent for the five marketing methods) across all six hedging/pricing strategies that bad past marketing/pricing decisions of wheat growers led to learning and searching for more knowledge.

**Bad decisions leading to learning-knowledge for hedging strategies - comparative studies**

The NSW results indicating that there was relative high agreement (65 percent) by wheat growers that bad past marketing/pricing decisions led to learning and searching for more knowledge was then compared with the South Australian and Victorian results (Table 7.6.5).

A majority of South Australian wheat growers who undertook no hedging/pricing (85 percent) indicated that bad marketing/pricing decisions in the past led to learning and searching for more knowledge. The percentage for Victorian growers was lower (50 percent), but it was still relatively high.

### Table 7.6.5. Learning/knowledge and no hedging activity by State – 2005

<table>
<thead>
<tr>
<th>Past bad marketing/pricing decisions</th>
<th>No hedging/pricing activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Led to learning and knowledge</td>
<td>NSW</td>
</tr>
<tr>
<td></td>
<td>65%</td>
</tr>
<tr>
<td>Did not lead to learning and knowledge</td>
<td>35%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

The NSW results of past bad marketing/pricing decisions leading to learning and searching for more knowledge were then compared with the type of hedging/pricing strategy for South Australian and Victorian wheat growers in the comparative studies (Table 7.6.6).

### Table 7.6.6. Learning/knowledge and hedging strategy by State - 2005

<table>
<thead>
<tr>
<th>Decisions led to learning/knowledge</th>
<th>Hedged through futures broker</th>
<th>Hedged through futures adviser</th>
<th>Hedged through merchant</th>
<th>Hedged through bank</th>
<th>Hedged through private pool manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>NSW 100%</td>
<td>NSW 83%</td>
<td>NSW 90%</td>
<td>NSW 88%</td>
<td>NSW 100%</td>
</tr>
<tr>
<td>No</td>
<td>* 0%</td>
<td>* 17%</td>
<td>* 10%</td>
<td>* 12%</td>
<td>* 0%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* No surveyed grower hedged using this method
The NSW finding was supported by the South Australian (100 percent) and Victorian results (100 percent) whenever the strategy was used. The conclusion is that across all six hedging/pricing strategies wheat growers even from very different and diverse regions were more likely to agree that previous bad decisions regarding marketing/pricing led to learning and searching for more knowledge.

**Bad decisions leading to learning-knowledge for hedging strategies - Fisher Exact Test**

Again, this finding was supported by the Fisher Exact Test (Table 6.5.2) which found that there was no significant difference between users and non-users for any of the six hedging/pricing strategies. The general conclusion is that previous bad decisions regarding marketing/pricing have some positive outcomes (learning and searching for more knowledge) for the majority of wheat growers.

**Conclusions:**

1. The incidence of regret and avoidance in relation to marketing methods and hedging/pricing strategies could be considered high for wheat growers, at least for the 2005 season, but the results between States was not consistent.

2. Users of cash sales at harvest (except for Victorian growers) and privately managed pools (except for South Australian growers) were less likely to have bad decisions in the past leading to regret/avoidance of repeating the decision, relative to non-users. This suggests that some wheat growers either did nothing (merely undertook a cash sale at harvest time) or transferred the responsibility of marketing from the grower to a pool manager (in a privately managed pool) in order to avoid repeating the error incurred with alternate marketing methods. It is consistent with avoiding other higher risk strategies such as the National/export pool (risk of prices falling over the length of the pool), storage (risk of prices falling), and forward contracting (risk of default and cash settlement).

3. Those South Australian wheat growers who hedged/priced using private pool managers were more likely to agree that past bad decisions led to regret and avoidance. This may suggest that
bad decisions by growers could lead to the transference of hedging/pricing activity to an external private pool manager in some instances.

4. The hypothesis that wheat growers might avoid all hedging/pricing activity if past bad marketing/pricing decisions have led to regret and avoidance was seemingly upheld for South Australian wheat growers, but not for Victorian growers. This is consistent with regret and avoidance impacting greater for more specialized South Australian growers, compared with the more farm enterprise diversified growers in Victoria.

5. There was some evidence that regret/avoidance for wheat growers occurred more when there was greater wheat specialization (growers had more regret and avoidance when their income was largely dependent on wheat), seasonal conditions (more regret and avoidance was likely to occur in drought years), a large financial loss, and the ability of the grower to recall the event.

6. Wheat growers even from very different and diverse regions were more likely to agree that previous bad decisions regarding marketing/pricing led to positive outcomes (learning and searching for more knowledge), regardless of the marketing method or the hedging/pricing strategy.

7.7. Research question 7

Do Roger's (1983) adoption criteria have any influence on decision-making regarding marketing method and hedging/pricing strategy for wheat growers?

It is hypothesized that Roger's adoption criteria have some influence on decision-making regarding marketing method and hedging/pricing strategy for wheat growers. Roger’s five adoption criteria were tested with individual survey questions in the Main Study for NSW wheat growers, with the results then compared to SA and Victorian growers in the comparative studies. The five individual survey question criteria based on the perception of new marketing/pricing ideas were as follows:
1. I am venturesome and take innovative risks.
2. I follow quickly after other innovators.
3. I deliberate before adopting the new marketing/pricing idea.
4. I am very reluctant and skeptical in adopting new marketing/pricing ideas.
5. There are major delays in adopting the marketing/pricing idea.

Adoption criteria and marketing method - Main Study

Roger’s five adoption criteria were analyzed against the five marketing methods in the Main Study for NSW wheat growers. The results are summarized in Table 7.7.1.

NSW users of the National/export pool, storage, and private pools all showed more propensity to be venturesome and take innovative risks (40 - 50 percent) compared to cash sales at harvest (29 percent) and forward contracting (25 percent). Alternatively, there were no major delays in adoption of ideas for NSW users of private pools and forward contracting, there were some delays for users of the National/export pool (7 percent) and cash sales at harvest (21 percent), while storage users incurred the most delays in the adoption of ideas (79 percent).

The major weakness in the analyses was the usage of more than one marketing method by growers. Each marketing method had to be analysed independently of the others (mutual exclusivity), despite growers using several different marketing methods. This had a diluting effect on the category results.

Adoption criteria and marketing method - comparative studies

The NSW Main Study results that compared the five adoption criteria against the marketing methods were then compared with South Australian and Victorian wheat growers in the comparative studies (Table 7.7.1).

It could be hypothesized that more specialist medium-sized wheat growers (as characterized in South Australia) might have a tendency to take less innovative risks, and be more deliberative and have more reluctance/skepticism when adopting a new marketing/pricing idea. More specialist medium-sized wheat growers might be expected to have a higher dependency on wheat
for farm income, and therefore might be more cautious in adopting a new method that could have a greater impact on farm income.

**Table 7.7.1. Adoption criteria and marketing method (mutually exclusive) by State 2005**

<table>
<thead>
<tr>
<th>Adoption criteria for new marketing/pricing ideas</th>
<th>National/export pool</th>
<th>Cash sale at harvest</th>
<th>Storage</th>
<th>Privately managed pool</th>
<th>Forward contract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW %</td>
<td>SA %</td>
<td>Vic %</td>
<td>NSW %</td>
<td>SA %</td>
</tr>
<tr>
<td>Venturesome/takes innovative risks</td>
<td>40</td>
<td>22</td>
<td>50</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Follow quickly after others</td>
<td>47</td>
<td>28</td>
<td>25</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>Deliberate before adopting new idea</td>
<td>60</td>
<td>72</td>
<td>100</td>
<td>67</td>
<td>60</td>
</tr>
<tr>
<td>Very reluctant and skeptical</td>
<td>7</td>
<td>61</td>
<td>25</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>Major delays in adopting the idea</td>
<td>7</td>
<td>44</td>
<td>25</td>
<td>21</td>
<td>50</td>
</tr>
</tbody>
</table>

* No surveyed Victorian wheat grower used this marketing method

In table 7.7.1, South Australian wheat growers perceived themselves as more venturesome and taking risk when they used private pools (100 percent), storage (67 percent), and forward contracting (40 percent), with less venturesome and taking risks for the National/export pool (22 percent) and cash sales at harvest (20 percent). However, the majority did deliberate before adopting a new idea (60 - 100 percent for all marketing methods), and many were very reluctant and skeptical in the adoption of new ideas (40 - 100 percent for all marketing methods except for private pools).

Major delays in the adoption of new ideas for South Australian growers were more likely to arise from using cash sales at harvest (50 percent), National/export pool (44 percent), and storage (33 percent), and less likely for users of forward contracting (20 percent) and private pools (zero percent).
The results for Victorian growers were restricted because of the small sample size and the lack of usage of private pools and forward contracting in the surveyed sample of growers. They were more likely to perceive themselves as more venturesome and taking risk when they used cash sales at harvest (100 percent), storage (67 percent), and the National/export pool (50 percent). Major delays in the adoption of new ideas for Victorian growers were more likely to arise from using cash sales at harvest (100 percent), and less likely for users of storage (33 percent), and the National/export pool (25 percent).

One problem with the hypothesis was that NSW growers also had high percentages for those deliberating before adopting new ideas (50 - 69 percent), while all Victorian wheat growers deliberated before adopting new ideas (100 percent). The hypothesis therefore could not be upheld. One conclusion is that all wheat growers have a high propensity to deliberate before adopting a new idea.

Usage of more than one marketing method again diluted the results. Another conclusion might be that Roger’s adoption criteria are important, but the importance varies widely depending on the geographic local, production/delivery risk, the specialization of the grower, and the size of the farm.

**Adoption criteria and marketing method - Fisher Exact Test**
The Fisher Exact Test was then undertaken to test for significant differences between NSW users and non-users of each marketing method for each of the five Roger’s adoption criteria. Four areas of significant difference occurred for three of the marketing methods used by NSW wheat growers (Tables 6.3.2 and 6.3.3).

Theory might suggest that National/export users would have been more traditional and conservative in the adoption of new marketing/pricing ideas. However, the results from the Fisher Exact Test indicated that National/exports pool users were less likely ($P = 0.06$) to be very reluctant and skeptical in the adoption of new marketing/pricing ideas relative to non-users, and less likely ($P = 0.03$) to have major delays in the adoption of new marketing/pricing ideas, relative to non-users (Table 6.3.3). Another conclusion therefore is that wheat growers who use
the National/export pool are more likely not to have reluctance or skepticism of new marketing ideas, or experience adoption delays.

Again, theory might suggest that users of cash sales at harvest time would be less venturesome in innovative ideas and have reluctance to adopt new marketing/pricing ideas. However, wheat growers in NSW who used cash sales at harvest were less likely \( P = 0.06 \) to be very reluctant and skeptical in the adoption of new marketing/pricing ideas, relative to non-users.

Alternatively, theory might suggest that storage users might be more venturesome and take innovative risks. However, NSW wheat storage users were more likely \( P = 0.06 \) to be very reluctant and skeptical in the adoption of new marketing/pricing ideas, relative to non-users (Table 6.3.3). Storage may therefore be the bastion of traditional and conservative practices for NSW growers.

**Adoption criteria and hedging/pricing strategies - Main Study**

Roger’s five adoption criteria were then compared in the Main Study for NSW wheat growers who undertook no hedging/pricing activity. The results are summarized in Table 7.7.2.

NSW wheat growers who had no hedging/pricing activity (at least for 2005) had an adoption curve that was not dissimilar to Rogers’ original adoption curve. A few growers (16 percent) perceived themselves as venturesome and taking innovative risks, the majority deliberated before adopting a new idea (79 percent), while many experienced major delays in adopting new ideas (47 percent).

The research method differed to Rogers in that there was one survey question for each criterion, which meant that the categories were not mutually exclusive. This research procedure allowed each question to be tested against each of the five marketing methods and the six hedging/pricing strategies.

Roger’s five adoption criteria were then analyzed against the five hedging/pricing strategies in Table 7.7.3. The Main Study results indicated that NSW wheat growers who undertook
hedging/pricing strategies (except those who used futures brokers) were more likely (33 - 83 percent) to be venturesome, take innovative risks, and follow others quickly, and less likely (0 - 17 percent) to be reluctant or skeptical and have major adoption delays.

**Adoption criteria and hedging/pricing strategies - comparative studies**

The NSW results were then contrasted in the comparative studies with South Australian and Victorian growers who had no hedging/pricing activity (Table 7.7.2).

The one consistency across all three States was that wheat growers who undertook no hedging/pricing activity were more likely (77 - 100 percent) to deliberate before adopting new ideas. They were also less likely to be venturesome and take innovative risks (0 - 16 percent), and less likely to quickly follow after others (0 - 32 percent).

**Table 7.7.2. Adoption criteria and no hedging/pricing activity by State – 2005**

<table>
<thead>
<tr>
<th>Adoption criteria for new marketing/pricing ideas</th>
<th>NSW</th>
<th>SA</th>
<th>Vic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venturesome/takes innovative risks</td>
<td>16</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Follow quickly after others</td>
<td>32</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>Deliberate before adopting new idea</td>
<td>79</td>
<td>77</td>
<td>100</td>
</tr>
<tr>
<td>Very reluctant and skeptical</td>
<td>42</td>
<td>62</td>
<td>0</td>
</tr>
<tr>
<td>Major delays in adopting the idea</td>
<td>47</td>
<td>62</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

Rogers’ original adoption curve occurred for South Australian growers but with more reluctance, skepticism, and major delays in the laggard stage (62 percent). Dependency on one farm enterprise may induce greater deliberation and skepticism before new ideas are adopted. The adoption graph was a solitary peak for the Victorian growers (100 percent deliberating before adopting new ideas).

The NSW Main Study results from analyzing Roger’s five adoption criteria against the five hedging/pricing strategies were then compared to South Australia and Victoria (Table 7.7.3).
Whereas NSW wheat growers who undertook hedging/pricing strategies (except those who used futures brokers) were more likely to be venturesome, take innovative risks, and follow others quickly, South Australian growers who hedged/priced through merchants or private pools were more likely to deliberate (50 - 67 percent), be reluctant and have skepticism (33 - 67 percent) in the adoption of new marketing/pricing ideas.

The results from the Victorian wheat growers were again affected by the small sample size. However, for Victorian growers who hedged/priced through merchants, there was some reluctance and skepticism (50 percent), and some major delays (50 percent) in the adoption of new marketing/pricing ideas.

Another conclusion might be that the level of reluctance, skepticism, and delay in the adoption of new marketing/pricing ideas might be influenced by marginality of production, crop specialization (dependency), and farm size.

Table 7.7.3. Adoption criteria and hedging/pricing strategy by State - 2005

<table>
<thead>
<tr>
<th>Adoption criteria for new marketing/pricing ideas</th>
<th>Hedged through futures broker</th>
<th>Hedged through futures adviser</th>
<th>Hedged through merchant</th>
<th>Hedged through bank</th>
<th>Hedged through a private pool</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW %</td>
<td>SA %</td>
<td>Vic %</td>
<td>NSW %</td>
<td>SA %</td>
</tr>
<tr>
<td>Venturesome/takes innovative risks</td>
<td>0</td>
<td>*</td>
<td>*</td>
<td>83</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>0</td>
<td>100</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>Follow quickly after others</td>
<td>0</td>
<td>*</td>
<td>*</td>
<td>67</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>63</td>
<td>0</td>
</tr>
<tr>
<td>Deliberate before adopting new idea</td>
<td>0</td>
<td>*</td>
<td>*</td>
<td>50</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Very reluctant and skeptical</td>
<td>0</td>
<td>*</td>
<td>*</td>
<td>17</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Major delays in adopting the idea</td>
<td>0</td>
<td>*</td>
<td>*</td>
<td>17</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* No surveyed wheat grower used this marketing method

Adoption criteria and hedging/pricing strategies - Fisher Exact Test
The Fisher Exact Test was then undertaken to test for significant differences between NSW wheat growers who undertook no hedging/pricing activity with those who did, for each of the...
five Roger’s adoption criteria. Three areas of significant difference occurred for NSW wheat growers (Tables 6.5.2 and 6.5.3).

NSW wheat growers who undertook no hedging/pricing activity were less likely (P = 0.048) to acknowledge that they were venturesome or took innovative risks when new ideas had been perceived, relative to growers who undertook hedging/pricing activity. These growers were more likely (P = 0.065) to be very reluctant and skeptical in the adoption of new ideas, and more likely (P = 0.031) to incur major delays in the adoption of new ideas, relative to growers who undertook hedging/pricing activity.

Storage/warehousing can be considered similar to no hedging/pricing activity because the usual medium-long term objective of storing agricultural commodity is price speculation (the expectation or hope that price increases will exceed storage costs and opportunity costs/losses). To have similar adoption results between storage/warehousing and no hedging/pricing activity achieves some research outcome consistency.

The Fisher Exact Test was then undertaken to test for significant differences between NSW users of hedging/pricing strategies with non-users, for each of the five Roger’s adoption criteria. Two areas of significant difference occurred for NSW wheat growers (Tables 6.5.2 and 6.5.3).

NSW users of bank pricing products were less likely (P = 0.08) to experience major delays in the adoption of new marketing/pricing ideas, relative to non-users. As bank agricultural pricing products were introduced into Australia in the late 1990s, the results are consistent with users perceiving these products to be relatively new ideas and adopting them without major delays.

Alternatively, users of futures advisers were more likely (P = 0.02) to be venturesome and take innovative risks when new ideas have been perceived, relative to non-users. Using futures advisers is a relatively new concept for many Australian wheat growers, which perhaps would result in users perceiving themselves to be venturesome and taking innovative risks.
The Fisher Exact Test results did not find any significant difference between users and non-users of merchants, private pools, and futures brokers regarding the five adoption criteria.

Conclusions

1. The hypothesis that Rogers’ adoption criteria have some influence on decision-making regarding marketing method and hedging/pricing strategy was upheld. However, the importance of the adoption criteria may vary widely depending on the geographic locality, production/delivery risk, the specialization of the grower, and the size of the farm.

2. Australian wheat growers generally have a high propensity to deliberate before adopting a new marketing/pricing idea.

3. Wheat growers in NSW who use the National/export pool are less likely to have reluctance or skepticism of new marketing/pricing ideas ($P = 0.06$), or experience adoption delays ($P = 0.03$).

4. Wheat growers in NSW who used cash sales at harvest were less likely ($P = 0.06$) to be very reluctant and skeptical in the adoption of new marketing/pricing ideas, relative to non-users.

5. NSW wheat storage users were more likely ($P = 0.06$) to be very reluctant and skeptical in the adoption of new marketing/pricing ideas, relative to non-users.

6. Australian wheat growers who undertook no hedging/pricing activity were more likely to deliberate before adopting new ideas, regardless of the geographic location.

7. The level of reluctance, skepticism, and delay in the adoption of new marketing/pricing ideas by Australian wheat growers might be influenced by marginality of production, crop specialization (dependency), and farm size.

8. NSW wheat growers who undertook no hedging/pricing activity were less likely ($P = 0.048$) to acknowledge that they were venturesome or took innovative risks when new ideas had been
perceived, more likely (P = 0.065) to be very reluctant and skeptical in the adoption of new ideas, and more likely (P = 0.031) to incur major delays in the adoption of new ideas, relative to growers who undertook hedging/pricing activity. There were similar adoption results between storage/warehousing and no hedging/pricing activity, which indicated some research outcome consistency.

9. NSW users of bank pricing products were less likely (P = 0.08) to experience major delays in the adoption of new marketing/pricing ideas, relative to non-users.

10. NSW users of futures advisers were more likely (P = 0.02) to be venturesome and take innovative risks when new ideas have been perceived, relative to non-users.

7.8. Research question 8

Is the 'certainty effect' (defined by Kahneman and Tversky as the tendency for an individual to be risk averse when certain gains are known to eventuate, but a risk taker when losses occur) relevant to Australian wheat growers?

It is hypothesized that the Kahneman and Tversky’s (1979) ‘certainty effect’ proposition (to be risk averse when certain gains are known to eventuate, but a risk taker when losses occur) has some validity for Australian wheat growers.

The problems that often occur when establishing whether growers are risk-averse or risk-takers include contradiction, ambiguity, vagueness, misinterpretation, as well as interpretation varying with circumstance and changing over time. Much of the literature assumes that risk attitude is innate and therefore rigid and inflexible, so if the Kahneman and Tversky proposition is valid, it first needs to be established that risk attitudes are less rigid and more dynamic that what is portrayed in the general literature.

To establish whether wheat growers are less rigid and more dynamic in their risk attitudes, two direct questions on risk attitude flexibility were asked in the Main Survey and the comparative
surveys. These questions related to risk attitude changing depending on role in family/farm/business and whether risk attitude changed depending on altered circumstance. The results for both NSW and South Australia were compared and contrasted, however, the Victorian comparative study was excluded because the small sample size distorted the analyses.

Risk attitude changing with role - NSW Main Study and SA comparative study

The NSW Main Study and South Australian comparative study results relating to the question (Q.21. Depending on my role in family, farm, and business, I sometimes perceive myself as a risk taker, but at other times I perceive myself as risk averse) are summarized in Table 7.8.1 and are based on the Likert Scale of 1 - 7.

Table 7.8.1. Perceptions of risk attitude changing depending on role: NSW and SA - 2005

<table>
<thead>
<tr>
<th>State</th>
<th>Likert scale 1-7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>NSW</td>
<td>5%</td>
</tr>
<tr>
<td>SA</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

Based on a 1 - 3 Likert Scale indicating agreement, 63 percent of NSW wheat growers and 55 percent of South Australian growers agreed that they perceived themselves as risk-takers, but at other times perceive themselves as risk-averse, depending on their role in family, farm, and business. Based on a 1 - 4 Likert Scale indicating agreement, 93 percent of NSW wheat growers and 70 percent of South Australian growers agreed with the question. This indicates that it is highly likely that wheat growers perceive themselves as risk-takers, but at other times perceive themselves as risk-averse, depending on their role in family, farm, and business. A degree of dynamism in risk attitudes by a majority of wheat growers has been established.

Risk attitude changing with circumstances - NSW Main Study and SA comparative study

The second question on risk attitude was then tested. Results relating to the question (Q.22. When a change occurs with my production, marketing, or price circumstances, my attitude towards risk changes) are summarized in Table 7.8.2 and are based on the Likert Scale of 1 - 7 with comparisons between NSW and South Australia.
Table 7.8.2. Risk attitude changing depending on circumstances: NSW and SA - 2005

<table>
<thead>
<tr>
<th>State</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>18%</td>
<td>30%</td>
<td>30%</td>
<td>7%</td>
<td>12%</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>SA</td>
<td>10%</td>
<td>45%</td>
<td>10%</td>
<td>20%</td>
<td>10%</td>
<td>5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

Based on a 1 - 3 Likert Scale indicating agreement, 78 percent of NSW wheat growers and 65 percent of South Australian growers agreed that their risk attitude changes with changing production, marketing, or pricing circumstances. Based on a 1 - 4 Likert Scale indicating agreement, both NSW and South Australian growers had 85 percent agreement with the question. This indicates that it is very highly likely that wheat growers would agree that their risk attitude changes with changing production, marketing, or pricing circumstances. Again, this supports the evidence of flexibility and dynamism in risk attitudes by a majority of wheat growers.

**Risk attitude changing with decisional outcomes - Main Study and SA comparative study**

Having established that the risk attitude of wheat growers can change depending on their role and circumstance, the Kahneman and Tversky ‘certainty effect’ proposition that risk attitude depends on decisional outcomes was then tested.

The inherent problem with the Kahneman and Tversky’s ‘certainty effect’ proposition is that the outcome is not known in advance of making the risk decision. It is always based on hindsight, so its application to decision-making may be minimal. Knowledge of the ‘certainty effect’ might induce some cautiousness or greater awareness of possible outcomes when making risk decisions. It may introduce an element of Game Theory where possible scenarios and outcomes are factored into a grower’s decision-making process.

There was a direct question asked in the Main Study and comparative study that tested whether growers changed their risk attitude depending on decision outcome. No prior assumptions were
made with the survey respondent as to the dubiousness of knowing outcomes in advance of the production, marketing, and pricing decision.

Results relating to the question (*Q.20. I would describe myself as risk averse when I make correct production, marketing, and pricing decisions, and a risk taker when I make incorrect production, marketing, and pricing decisions*) are summarized in Table 7.8.3 and are based on the Likert Scale of 1 - 7 with a comparison of the results between NSW and South Australia.

**Table 7.8.3. Risk attitude changing depending on decision outcome: NSW and SA - 2005**

<table>
<thead>
<tr>
<th>State</th>
<th>Likert scale 1-7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>NSW</td>
<td>No commitment</td>
</tr>
<tr>
<td>SA</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

Based on a 1 - 3 Likert Scale indicating agreement, 35 percent of NSW wheat growers and 47 percent of South Australian growers agreed that their risk attitude changes with decision outcomes. Based on a 1 - 4 Likert Scale indicating agreement, NSW growers had 65 percent agreement with the question and South Australian growers had 78 percent agreement with the question. This indicates that a majority of wheat growers would generally agree that their risk attitude changes with decision outcomes.

This supports the Kahneman and Tversky’s ‘certainty effect’ proposition. The hypothesized that the Kahneman and Tversky’s ‘certainty effect’ proposition (to be risk-averse when certain gains are known to eventuate, but a risk-taker when losses occur) was upheld for Australian wheat growers. This challenges orthodox theory that risk attitudes are innate, rigid, and inflexible.

**Risk attitude changing with decisional outcomes - Fisher Exact Test**

The Fisher Exact Test was used to test for significant differences between NSW users and non-users for the five marketing methods and six hedging/pricing strategies based on the question that risk attitude changed with decisional outcomes.
Only one area of significant difference occurred for NSW wheat growers (Tables 6.5.2 and 6.5.3) and that was only for growers who undertook no hedging/pricing activity. NSW wheat growers who undertook no hedging/pricing activity were less likely (P = 0.096) to acknowledge that they were risk-averse when correct decisions are made, but risk-takers when incorrect decisions are made, relative to growers who undertook hedging/pricing activity.

This outcome implied that users of hedging/pricing strategies were more likely to agree that they were risk-averse when certain gains are known to eventuate, but risk-takers when losses occur. It suggested that those wheat growers who forward priced/hedged were more likely to acknowledge that risk attitude depended on decisional outcome.

There were no significant differences between users and non-users (P < 0.10) based on the marketing method used or between the hedging/pricing strategies adopted. This suggested that the type of marketing method used or the hedging/pricing strategy adopted was not significant when determining whether risk attitude depended on decisional outcomes.

**Demographic/financial/geographic characteristics - Main Study and SA comparative study**

The demographic background characteristics of those wheat growers who agreed that their risk attitude changes with decision outcomes was then compared to those growers who did not agree, both for NSW Main Study results and for South Australian comparative study results.

Agreement was based on the 1-3 Likert Scale, while the 4-7 Likert Scale indicated disagreement. The results are summarized in Table 7.8.4.

If farm size, age, and farm experience were to be associated with risk attitude changing depending on decision outcome, then the results between those who agreed and those that disagreed would need to be inverse. The results from Table 7.8.4 did not indicate this for farm size or for farm experience.
Table 7.8.4. Demographic characteristics of wheat growers who agreed that risk attitude changes depending on decision outcome: NSW and SA - 2005

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>State</th>
<th>Growers who agreed with question</th>
<th>Growers who did not agree with question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size &lt; 5000 ha</td>
<td>NSW</td>
<td>65%</td>
<td>79%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>47%</td>
<td>53%</td>
</tr>
<tr>
<td>Size &gt; 5000 ha</td>
<td>NSW</td>
<td>35%</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Age &lt; 45 years</td>
<td>NSW</td>
<td>56%</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>56%</td>
<td>36%</td>
</tr>
<tr>
<td>Age &gt; 45 years</td>
<td>NSW</td>
<td>44%</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>44%</td>
<td>64%</td>
</tr>
<tr>
<td>Experience &lt; 20 years</td>
<td>NSW</td>
<td>36%</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>56%</td>
<td>45%</td>
</tr>
<tr>
<td>Experience &gt; 20 years</td>
<td>NSW</td>
<td>64%</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>44%</td>
<td>55%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* There were no surveyed growers in South Australia having more than 5000 ha.

However, more NSW wheat growers who were aged below 45 years agreed that risk attitude changes depending on decision outcome (56 percent), whilst more growers who were aged above 45 years agreed that their risk attitude did not change with decision outcomes (71 percent). This result was also supported by the South Australian outcomes. One conclusion therefore is younger wheat growers (below 45 years) are more likely to perceive that risk attitude can change depending on decision outcome than older growers (above 45 years).

The financial and locality background characteristics of wheat growers based on the same 1 - 3 Likert Scale agreement rating and 4 - 7 disagreement rating are summarized in Table 7.8.5.

If financial and locality characteristics are to be associated with risk attitude changing depending on decision outcome, then the results between those who agreed and those that disagreed would needed to have been inverse. The results from Table 7.8.5 did not indicate this for the percentages of wheat in the farm enterprise or for farm debt, or for NSW growers across the four characteristics (percentages of wheat in the farm enterprise, farm debt, rainfall, and drought frequency).
Table 7.8.5. Financial and locality characteristics of wheat growers who agreed that risk attitude changes depending on decision outcome: NSW and SA - 2005

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>State</th>
<th>Growers who agreed with question</th>
<th>Growers who did not agree with question</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50% wheat in farm enterprise</td>
<td>NSW</td>
<td>57%</td>
<td>63%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>78%</td>
<td>82%</td>
</tr>
<tr>
<td>&gt; 50% wheat in farm enterprise</td>
<td>NSW</td>
<td>43%</td>
<td>37%</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>22%</td>
<td>18%</td>
</tr>
<tr>
<td>&lt; 45% farm debt</td>
<td>NSW</td>
<td>93%</td>
<td>92%</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>SA</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>91%</td>
</tr>
<tr>
<td>&gt; 45% farm debt</td>
<td>NSW</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>SA</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9%</td>
</tr>
<tr>
<td>&lt; 200 mm rainfall</td>
<td>NSW</td>
<td>28%</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>**</td>
<td>SA</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>46%</td>
</tr>
<tr>
<td>&gt; 200 mm rainfall</td>
<td>NSW</td>
<td>72%</td>
<td>62%</td>
</tr>
<tr>
<td></td>
<td>**</td>
<td>SA</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>54%</td>
</tr>
<tr>
<td>&lt; 4 droughts</td>
<td>NSW</td>
<td>42%</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>SA</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60%</td>
</tr>
<tr>
<td>&gt; 4 droughts</td>
<td>NSW</td>
<td>58%</td>
<td>58%</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>SA</td>
<td>77%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>40%</td>
</tr>
</tbody>
</table>

Source: John Williams, Main Study and comparative studies (2005)

* Farm debt includes average overdraft and short/long term debt as a percentage of current farm value
** Average rainfall over a 20 - 100 year period during the June - December period
*** Frequency of drought in the last 20 years
**** No surveyed South Australian grower had > 45% farm debt who agreed with the question

However, slight inverseness did occur for South Australian wheat growers for rainfall differences, but was more pronounced for drought frequency. More South Australian growers who had high drought frequency (greater than four droughts in the last 20 years) agreed that their risk attitude changes with decision outcomes (77 percent), whilst more growers who had less drought frequency (less than four droughts in the last 20 years) did not agree that their risk attitude changes with decision outcomes (60 percent).

One conclusion is that South Australian growers who have high drought frequency (greater than four droughts in the last 20 years) are more likely to perceive that risk attitude can change depending on decision outcome than growers with less than four droughts in the last 20 years.
Conclusions:

1. There was much evidence to support the application of the Kahneman and Tversky’s ‘certainty effect’ proposition to Australian wheat growers that they were risk-averse when certain gains are known to eventuate, but risk-takers when losses occur. The evidence challenges orthodox theory that risk attitudes are innate, rigid, and inflexible.

2. Those Australian wheat growers who forward priced/hedged were more likely to acknowledge that risk attitude depended on decisional outcome. However, the type of marketing method used or the hedging/pricing strategy adopted was not significant when determining whether risk attitude depended on decisional outcomes.

3. There was evidence of flexibility and dynamism in risk attitudes by a majority of Australian wheat growers in that they change their risk attitude based on their role and circumstance.

4. Younger wheat growers (below 45 years) might be more likely to perceive that risk attitude can change depending on decisional outcome than older growers (above 45 years).

5. South Australian growers who have high drought frequency (greater than four droughts in the last 20 years) are more likely to perceive that risk attitude can change depending on decisional outcome than growers with less than four droughts in the last 20 years.
8. DISCUSSION

8.1. Research Question One - Management approach to marketing and hedging/pricing

The conclusion that indicated the management approach to decision-making by wheat growers is more likely to affect the chosen marketing method and less likely to affect any decision to hedge/price was not unexpected, despite there being little previous international research.

Some growers need cash flow, and therefore would choose cash sales at harvest to alleviate their cash flow problems. Many growers who used the National/export pool, stored/warehoused, or used forward contracts did so because they perceived direct management benefits such as the achievement of a better price or price averaging. Others had specific management reasons such as best price for higher grades or selling as last resort (National/export pool), price speculation benefits or flexibility (storage), and business planning benefits or covering their costs of production (forward contracts). All of these management approaches led to a particular marketing method, which suggests a relatively strong positive linkage between the management approach and the selection of a particular marketing method.

In contrast, the hedging/pricing strategy appeared to lead to particular management reaction. There is some strong evidence that a particular hedging/pricing decision leads to some subsequent management action. This implies that a particular management approach does not lead to a particularly hedging/pricing decision. Rather it is the perception of risk that led to the selection of a particular hedging/pricing strategy, which then determined the necessary management approach.

Growers who perceived the risk of both price and production might be more likely to choose cash-settled pricing products such as bank products, but then are confronted by the management issues of requiring data, information, and analyses. This contrasts to growers who do not perceive price risk and do not hedge/price, and who therefore do not need data, information, and analyses.
The choice to implement a particular hedging/pricing strategy or not determines whether a particular management approach is subsequently required. Therefore, there is little evidence to suggest that a positive linkage between the management approach and the selection of a particular hedging/pricing strategy exists.

Four out of the five marketing methods in this research (public and private pooling, storage, and cash sales at harvest) involved delivery, whilst forward contracting involved both forward pricing and delivery. It might be expected that a more structured management approach might be more appropriate for any low complexity activity such as physical delivery.

This contrasts with more complex hedging/pricing decision-making which involves many risk variables including perception of risk, attitude (Research Question/Conclusions 8) and behaviour (Research Questions/Conclusions 2 and 6). It might be expected that as risk factors such as perception, attitude, and behaviour become more important in hedging/pricing decision-making, the structured management approach to decision-making becomes less important.

Any comparison with overseas research is possibly not valid because of the different types of marketing methods used in Australia and the different climatic risks (drought and frequent production shortfalls) that might influence both marketing method and hedging/pricing decision-making. The in-depth decision-making questioning in the survey differentiated the results from other Australian research.

Xu’s (2005) conclusion that risk attitude and personality types have only limited effects on marketing methods may be valid. Risk attitude and personality type might be considered intrinsic to a particular management approach, despite their innate characteristics and inflexibility. However, this does not preclude different management approaches to marketing method decision-making being significant.
Lence’s (1995, 1996) suggestion that the selection of a particular marketing method simply depended on the lowest transaction cost is deemed to be too simplistic in the context of the research question. Many risk variables (including weather and production/specification risk) and management decision-making complexity over-ride least-cost decisions, even for marketing method decision-making.

The research results may have some synergy with Anderson (1979) who stated that price/market uncertainty, climatic variability, and time lags in production made management decisions difficult. However, the research results suggested that Anderson’s statement applied more to hedging/pricing decision-making than it did to marketing method decision-making which was positively linked to a structured management approach.

Johnson’s (1952) and Nuthall’s (2001) findings that farmers made decisions without adequate knowledge and any apparent formal process, and unable to explain how they achieved the outcome, was not supported by the current survey results. For example, National/export pool users in Australia might have been expected to be conservative farmers lacking knowledge and slow to adopt new ideas, but the results indicated that National/export pool users were less likely to be very reluctant and skeptical in the adoption of new marketing/pricing ideas and less likely to have major delays in the adoption of new marketing/pricing ideas.

A major research problem may have been that most Australian wheat growers use a combination of physical marketing methods to sell their wheat, and some growers use a combination of strategies to hedge/price their wheat, and these combinations might be expected to vary widely each year according to price movement, weather conditions, and risk factors. However, this does not alter the conclusion that the management approach to decision-making by wheat growers (based on the 2005 crop year) is more likely to affect the chosen marketing method than any decision made as to whether to hedge/price and which strategy to implement.
8.2. Research Question Two - Emotional anxiety when making acreage/marketing/pricing decisions

The suggestion that the risk of decreased cash flow might lead to emotional anxiety was new to previous research, but not entirely unexpected. Theory should support the notion that cash flow drives any business, but in the evaluation of marketing methods and hedging/pricing strategies the importance of cash flow in farmer decision-making is often over-looked.

One contradiction to this cash flow theory is that storage/warehouse users usually do not incur the highest emotional anxiety that would normally be associated with the loss of cash flow in a storage strategy. The Fisher Exact Test resulted in storage users being more likely to make decisions alone, make decisions spontaneously, take risk, and be flexible. Storage users might therefore have a unique personality that decreases emotional anxiety, or perhaps the emotions become conditioned to taking risk over time.

The conclusions relating to the high emotional anxiety for users of the National/export pool and bank pricing products may be perceived paradoxical, but not unexpected. Usage of the National/export pool has often been expounded because of its price averaging characteristics, while usage of bank pricing products have been encouraged because of the lowering of price risk. The paradox exists because the price averaging associated with the National/export pool does not manage price risk, and bank pricing products have the risk of cash settled payouts at maturity. Both of these risks (which encompass large cash flow considerations) would be expected to lead to emotional anxiety amongst users.

Although Nuthall (2001), McGregor et al. (1995), and Bohm et al. (1996) indicated that personality, emotions, and current anxiety influenced the farmer decision-making processes, the linkage between risk (especially cash flow risk) and emotional anxiety has been inadequately researched in the past, both in Australia and overseas. If cash flow is the essence of a farm business, then more research needs to be focused on the cash flow impact of acreage/marketing/pricing decisions, particularly regarding marketing methods and hedging/pricing strategies.
8.3. Research Question Three - knowledge of variable cost of production influencing price risk management

Previous research that examined the relationship between costs and price risk management has been minimal. It is doubtful whether there has been a previous direct survey question that tested the progression from knowing variable costs of production to the management of price risk.

The inherent weaknesses with this research question were noted in Section 7. Variable costs of production are highly unlikely to be accurately known in advance of crop maturity because of the uncertainty over management responses to pests, diseases, and plant nutrition. Costs are more likely to be only known in hindsight, after price risk management decisions have been already made.

Any relationship between costs of production (expenditure per hectare) and price risk management (income per tonne) can only occur through knowing yield. However, yield is not known in advance, and can be extremely variable for countries such as Australia. Therefore, the relevancy of using historical average yields is highly questionable for any one particular cropping year. This makes any calculation of variable costs of production in expenditure per tonne highly problematical.

The significance of this research question lay in the perception of the grower, rather than in the mind of the researcher. By asking a direct question, the research sought the perception of the grower, and avoided any attempt to discover how the grower knew the variable cost of production in advance of making price risk management decisions, the accuracy of the yield estimate, or even if the grower knew the variable cost of production.

Given these research limitations, the results strongly suggested that NSW and South Australian growers were likely to perceive that knowledge of variable costs of production led to price risk management. The one exception was Victorian growers who might be characterized by smaller wheat acreages, greater farm enterprise diversification, and higher production risk. This might suggest that size, specialization, and rainfall regularity might influence the perception that
knowledge of variable costs of production led to price risk management. More research would be required to test these linkages.

It might be expected that agreement with the research question might be dependent on the grower actually undertaking price risk management. However, the results indicated that there was high agreement by wheat growers with the research question, regardless of whether or not they undertook hedging/pricing.

Not only did growers perceive that knowledge of variable costs of production led to price risk management, but it also led to targeting more realistic price levels in risk management. Again, there was an exception for Victorian wheat growers who did not hedge/forward price or hedged using bank pricing products. Results from both survey questions indicated consistency in the research results and this supported the findings.

The research findings have important implications. It suggests that if growers do not have knowledge of their costs of production, then they would be less likely to manage their price risk and less likely to target realistic prices even if they undertook some risk management. The corollary is that for growers to increase their adoption of price risk management, then they first need to increase their knowledge of their variable costs of production.

However, if variable costs of production are only accurately known in hindsight and after price risk management decisions are made, then the corollary can be described as being pedantic. To reconcile the research findings to reality, there must be a perception by the grower of an arbitrary cost of production based on an average crop year and average yield. This perception would be expected to be based on the individual’s psychology and personality trait, and change depending on location, circumstances, and time.

A.F.F.A. (2003) found that 83 percent of Australian grain growers calculated their costs of production. However, accounting method consistency, effectiveness and accuracy were not measured, nor did the questioning separate fixed costs from variable costs. Regardless of these limitations, mere cost calculation is very different from active cost control.
8.4. Research Question Four - price risk management acting as an incentive to lower variable cost of production

There were no sequential difficulties with this research question. Management of price risk can occur irrespective of knowing costs of production or whether cost control measures have been implemented. The survey question did not seek to understand how the variable cost of production was calculated, while the research question assumes no prior conditions over costs. Despite the practicality of the research, there was no evidence of any prior local or international research that examined this question.

Theory might suggest that the positive skewness of wheat prices should increase the awareness of income risk exposure for growers. It might then be assumed that the management of the three income components (price, cost, and yield) by growers would be highly desirable. This particular research question examined whether managing price risk might be the leader and act as an incentive for better management over costs. It assumed that the potential for production yield existed. Without production yield, costs might be minimal with no need to manage price.

The conclusion that many growers agreed that price risk management acted as an incentive to lower variable costs of production has enormous implications to industry. It suggests that one method to decrease the costs of production would be to firstly manage price risk. The corollary might suggest that without price risk management, any decrease in the costs of production would be difficult. Previous singular attempts to control costs of production might be in vain, if the wider implications of price risk are ignored.

There was some evidence that those growers who do not manage their price risk are unlikely to agree that price risk management leads to lower variable costs of production. This was the case for many Victorian growers who might be characterized by having smaller farms, greater farm enterprise diversification, and more marginal in production. These growers would be expected to be more focused on production/yield risk, and be more inclined to manage income risk through farm enterprise diversification rather than any direct price risk management.
8.5. Research Question Five - influence of farm size, age, debt, farming experience, and training on the choice of marketing method or hedging/pricing strategy

**Farm size.** Patrick *et al.* (1998), Pennings *et al.* (2000), and Kingwell (2000) all found that the usage of forward pricing depends largely on the size of operations. Isengildina *et al.* (2001) found that farm size was a factor influencing the marketing behaviour of commodity producers. Larger producers were more likely to use alternative marketing strategies because of economies of scale/lower unit costs, ability to access computer software and data sources, ability to appoint external marketing advisers, and better management of hedging transaction costs.

The research hypothesis was that a wheat grower would increase their forward contracting and hedging/pricing activity as farm size increased. This was upheld in the results for NSW (larger size growers), but there were caveats in other States. Where there were smaller farm sizes (and possibly greater dependency on farm enterprise diversification and marginal production), such as in Victoria, the results were inconclusive.

Larger growers (such as those in NSW) were more polarized in their cash flow management. There was a strong propensity for cash sales at one end of the spectrum and storage/warehouse (little cash-flow) at the other end of the spectrum. Pre-harvest private pools and forward contracting (both of which might be classified within the 30 day cash-flow category) increased with increasing farm size. Usage of any marketing method or hedging/pricing strategy that was situated between the two cash-flow polarized points (such as the National/export pool) decreased with increasing farm size.

In contrast to NSW, South Australian wheat growers actually decreased their hedging/pricing activity as farm size increased. This was explained in Section 7 by larger farm sizes existing near the Goyder drought line with higher risk-taking marginal farmers. The results suggest that usage of forward contracting and hedging/pricing activity rises as farm size increases only when production is relatively secure. If production is more marginal, then growers may be more
inclined to use middle-of-the-spectrum marketing methods such as the National/export pool which averaged price over the longer-term.

**Age.** It was hypothesized that age did not affect the decision-making of wheat growers regarding marketing methods and hedging/pricing strategies. The research problem was that even if age had been proven to affect such decision-making, other factors such as production risk in countries such as Australia were more likely to have a far greater impact on marketing and hedging/pricing decision-making.

Despite the attempt in the research design to rank the factors in order of importance, the extreme number of factors that could influence marketing and hedging/pricing decision-making overwhelmed the final outcome. Age could have been one of these factors, but the results suggested otherwise.

The results (negative association) contradicted Asplund *et al.* (1989) who found that forward contracting was significantly dependent on age (positive association). However, this finding was based on results only in the USA, where soils are better and production risk is much lower than Australia. Apart from the influence of production risk and soil type, the amount of forward contracting may also be influenced by the spreading of risk with other farm enterprises and double cropping, and closeness to major end-user activity.

Rougoor *et al.* (1998) found the contribution of age to farm management decision-making had mixed conclusions in the USA. The research findings of a negative association between age and marketing methods and hedging/pricing strategies in Australia therefore had some alignment with other research results in the USA.

**Debt.** There was much previous evidence to support the hypothesis that as farm debt levels increase, price risk management adoption increases. Asplund *et al.* (1989), Shapiro and Brorsen (1988), Brorsen (1995), Turvey and Baker (1990), Arias *et al.* (2000), Pennings and Leuthold (2000), and Ada (2004) all supported this theory. The limitation in the evidence was that
production/yield risk (which is influenced by marginal rainfall and soil type) was generally ignored.

In Ada’s (2004) study on Australian cotton growers, much of the production region was irrigated, which minimized production/yield risk. Much of the U.S.A. research has been performed in regions with relatively good rainfall and soil type. This contrasts to Australian conditions where much of the rainfall is highly variable, average rainfall is marginal compared to the U.S.A., and soil types generally range from medium to very poor.

Kingwell (2000) suggested that high debt in Australia limited the producer's ability to manage risk. The added costs to manage price risk were considered too burdensome. Without sufficient financial reserves and cash flow, it was considered very difficult to manage farm business operations efficiently.

This suggestion by Kingwell (2000) for marginal production countries such as Australian challenged the orthodox theory. It meant that there was a possible contradiction regarding the association between increasing debt and hedging activity. The research objective sought to clarify this possible contradiction.

Research results (Section 7) indicated a possible positive association between debt levels and hedging activity, but only for smaller size growers. There was research consistency because there was also a positive association between debt levels and agreement that price risk management was important to farm income, but only for smaller size growers.

In contrast but also providing research consistency, there was a negative association for larger size growers between debt levels and hedging activity, and a negative association between debt levels and agreement that price risk management was important to farm income. One explanation might be that larger growers with more cash flow may take more speculative risks such as cash sales at harvest or storing for long time periods, rather than be forced to sell or hedge to gain cash flow.
There may be a special category for medium-sized specialized wheat growers in marginal producing regions, such as South Australia. The research found that these growers had a negative association between debt levels and hedging activity, but a positive association between debt levels and agreement that price risk management was important to farm income.

Orthodox theory therefore might be upheld, but only for the smaller-size wheat growers and those who are not specialized in wheat in marginal producing regions. Kingwell’s (2000) theory might also be upheld for those medium-sized specialized wheat growers in marginal producing regions. The research findings suggest that any debt-hedging association should not be examined unless the size of the farming operation, the specialization of farm enterprises, and the marginality of production are also considered.

**Farming experience.** There was little previous research that related marketing method decision-making to farming experience. Rougoor et al. (1998) found the contribution of experience to farm management decision-making had mixed conclusions in the USA. Even if there had been more direct international research into this topic, its relevancy for Australian marketing methods under Australian production conditions would be highly questionable.

The research found (Section 7) that farming experience generally was likely to influence marketing method selection, but the results were not consistent between the surveyed Australian regions. For example, usage of forward contracting was more likely to be influenced by the marginality of production, rather than simply being dependent on the grower’s number of years with farming experience. Makus et al. (1990) suggested that previous usage of forward contracts might influence the adoption of alternative strategies to manage price risk, such as the usage of futures or options contracts which provide choice in delivery decisions.

Regarding an association between previous farming experience and hedging/pricing activity, Shapiro and Brorsen (1988) found that the adoption of hedging was influenced by farming business experience. As the number of farm-experience years increased, the more likely was hedging to be adopted.
Whilst there was some evidence in Section 7 that the farming experience of the Australian wheat grower had some influence over decision-making regarding hedging/pricing strategies, again there was little consistency in the results. The theory, which suggests that farming experience influences decision-making relating to wheat marketing method section and the adoption of hedging/pricing, remains problematical, particular under the high production risk Australian conditions where there has been evidence of past regret and avoidance (Section 8.6).

**Training.** Previous international research largely examined training of farmers quite independent of production risk and the marginality of farms. Research results in Section 7 indicated that training is no substitute for high production risk. Many relevantly-trained Australian wheat growers do not hedge/price because they are limited by high production risk, while many non-trained growers have no desire to undertake relevant training because of high production risks limiting hedging/pricing effectiveness.

Whilst Rougoor *et al.* (1998) found a correlation between education of the farmer and farm efficiency, the relevancy to usage of marketing methods and hedging/pricing strategies in marginal high production risk countries such as Australia is extremely limited. As well, being educated does not imply having relevant training, while farm efficiency may not always align with price risk management objectives.

Previous research largely ignored the influence of past experiences on regret and avoidance in relation to the uptake of training and adoption of hedging/pricing. Training is difficult when there are emotional barriers that have been caused by previous bad experiences either with forward contract default or cash payouts at settlement.

Isengildina and Hudson (2001) found that the availability of trained management was a factor influencing the marketing behaviour of U.S. commodity producers. In contrast, the results in Section 7 found inconclusiveness over any association between relevant training and the marketing method used for Australian wheat growers. There was some suggestion that some relevantly trained wheat growers used the National/export pool, while some untrained growers used private pools.
There was some evidence of a positive association between those Australian wheat growers who attended at least two days of relevant training and hedging/pricing activity. As well, relevant training may not drastically increase the usage of hedging/pricing amongst many Australian wheat growers, rather it allows growers to use (or to choose from) a wider range of hedging/pricing strategies.

Training increased the usage of futures brokers/advisers, merchants, and banks. Alternatively, those growers who used futures brokers/advisers were more likely to indicate the need for more relevant training. These findings agreed with Pennings et al. (2000) who indicated the usage of futures contracts was positively related to the level of understanding (training) in the futures market. However, the issue as to whether usage followed the understanding, or did the understanding follow the usage was not adequately resolved.

In contrast, those wheat growers who had no relevant training were more likely to use private pool managers for hedging/pricing purposes. This indicates that the significance of relevant training is diminished when non-trained growers can pass hedging/pricing responsibility to a private pool manager. However, the consequences of not understanding or auditing the procedures and outcomes of the private pool manager in relation to marketing or hedging/pricing were not examined in the current research.

In terms of factors that motivate relevantly-trained wheat growers to manage their price risk, the research findings went beyond the previous results of Shapiro and Brorsen (1988) and Makus et al. (2006). Price risk management motivating factors such as maximizing income, loss minimization, avoidance of past mistakes, and price volatility were seemingly more important for relevantly-trained Australian wheat growers than Shapiro’s et al. (1988) motivational factors (farm size, education, experience, management style, off-farm income, expected outcomes, debt levels, and risk attitudes) and Makus’s et al. (1990) motivational factors (experience, farm size, location, operational type, education, and membership of a marketing club).
8.6. Research Question Six - Do past bad decisions over marketing methods or hedging/pricing strategies lead to regret and avoidance by wheat growers, or to learning and seeking more knowledge?

Weber et al. (1997) found that the perception of risk by farmers can depend on past regret and performance of previous decisions. However, there was a general absence of previous research on the effect of bad decisions in the past leading to regret and avoidance, specifically relating to marketing methods and hedging/pricing strategies. There was a general absence of previous research on the effect of bad decisions in the past leading to greater learning and the search for new knowledge.

The Section 7 results supported Weber’s et al. (1997) findings in that the incidence of regret and avoidance in relation to marketing methods and hedging/pricing strategies as a result of past bad decisions was high for Australian wheat growers. However, there was inconsistency between States/regions, and the results might be expected to change with the season type, the frequency and intensity of drought, the size of the financial loss, and the ability of the grower to recall the event.

The risks associated with the National/export pool (risk of prices falling over the length of the pool), storage (risk of prices falling), and forward contracting (risk of default and cash settlement) were noted in Section 7. However, if growers used alternate marketing methods such as cash sales at harvest and privately managed pools to avoid bad decisions of the past and a repeat of the error, then there may be a paradox existing. Doing nothing and then making a cash sale at harvest time incurs the risk that prices could fall during the production period. Transferring price risk responsibility to a private pool manager has the risk that the pool price might suffer from either inadequate hedging when prices fall or over-hedging when prices rise.

Therefore, all marketing methods incur some risk, and some regret and avoidance could occur with any of the five marketing methods that are used in Australia. Similarly all six hedging/pricing strategies have some risk (basis, currency, transaction cost, margin risk, liquidity,
opportunity cost, and delta). Regret and avoidance could be expected to arise from any one of the six hedging/pricing strategies.

The alternative to hedging/pricing using one or more of the six hedging/pricing strategies is not to hedge or forward price. But if specialized wheat growers choose not to hedge/price, their income becomes exposed to downside financial losses when prices fall. This is the dilemma for highly specialized wheat growers such as those in South Australia. It contrasts with Victorian growers who have more farm enterprise diversification, and with northern NSW growers who have the benefit of double cropping with winter-summer rainfall.

Previous bad decisions do not always lead to negative outcomes such as regret and avoidance. There can be positive outcomes such as learning and the search for new knowledge. The results found that wheat growers even from very different and diverse regions were more likely to agree that previous bad decisions regarding marketing/pricing led to positive outcomes (learning and searching for more knowledge), regardless of the marketing method or the hedging/pricing strategy.

These new results have an important significance to industry, particularly since the Australian 2007 drought cause a high incidence of regret and avoidance for marketing methods such as forward contracting and hedging/pricing strategies such as using merchants and banks (swaps). There is a need for wheat growers to shift from the negative regret and avoidance paradigm to the more positive paradigm of greater learning and searching for new knowledge. Otherwise, regret and avoidance can result in not hedging/pricing, which can lead to financial losses occurring each year through falling prices, thus cementing mistakes into annual decision-making.

8.7. Research Question Seven - Influence of Roger's (1983) adoption criteria on decision-making regarding marketing method and hedging/pricing strategy for wheat growers

There have been many problems with accurately measuring risk attitude, such as the difficulty in segmenting producers into different risk profiles because risk attitudes cannot be directly
observable (Pennings and Leuthold, 2000), or the existence of dynamic behaviour-attitude (Bentler and Speckart, 1981).

These measurement problems and dynamic behaviour-attitude might explain why Weber et al. (1997) claimed that farmers should be simply categorized as risk-takers, whereas Pennings et al. (2000), Brockhaus (1980), and March et al. (1987) indicated that farmers have very diverse risk attitudes. It was due to the lack of accurate measurement methods and the inherent contradictions in interpretation that there was no direct questioning on risk-attitude categorization in the Main Survey.

As well, perceptions of risk-reduction leading to hedging/pricing may not always be the primary motivator. Opportunities for price-enhancement may be the primary motivation for producer hedging rather than for risk-reduction (Working, 1953; Gray and Rutledge, 1971; Tomek and Peterson, 2001). The risk profile of a speculator therefore may not be dramatically different to that of a commodity hedger. Also, theories that related hedging to risk-averseness was contradicted by Goodwin and Schroeder’s (1994) finding that risk-takers are more likely to adopt forward pricing/hedging strategies than risk-averse producers. Therefore, there was a need in the research method to avoid the simple risk-attitude categorization.

However, Rogers’ (1983) five adoption criteria can reflect the risk attitude of the individual decision-maker. Risk preferences do affect the adoption of marketing methods (Isengildina and Hudson, 2001) and hedging practices (Holthausen, 1979; Simmons and Rambaldi, 1997). Adoption characteristics can be more easily identifiable than attempting to categorize risk attitudes. Rogers’ adoption criteria method therefore facilitates easier categorization of risk attitude and behaviour.

A risk-taker presumably would be more venturesome and take innovation risks. In contrast, being risk-averse would suggest major delays in adopting new ideas. In this research question, the adoption of new ideas related to marketing/pricing ideas. Therefore, the risk attitude towards marketing methods and hedging/pricing strategies was examined in this research question through Rogers’ (1983) five adoption criteria.
The hypothesis that Rogers’ adoption criteria have some influence on decision-making regarding marketing method and hedging/pricing strategy was upheld (Section 7). This supported the risk preference findings of Isengildina and Hudson (2001) in the adoption of marketing methods and Holthausen (1979) and Simmons et al. (1997) in the adoption of hedging practices.

However, the findings in Section 7 suggested some adoption and risk behaviour-attitude inconsistencies which might have been explained by geographic locality, production/delivery risk, the specialization of the grower, and the size of the farm. Alternatively, these inconsistencies might have been explained by Bentler’s et al. (1981) dynamic behaviour-attitude.

The finding that all Australian wheat growers have a high propensity to deliberate before adopting a new marketing/pricing idea (Section 7) was not unexpected given the marginality of production in most regions. This research outcome was consistent with Australian wheat growers who undertook no hedging/pricing activity being more likely to deliberate before adopting new ideas, regardless of the geographic location.

Also, the finding that the level of reluctance, skepticism, and delay in the adoption of new marketing/pricing ideas by Australian wheat growers might be influenced by locality (production marginality), crop specialization (dependency), and farm size was not unexpected. However, there had been little research and evidence to date.

Previous theory suggested that risk-averse growers would be more inclined to use traditional marketing methods such as the National/export pool, cash sales at harvest, and storage. However, the Fisher Exact Test found that NSW users of the National/export pool and cash sales at harvest were more likely to be risk-takers. Given the high price risk associated with both marketing methods, there was consistency between high price risk and being a risk-taker. However, this research result contradicted Goodwin and Schroeder’s (1994) finding that risk-takers are more likely to adopt forward pricing/hedging strategies than risk-averse producers.
In contrast, NSW wheat storage users were more likely to be very reluctant and skeptical in the adoption of new marketing/pricing ideas, which meant they could be categorized as risk-averse. However, storage incurs high price risk. This indicates that a contradiction (paradox) exists for growers perceiving that they are risk averse when they store wheat, when in reality they adopt high price risk marketing methods and become risk-takers. However, whilst there is agreement with Goodwin and Schroeder’s (1994) finding that risk-averse producers are less likely to adopt forward pricing/hedging strategies, the perception of risk averseness appears to over-ride the reality of risk-taking in the paradox.

Those NSW wheat growers who undertook no hedging/pricing activity and who were less likely to acknowledge that they were venturesome or took innovative risks when new ideas had been perceived, more likely to be very reluctant and skeptical in the adoption of new ideas, and more likely to incur major delays in the adoption of new ideas, could be categorized as being risk averse. This would then fully agree with Goodwin and Schroeder’s (1994) finding that risk-averse producers are less likely to adopt forward pricing/hedging strategies.

If NSW users of bank pricing products were less likely to experience major delays in the adoption of new marketing/pricing ideas, and if NSW users of futures advisers were more likely to be venturesome and take innovative risks when new ideas have been perceived, then both user types can be considered risk-takers. Both these risk-taker types hedged either through banks or with the assistance of a futures adviser. Therefore, there is agreement with Goodwin and Schroeder (1994) in that risk-takers are more likely to adopt forward pricing/hedging strategies.

It is concluded that Goodwin and Schroeder’s (1994) findings really depend on the particularly marketing method and hedging/pricing strategy, and whether a risk-attitude paradox exists. The research findings did agree with Goodwin and Schroeder (1994) in some circumstances, but there are situations for some marketing methods and strategies where the theory was not upheld. However, there was full agreement with Goodwin and Schroeder (1994) in that risk-averse producers were found to be less likely to adopt forward pricing/hedging strategies.
The relevancy of Rogers’ (1983) adoption criteria as overall indicators of risk attitude/behaviour towards marketing/pricing might be questionable. Issues in hedging/pricing adoption might include uncertain consequences (desirable or undesirable), difficulties in determining relative advantages in hedging outcomes, the impact of a cluster effect of new ideas (maybe caused by a sudden policy change such as market deregulation), the role of education and training, knowledge verses action decisions, individuality of making hedging decisions based on personality trait and circumstance, and discontinuance (avoidance) after earlier adoption possibly with regret.

8.8. Research Question Eight - The relevance of Kahneman and Tversky’s 'certainty effect' to Australian wheat growers?

There is a continuing debate over whether agricultural producers should be categorized as risk averse or risk-takers. Francisco et al. (1972) and Bond et al. (1980) suggested that Australian producers should be considered as risk averse. However, this contradicted Goodwin and Schroeder (1994) who found U.S. producers were more risk-takers. Weber and Milliman (1997) claimed that entrepreneurs such as farmers should be categorized as risk-takers.

This contrasts with much evidence that suggests that agricultural producers have differing risk attitudes that are dynamic and not static (Pennings and Leuthold, 2000; Brockhaus, 1980; and March and Shapira, 1987). Risk attitude can change over time (Weber and Milliman, 1997), vary with different management roles and different factors at risk (Dyer and Sarin, 1982), depend on historical outcomes/regret/performance of previous decisions (Weber and Milliman, 1997), and be influenced by ego satisfaction levels (Weber and Milliman, 1997).

Whilst Weber and Milliman (1997) found that risk attitude changed over time, there was no attempt in the Main Survey/Study to test whether risk perception changed over time because of the static nature of the survey. The questionnaire specifically dealt with the 2005 calendar/cropping year wheat crop so that comparisons and profiling could be undertaken in the one time period. This minimized the impact that other more different years might have had on the wheat grower’s decision-making and risk perceptions.
Both Pennings *et al.* (2000) and Bentler *et al.* (1981) noted that the inaccuracy of risk attitude measurement because dynamic behaviour prevented risk profile segmentation. This explains why there was no direct questioning on risk attitude categorization in the Main Survey or comparative surveys. Instead, relevant questions focused on whether risk attitude altered according to role, circumstance, and decisional outcome. The effect of historical regret and avoidance on risk attitude was not examined in this research question, nor was there any attempt to test the impact of any ego satisfaction criteria.

Results from the analyses (Section 7) suggested evidence of flexibility and dynamism in risk attitudes by a majority of Australian wheat growers in that they change their risk attitude based on their role and circumstance. This agreed with the conclusions of Dyer and Sarin (1982) in relation to risk attitude variations caused by different management roles and different factors at risk (circumstance). It also had general agreement with the dynamic risk attitude findings of Pennings *et al.* (2000), Brockhaus (1980), and March *et al.* (1987).

Kahneman and Tversky (1979) and Dyer *et al.* (1982) suggested that risk attitude perception by farmers depended on the actual outcome of the decision. Despite theory suggesting that this dependency exists, the relevancy of hindsight knowledge on prior acreage/marketing/pricing decision-making is questionable, given the uncertainty involved with the associated risks (production, yield, quality/grade, price/basis, and currency). However, the overall longer-term risk attitude of the producer might be affected by previous decisional outcomes.

There was much evidence in the NSW Main Study and comparative study in South Australia to support Kahneman and Tversky’s (1979) ‘certainty effect’ that Australian wheat growers were risk-averse when certain gains are known to eventuate, but risk-takers when losses occur. The evidence challenged the orthodox theories of Francisco *et al.* (1972), Bond *et al.* (1980), Goodwin *et al.* (1994), and Weber *et al.* (1997) who all claimed some rigidity and inflexibility in farmer’s risk attitudes. However, the findings had general agreement with the dynamic risk attitude findings of Pennings *et al.* (2000), Brockhaus (1980), and March *et al.* (1987).
The results indicated that Australian wheat growers who forward priced/hedged were more likely to acknowledge that risk attitude depended on decisional outcome, irrespective of the hedging/pricing strategy adopted. This result was not entirely unexpected. It might be expected that favourable decisional outcomes would lead to greater satisfaction (and a more positive approach to risk attitude) than an unfavourable decisional outcome that led to less satisfaction (and a more negative approach to risk attitude). This might suggest that grower risk attitudes might be influenced by ego-satisfaction levels, as indicated by Weber and Milliman (1997).

Kahneman and Tversky’s (1979) ‘certainty effect’ could be influenced by age. Younger Australian wheat growers (below 45 years) were found to be more likely to perceive that risk attitude can change depending on decisional outcome than older growers (above 45 years). Whether this was a current generational characteristic that would not be expected to change over time, or whether perceptions of the ‘certainty effect’ change over time with age, could not be determined given the Main Survey questions. There is the possibility that education, training, or acquired new knowledge may be affecting younger growers more than older growers in terms of risk attitudes, but such research complexity was beyond the capacity of the current research.

There was some evidence that Kahneman and Tversky’s ‘certainty effect’ would have more application to growers with higher production risk/marginality. South Australian wheat growers who already had high production risk/marginality and who then had high drought frequency had more agreement with Kahneman and Tversky’s ‘certainty effect’.

Under these high risk circumstances, achieving a desired (financial) outcome might make any prior production/marketing/pricing decision appear ‘good’, which might then reflect on risk attitude conservatism such as being risk-averse. This would concur with Kahneman and Tversky’s ‘certainty effect’. However, the desired (financial) outcome and ultimate risk attitude probably would have been dependent on the occurrence and timing of rainfall. Because rainfall can be perceived as a circumstance, this particular rationale might be more aligned to the findings of Dyer and Sarin (1982) rather than Kahneman and Tversky’s ‘certainty effect’. This then is a research dilemma.
9. CONCLUSIONS

There was a comprehensive range of factors identified in the Literature Review (summarized in Table 4.14.1) that influenced the usage or adoption of some marketing methods (especially forward contracts) and some hedging strategies (especially types such as futures and options hedging), but mostly for U.S.A. conditions. Little research existed for usage/adoption of the complete range of marketing methods or hedging/pricing strategies used by wheat growers in Australia under conditions of high production risk/uncertainty.

Within this gap of research knowledge, eight research questions were identified that were very topical to Australian conditions which would have important implications to industry. The Main Survey/Study on NSW wheat growers drew on the experiences gained through a Pilot Survey amongst Victorian wheat growers. Eighteen key management survey questions and seventeen key adoption/risk attitude questions were then analysed against the five marketing methods and six hedging/pricing strategies using the Fisher Exact Test. Areas of significant difference were then applied to the research questions. Subsequent comparative studies were then conducted on South Australian and Victorian wheat growers.

By undergoing comparative studies in northern NSW (large-sized diversified farms with both winter and summer crops, across a range of production marginality, with a range of end-usage intensity), South Australia (medium-sized specialized farms across a range of production marginality, with no end-usage intensity), and Victoria (small-sized diversified farms generally with high production risk/marginality, with medium end-usage intensity), most of the broad range of production and marketing conditions would be covered in the research to enable conclusions to be drawn for most Australian wheat growers. Wheat growers in Queensland (medium-sized diversified farms with high production risk/marginality, with high end-usage intensity), southern NSW (medium-sized specialized farms with medium production risk/marginality, with medium end-usage intensity), and Western Australia (large-sized diversified farms with medium
production risk/marginality, with low end-usage intensity), have characteristics that are common to the three selected study regions/States.

The **first** research question focused on whether the management approach to decision-making affected a wheat grower's choice of marketing method or hedging/pricing strategy. It was found that management approaches to decision-making by wheat growers are more likely to affect the chosen marketing method, but less likely to affect any decision to hedge/price. Perception of risk needed to be considered in hedging/ pricing decision-making, rather than the management approach.

The **second** research question focused on whether Australian wheat growers experience anxiety when choosing marketing methods or hedging/pricing strategies. It was found that wheat growers generally experience high levels of emotional anxiety whenever they make decisions relating to acreage, marketing, or pricing, usually irrespective of the marketing method or hedging/ pricing strategy, and regardless of whether usage occurred. National/export pool users generally had the highest emotional anxiety when comparing the marketing methods, while users of bank pricing products incurred the highest emotional anxiety when comparing the hedging/pricing strategies. There was some evidence to suggest that cash flow might be a greater contributing factor leading to emotional anxiety than either the marketing method or hedging/ pricing strategy.

The **third** research question focused on whether knowledge of variable cost of production influenced price risk management decisions for wheat growers. It was found that a large proportion of growers were more likely to perceive that knowledge of variable costs of production led to price risk management, regardless of whether or not they undertook hedging/ pricing. Growers were also more likely to perceive that they target more realistic price levels in risk management when variable costs are known, regardless of whether or not they undertook hedging/ forward pricing.

The **fourth** research question focused on whether price risk management acts as an incentive to lower variable costs of production for wheat growers. It was found that price
risk management generally acted as an incentive to lower variable costs of production. Private pool users were more inclined to agree that price risk management acted as an incentive to lower variable costs of production when they perceived private pools as a marketing method. This farm management benefit may be one reason why growers use private pools.

The fifth research question focused on whether the wheat grower's farm size, age, debt, farming experience, or training influenced the choice of marketing method or hedging/pricing strategy.

It was found that as farm size increased, NSW wheat growers generally increased their hedging/pricing activity. However, there was a relatively high proportion (14 - 31 percent) of NSW growers who had 100 percent hedge ratios across all farm sizes. There was a strong propensity for NSW wheat growers for cash sales and storage/warehouse across all farm sizes. Usage of the National/export pool decreased with increasing farm size, while usage of private pools and forward contracting increased with increasing farm size.

In contrast, South Australian wheat growers decreased their hedging/pricing activity as farm size increased. This may possibly be explained by larger farm sizes existing near the Goyder drought line with higher risk-taking marginal farmers. As farm size increased, South Australian wheat growers increased their usage of both the National/export pool and storage, while usage of all other marketing methods decreased.

The age of the wheat grower had little influence over decision-making regarding marketing methods and hedging/pricing strategies.

A positive association is likely to occur between debt levels and hedging activity for smaller size growers, and a negative association is likely to occur for larger size growers. NSW wheat growers (larger size farms) had a negative association between debt levels and agreement that price risk management was important to farm income. In contrast,
Victoria (smaller size farms) had a positive association between debt levels and agreement that price risk management was important to farm income. Alternatively, South Australian growers (medium size farms) had a negative association between debt levels and hedging activity, but a positive association between debt levels and agreement that price risk management was important to farm income. This inconsistency might be explained through greater specialization and high production risk.

There was some evidence that the farming experience of the wheat grower had some influence over decision-making regarding marketing method and hedging/pricing strategy. However, there were no significant differences detected in the Fisher Exact Test between users and non-users either for marketing methods or hedging/pricing strategies.

Growers with more than 20 years farming experience generally were more likely to use storage and privately managed pools, and less likely to use the National/export pool and cash sales at harvest. Growers with less than 20 years farming experience generally were more likely to use the National/export pool and cash sales at harvest, and less likely to use storage and privately managed pools. More experienced NSW growers were more likely to use forward contracting, while more experienced South Australian growers were less likely to use forward contracting.

Inconclusiveness existed over any association between relevant training and the marketing method used. There was some evidence that those growers who attended at least 2 days of relevant marketing/hedging training undertook more hedging/pricing activity than those growers who did not attend at least 2 days of marketing/hedging training. However, production/delivery risk and settlement risk were more likely to explain the reason not to hedge/price than any non-attendance of relevant training.

There was some evidence that for NSW wheat growers who had attended at least two days of relevant training, a large percentage hedged/priced through futures brokers/advisers, merchants, and banks. Training may have broadened the type of hedging/pricing
strategy used. Those wheat growers who had never attended two days of relevant training yet still hedged/-priced generally did so through a private pool manager.

Wheat growers are more likely to acknowledge that more training would have contributed to a better performance when they use futures advisers. If growers undertook no hedging/forward pricing because of production risk, then it was highly unlikely for these growers to acknowledge that more training would have contributed to a better performance.

Those NSW wheat growers who had undertaken a minimum two days of relevant training were more likely to be motivated to manage price risk by a variety of factors including opportunities to maximize income (25 percent), the expectation of price falling (22 percent), knowledge of past risks (9 percent), as well as loss avoidance and recognition of price volatility (13 percent).

Those wheat growers who had no relevant training in marketing/hedging were more likely to be limited in managing price risk by production risk (71 percent), compared to those growers with relevant training (56 percent). The lack of training in marketing/hedging despite an acknowledgement of a lack of relevant knowledge/skills (14 percent) might be caused by the grower’s perception of high production risk undermining any benefits from price risk management.

The sixth research question focused on whether past bad decisions over marketing methods or hedging/pricing strategies lead to regret and avoidance by wheat growers, or to learning and seeking more knowledge. It was found that the incidence of regret and avoidance in relation to marketing methods and hedging/pricing strategies could be considered high for wheat growers, at least for the 2005 season, but the results between States was not consistent.

Users of cash sales at harvest (except for Victorian growers) and privately managed pools (except for South Australian growers) were less likely to have bad decisions in the past
leading to regret/avoidance of repeating the decision. This suggested that some wheat growers either did nothing (merely undertook a cash sale at harvest time) or transferred the responsibility of marketing from the grower to a pool manager (in a privately managed pool) in order to avoid repeating the error incurred with alternate marketing methods. It is consistent with avoiding other higher risk strategies such as the National/export pool (risk of prices falling over the length of the pool), storage (risk of prices falling), and forward contracting (risk of default and cash settlement).

Those South Australian wheat growers who hedged/priced using private pool managers were more likely to agree that past bad decisions led to regret and avoidance. This may suggest that bad decisions by growers could lead to the transference of hedging/pricing activity to an external private pool manager in some instances.

The hypothesis that wheat growers might avoid all hedging/pricing activity if past bad marketing/pricing decisions have led to regret and avoidance was seemingly upheld for South Australian wheat growers, but not for Victorian growers. This is consistent with regret and avoidance impacting greater for more specialized South Australian growers, compared with the more farm enterprise diversified growers in Victoria.

There was some evidence that regret/avoidance for wheat growers occurred more when there was greater wheat specialization (growers had more regret and avoidance when their income was largely dependent on wheat), seasonal conditions (more regret and avoidance was likely to occur in drought years), a large financial loss, and the ability of the grower to recall the event.

Wheat growers even from very different and diverse regions were more likely to agree that previous bad decisions regarding marketing/pricing led to positive outcomes (learning and searching for more knowledge), regardless of the marketing method or the hedging/pricing strategy.
The **seventh** research question focused on whether Roger's (1983) adoption criteria have any influence on decision-making regarding marketing method and hedging/pricing strategy for wheat growers. It was found that Rogers’ adoption criteria have some influence on decision-making regarding marketing method and hedging/pricing strategy, but the importance of the adoption criteria may vary widely depending on the geographic locality, production/delivery risk, the specialization of the grower, and farm size.

Australian wheat growers generally have a high propensity to deliberate before adopting a new marketing/pricing idea. As well, wheat growers who undertook no hedging/pricing activity were more likely to deliberate before adopting new ideas, regardless of the geographic location. The level of reluctance, skepticism, and delay in the adoption of new marketing/pricing ideas by Australian wheat growers might be influenced by marginality of production, crop specialization (dependency), and farm size.

NSW wheat growers who used the National/export pool were less likely to have reluctance or skepticism of new marketing/pricing ideas or experience adoption delays, those who used cash sales at harvest were less likely to be very reluctant and skeptical in the adoption of new marketing/pricing ideas, relative to non-users, and those who used storage were more likely to be very reluctant and skeptical in the adoption of new marketing/pricing ideas.

NSW wheat growers who undertook no hedging/pricing activity were less likely (to acknowledge that they were venturesome or took innovative risks when new ideas had been perceived, more likely to be very reluctant and skeptical in the adoption of new ideas, and more likely to incur major delays in the adoption of new ideas. There were similar adoption results between storage/warehousing and no hedging/pricing activity, which indicated some research outcome consistency.

Those NSW wheat growers who used bank pricing products were less likely to experience major delays in the adoption of new marketing/pricing ideas, and those who
used futures advisers were more likely to be venturesome and take innovative risks when new ideas have been perceived.

The eighth research question focused on whether Kahneman and Tversky’s (1979) 'certainty effect' (defined by as the tendency for an individual to be risk averse when certain gains are known to eventuate, but a risk taker when losses occur) was relevant to Australian wheat growers. There was much evidence to support the application of the Kahneman and Tversky’s ‘certainty effect’ proposition to Australian wheat growers. The evidence challenges orthodox theory that risk attitudes are innate, rigid, and inflexible.

There was evidence of flexibility and dynamism in risk attitudes by a majority of Australian wheat growers in that they change their risk attitude based on their role and circumstance.

Those Australian wheat growers who forward priced/hedged were more likely to acknowledge that risk attitude depended on decisional outcome. However, the type of marketing method used or the hedging/pricing strategy adopted was not significant when determining whether risk attitude depended on decisional outcomes.

Younger wheat growers (below 45 years) might be more likely to perceive that risk attitude can change depending on decisional outcome than older growers (above 45 years). South Australian growers who have high drought frequency (greater than four droughts in the last 20 years) are more likely to perceive that risk attitude can change depending on decisional outcome than growers with less than four droughts in the last 20 years.

There was no examination as to whether knowledge of Kahneman and Tversky’s (1979) ‘certainty effect’ might induce some cautiousness or greater awareness of possible outcomes when making risk decisions. It may introduce a type of Game Theory whereby possible strategic scenarios are factored into a grower’s decision-making process to achieve a desired outcome. This type of Game Theory possibility is one area for further
research, particularly in relation to possible differences in decision-making approaches between wheat growers who are more specialized compared to those who have diversified farm enterprises.
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