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## Resilience, Risk and Entrepreneurship

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### Abstract

Farmers worldwide face an increasingly turbulent environment. Successful farmers are those that adapt to shifts in the environment to capture the opportunities from such disturbance and outperform those who do not adapt. Such farmers, the literature would suggest, are entrepreneurs, catalysts for change with a risk-taking propensity. The paper presents analysis of farmers grouped with respect to their attitude to risk. It identifies that those farmers that are risk seekers would be more accurately described as gamblers based on their performance over six years of volatility. The most successful group of farmers were risk neutral, had a strong business focus and skills, managing quite high levels of debt to good effect. They had a positive attitude to change and an ability to successfully adapt to changing conditions so best fit the broader definition of entrepreneur. The risk averse group carried less debt and also outperformed the risk seeking group with strong cash results and retained earnings. Farmers cannot be assumed to be successful catalysts for change just from their attitude to risk and a belief in their ability to manage risk; instead they are those whose results prove that they are successfully taking risks, have strong business skills and run efficient farm businesses.

**Keywords:** risk attitude, perceptions and management, entrepreneurship, dairy farmers, New Zealand

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## Introduction

Farmers worldwide face an increasingly turbulent business environment (Boehlje, Gray, and Detre 2005; Gray, Dooley, and Shadbolt 2008, Parsonson-Ensor and Saunders 2011). The increase in volatility of milk price, illustrated in Figure 1, is an example of such turbulence for New Zealand dairy farmers with milk prices received halving/doubling from year to year since 2006. However, as identified by various farm management scholars, farm management research has focused on efficiency and optimizing system performance during short-term periods of stability rather than focusing on the development of long-term adaptive capacity under periods of turbulence (Chapman et al. 2007; Boehlje et al. 2005; Darnhofer, Fairweather, and Moller 2010; Darnhofer, Gibbon, and Dedieu 2012). The consequence is a reductionist approach to farm management aimed at achieving solutions which are not necessarily the best or most resilient systems under more volatile business environments. Shadbolt, Rutsito, and Gray (2011) recognize that a core competency of a resilient farming system is its ability to adapt to shifts in the environment, to capture the opportunities that might arise from disturbance and hence outperform those who do not adapt. Resilient farms are therefore reliant on the resilient qualities of human beings - flexibility, motivation, perseverance and optimism—because one cannot separate the business from the people forming and operating them.



**Figure 1.** Global Dairy Trade Index from 1999 to 2015.

Source. <https://www.globaldairytrade.info/>

Those same (resilient) qualities are often attributed in the literature to entrepreneurs, the catalysts for change (Kuratko and Hodgetts 2007) who seek to exploit opportunities (de Lauwere 2005; Alsos, Ljunggren, and Pettersen 2003). However the term entrepreneur is variously defined in the literature. A common theme is their innovativeness and risk-taking propensity (Cameron and Massey 1999; Hisrich, Peters, and Shepherd 2008) but beyond that the definitions are more

diverse. Often associated with smaller firms and self-employment they are thus identified as important for economic development, creators of employment and wealth (Wennekers and Thurik 1999; Cameron and Massey, 1999; Galloway and Mochrie 2006; Hisrich, Peters, and Shepherd 2008). The connection is also made between entrepreneurship and diversification (McElwee 2006) with Vesala, Peura, and McElwee (2007) making the distinction between conventional and portfolio farmers, the latter having more growth orientation, risk taking, innovativeness and personal control characteristics.

Common in the European literature is the parallel drawn between entrepreneurship and business skills (Olsson 1988; Phillipson et al. 2004), exploitation and opportunity recognition (Shane and Venkataraman 2000; Ravasi and Turati 2005) which is reflected in many agricultural entrepreneurial teaching programmes (Shadbolt, Kataliem, and Conforte 2009). McCarthy (2000) identified entrepreneurs as being either charismatic or pragmatic and cautioned against the assumption that all entrepreneurs were risk takers citing a number of studies that challenge the archetypical image of the entrepreneur as a high or even moderate risk taker. Her research identified how risk taking propensity altered with tenure and that learning played an important part in altering the perception of risk. The entrepreneurs she studied both perceived and reacted to risk differently as their business environment evolved. Her description of the pragmatic entrepreneur was very similar to the entrepreneur farmer identified by Olsson (1988) as being carefully deliberate in his actions, not impulsive and managing the business on a clearly formulated business idea. More distinctly both McCarthy and Olsson entrepreneurs were typified by having a positive attitude to change and an ability to successfully adapt to changing conditions in the external environment.

In fact the farmer typology from Olsson's research that was not afraid to take significant risks was termed a gambler, not an entrepreneur. The gambler was identified as having an impulsive personality and overestimated his ability to manage the farm business. Both McCarthy and Olsson discuss the impact of crises caused by 'growth sacrifices' or what could more colloquially be described as 'speed wobbles'. Various empirical studies in Sweden support Olsson's observation that often miscalculated or deficient management of a growth opportunity can result in crises; the manager (gambler) taking substantial risks may fail but his business may be picked up by a more successful manager.

Those farmers with less of an appetite for risk have been defined by Olsson (1988) as cautious or defensive strategists, the former successful producers unlikely to be interested in opportunities outside their field of competence and the latter who avoid risk to such an extent that the farm becomes rundown through lack of reinvestment.

With respect to the relationship between risk and performance there is a commonly stated assumption that high risk-taking goes hand in hand with high performance, the so called risk-return trade-off (Purdy, Langemeier and Featherstone 1997; and Nartea and Webster 2008). Patrick (2013) also identified significant positive relationships between farmers' self-assessment of their management skills and their willingness to take risks echoing the work of Ray (1986) in which high self-esteem and risk-taking propensity was aligned. The question left unanswered by both was, do such perceived skills and/or self-esteem and risk taking result in better performance?

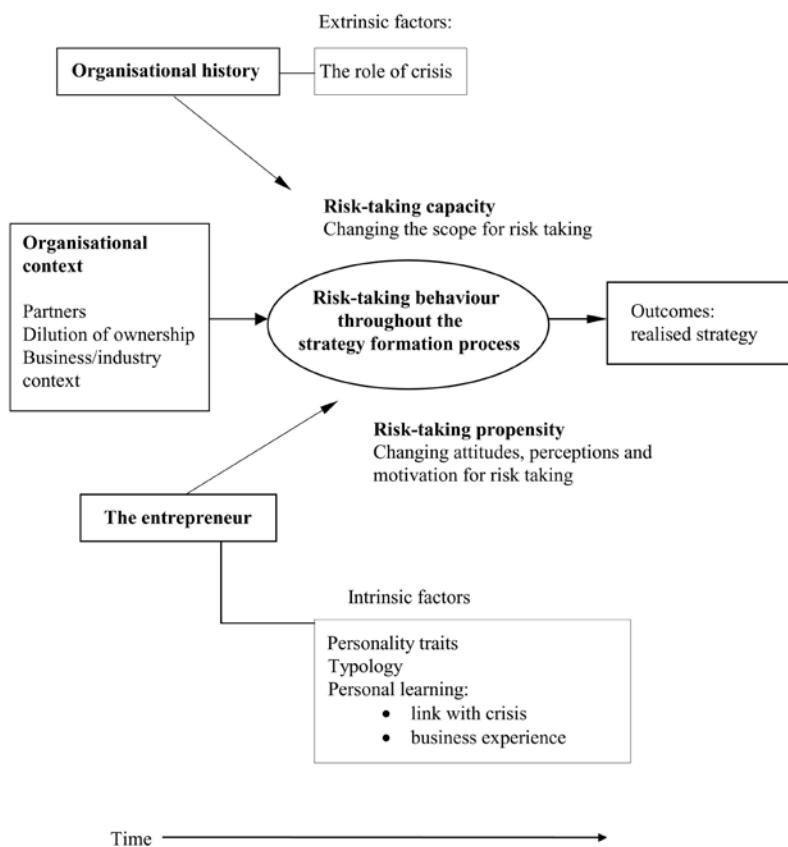
Debt can be used as a proxy for risk taking as it affects the vulnerability of the business to shocks, but its impact on performance in the literature is contradictory. Purdy and Langemeier (1995) state that solvency measures provide an indication of the farm's ability to continue operations as a viable business after financial adversity, which typically results in increased debt and reduced net worth. In the UK farmer research low debt (risk-taking) was connected to more efficient farmers (Hadley 2006; Barnes 2008) and higher performance (Langton 2011; 2012).

Shadbolt et al. (2011) in New Zealand confirmed the negative impact of debt when farm returns are low as well as the positive leverage of debt in favourable conditions, the espoused 'principle of increasing risk'. However in their Principal Component Analysis (PCA) of five years of farm data there was no evidence that debt levels or debt servicing were distinguishing features of either technical or financial farm performance. Similarly using Data Envelopment Analysis (DEA) Beux-Garcia (2013) did not find a connection between levels of debt and farm efficiency. For New Zealand dairy farms efficiency was driven by both labour productivity and cost control. As Purdy & Langemeier (1995) explain efficiency is not only the simple input-output technical efficiency of the business but also the intensity with which that business uses its assets to generate gross farm income and realizes profit. If a farm consistently underperforms (cannot deliver sufficient returns to cover family labour costs) the relative inefficiency of the farm increases with debt and vice versa (Yeager and Langemeier 2013). What influences that underperformance most is management capacity and capability (Olsson 1988).

This study is part of a wider set of research projects that have examined resilience, risk and entrepreneurship in the New Zealand dairy industry. Quantitative (Shadbolt and Olubode-Awosola 2013) and qualitative (Gray et al. 2014) research has examined farmers' attitude to, perception of, management of and performance under risk and uncertainty, as well as how to define and measure resilience within a farming business (Shadbolt et al. 2011). This study covers the examination of farmer groups, typified by their attitude to risk, to determine differences between them with respect to how they perceive and manage risk and their physical and financial performance over six highly volatile farming years. It aims to answer the question posed by Patrick (2013) and Ray (1986) on whether perceived skills and/or self-esteem and risk taking result in better performance.

## Methodology

In McCarthy's research she began with a conceptual framework for the study of risk in entrepreneurship that included intrinsic and extrinsic factors and various schools of thought that influenced risk taking propensity and ultimately business success or failure. The revised framework she devised from her results (Figure 2) provide a useful model for this research as, within the context of a turbulent six years the risk-taking propensity (attitudes and perceptions) of NZ dairy farmers was measured along with their behavior (risk management strategies adopted) and the outcomes realized from adopting those strategies (physical and financial performance).



**Figure 2.** Changes in risk perception over time

Source. McCarthy 2000

This study aims to identify and assess perceptions of, attitude to, management of and performance under risk and uncertainty in the New Zealand dairy industry using sample survey and database data from dairy farmers. A questionnaire was distributed as either a postal or online survey to approximately 1,000 farmers randomly selected from a database of industry levy payers and 500 purposely selected farmers from the DairyBase® database. This was followed by three iterations of reminders, as the survey spanned between September and December 2011. Responses from 275 respondents were completed and used.

In the first section of the survey the respondents were asked to assess their perceived ability to manage uncertainties within a season and over the long-term, their attitude to planning, aptitude in decision making and degree of risk aversion.

Respondents were then asked to assess the potential for their businesses to benefit from a range of sources of uncertainty (Table 1a) and state what they believed was the likelihood of this opportunity arising. They were then asked to assess the potential for their business to be disadvantaged from the same range of sources of uncertainty and state what they believed was the likelihood of this threat arising. This self-assessment was carried out twice, once from a within season perspective and then again from a longer term (five–ten year) perspective. The sources of uncertainty, edited slightly from a preliminary study (Shadbolt et al. 2011), were taken from a combination of the studies of Pinochet-Chateau et al. (2005), Martin (1994) and Detre et al. (2006).

In the next section the respondents were asked to determine how important specified risk management strategies (Table 1b) were for managing risk on their farm and then to state whether they did or did not use that strategy. The same list of risk management strategies, taken from Pinochet-Chateau et al. (2005) and Martin (1994) were provided to the respondents as in the preliminary study (Shadbolt et al. 2011). The questionnaire finished with some questions about the respondents dairy farm and personal characteristics.

Apart from the last section, the questions were framed in a way that responses are captured as ordinal data on a scale of 1 to 5. Typical responses were constructed using the median. Where the average median response was a fraction, the mode was used instead to represent the typical response after considering extreme responses (outliers) by using standard deviation and skewness in responses.

**Table 1. Sources of Uncertainty and Risk Management Strategies**

<b>a) Sources of Uncertainty</b>		
Climate variation	Business relationships (within supply chain)	Availability of labor (self and family, employees, contractors)
Pasture/crop/animal health	Dairy industry structure	Skills and knowledge of those associated with the business
Interest rates	The global economic and political situation	Technological changes
Land values	Global supply and demand for food	Government laws and policies
Product prices	Global competitors & competition	Local body laws and regulations
Input prices and availability	Reputation and image	
<b>b) Risk Management Strategies</b>		
Having more than one type of animal or other enterprises on your property	Geographic diversity through having properties in different areas	Not producing to full capacity so there are reserves in the system
Maintaining feed reserves	Forward contracting	Having personal and/or business insurance
Assessing strengths, weaknesses, threats and opportunities	Gathering market information	Using practical planning steps in your business
Having short term flexibility to adjust quickly to weather, price and other factors	Maintaining financial reserves: having cash and easily converted financial assets	Having a clear and shared vision or strategic purpose for your operation
Routine spraying or drenching	Main farm operator or family working off property	Using financial ratios for decision making
Irrigation	Managing debt	Using futures markets
Planning of capital spending	Keeping debt low	Spreading sales
Arranging overdraft reserves	Having long term flexibility	Monitoring program

**Note.** Sources of uncertainty used in the survey to determine respondents' perception of both upside and downside risk and its likelihood of happening; b) Risk management strategies used in the survey to determine how important respondents thought they were and whether they used them or not.

For the subset of survey respondents their farm performance data in the DairyBase® database was accessed. For each farmer with DairyBase® records the self-assessment of their attitude to, perception of, and management of risk could then be linked to their revealed physical and financial performance. DairyBase® ([www.dairybase.co.nz](http://www.dairybase.co.nz)) is a database used by farmers and professional advisors in New Zealand to analyse farm results and benchmark them with their peers. As a result data sets are not randomly generated samples from the farming population but biased samples based on whichever farm businesses are entered each year. DairyBase® calculates business KPIs (Appendix A) identified by a team of experts (Shadbolt 2009), including productivity, liquidity, profitability and solvency measures. Table 2 shows the number of DairyBase® records and the number of respondents that have records by year. This shows varying number of DairyBase® records available for the survey respondents. This was compiled into unbalanced panel data of risk survey responses and performance indicators.

**Table 2.** The DairyBase® records and number of survey respondents by year

Year	Total Number of DairyBase® records	Number of survey respondents having DairyBase® records*
2006/07	633	94
2007/08	646	116
2008/09	568	93
2009/10	579	77
2010/11	557	66
<b>2011/12</b>	<b>363</b>	<b>53</b>

**Note.** \*Out of the 275 total respondents

The first section of the survey data was used to identify typical risk profiles amongst the farmer sample; this was to better identify those with a risk-taking propensity. These are questions to capture the respondents' risk profiles in terms of their ability to manage risk, plan for the future, make choices when there are multiple options, and their attitude to risk (Table 3). Each question has five possible answers as a range of scale (from strongly disagree to strongly agree). This potentially gives five-by-five (25) arrays of responses, which can be categorized as 25 different possible types of profiles or categories.

**Table 3.** Risk ability/aptitude/attitude questions used in the survey to develop risk profiles.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<u>Within a season</u> I am able to manage almost all uncertainty that occurs	1	2	3	4	5
<u>Over the long term</u> I am able to manage almost all uncertainty that occurs	1	2	3	4	5
I find planning difficult because the future is so uncertain	1	2	3	4	5
When there are a number of solutions to a problem, I find it difficult to make a choice	1	2	3	4	5
When it comes to business, I like to play it safe	1	2	3	4	5

Multiple Correspondence Analysis (MCA) was used to examine some measure of correspondence between the five risk profile attributes and categories (responses) of the respondents. MCA is a modelling technique that can be used to reduce a large dimensional space into a low-dimensional space, normally a two dimensional map to reveal patterning in complex data sets (Greenacre 1984, 1993).

Responses to these questions were used to explore typical risk profiles among the farmers by reducing them into typologies. Typologies of farmers' risk profiles were identified by reducing these information sets into two dimensions. The two dimensions were plotted to examine the associations among the categories or typologies of the farmers. This technique was used to come up with visual maps that helped to visualize relationships among category variables (responses) for the data sets and then interpret the structure or pattern in the original data.

The farmer types were identified from the complete data set of 275 farmers. A subset of these, the survey respondents with DairyBase® records, were then summarised by type in terms of their average production and financial performance over six years. In addition, the typologies were related to their risk management strategies, business growth stage and perception of sources of risk.

## Results and Discussion

Following a process of sequential plotting of variables to explore underlying values of observation the final step of the Multiple Correspondence Analysis (MCA) was to create four quadrants to identify potential risk typologies. Some variables were well clustered within a quadrant while others were scattered within a quadrant. Distances between variables do not have a straight forward interpretation in MCA (Greenacre and Balasius 1994; Greenacre 1988), but typologies were able to be recognized from the four quadrants.

The four farm typologies outlined in Table 4):

1. Those that could be termed 'entrepreneur/gamblers' because they are risk seekers. These are farmers that believe they are able to manage almost all uncertainty that occurs within a season and over the long-term. This may be because they believe they are able to plan for the future and don't find it difficult to make a choice when there are a number of solutions to a problem. They don't play it safe when it comes to business and are therefore risk seekers. If we lean towards the Kirzner (1997) theory of alertness to opportunity in the theory of the firm, these are farmers that seek out opportunities to maximize their profit even in risky situations.
2. Those that can be termed 'here and now' conservative. These are farmers that believe they are able to manage almost all uncertainty within season, but find it difficult to plan for the future, perhaps because they are not sure of their ability to manage future uncertainty. They are neutral to the 'play it safe' approach.
3. Those that can be termed 'competent conservative'. These believe they are able to manage almost all uncertainty that occurs within a season and over the long-term, and are

neutral to the 'play it safe' approach, they do not see themselves as being either risk takers or risk averse. They do believe they are able to plan for the future and don't find it difficult to make a choice when there are a number of solutions to a problem.

4. Those that can be termed 'experienced but cautious'. These are farmers that believe they are able to manage almost all uncertainty that occurs within a season and over the long-term. This may be because they believe they are able to plan for the future and don't find it difficult to make a choice when there are a number of solutions to a problem. However, they do play it safe when it comes to business and are risk avoiders. If we lean towards the Kirzner (1997) theory of alertness to opportunity in the theory of the firm, these are farmers that are not alerted to opportunities to maximize their profit, they don't care about opportunity in risk, but rather settle for expected return ( Steven 1987).

**Table 4.** Typology Types and Risk Management

	Entrepreneur /gamblers	Here and now conservative	Competent conservative	Experienced but cautious
<u>Within a season</u> I am able to manage almost all uncertainty that occurs	Able	Able	Able	Able
<u>Over the long term</u> I am able to manage almost all uncertainty that occurs	Able	Neutral	Able	Able
I find future planning difficult because the future is so uncertain	Don't	Do	Don't	Don't
When there are a number of solutions to a problem, I find it difficult to make a choice	Don't	Don't	Don't	Don't
When it comes to business, I like to play it safe	Don't	Neutral	Neutral	Do

**Note.** Typology of respondents is based on the combinations of their ability to manage risk within a season, manage risk over the long term, plan for an uncertain future, make choices, and their propensity to 'playing it safe'.

A subset of the survey results for the farmers in each typology were then analyzed to determine how farmers in the same risk typology perceive and respond to risk and to compare their revealed farm business performance. As only those farmers who had data in DairyBase® could be included in this analysis the sample size reduced and the proportion of farmers in each typology changed; only three farmers were associated with the 'here and now conservative' typology and were therefore excluded from subsequent analysis and commentary. The exclusion of this typology reflects the bias within the DairyBase® sample. It would appear that the 'here and now conservative' farmers do not actively benchmark their businesses as regularly as the three other typologies.

## Summary Characteristics of the Farmer Typologies

### *Farmer Typology and Risk Management Strategies*

The full data set of 275 farmers in the survey reveals that the two strategies *Managing debt* and *Using practical planning steps* ranked very high and *Not producing to full capacity* and *Keeping debt low* both ranked very low (for the report on the analysis of the full data set see Shadbolt and Olubode-Awosola 2013). For the subset of farmers with DairyBase® records the proportion of farmers using these four risk management strategies by farm type are presented in Table 5.

As can be expected from the literature, the distribution shows that only a small percentage (21%) of the 'entrepreneur/gambler' farmer type used 'not producing to full capacity' to manage risk compared to the 'experienced but cautious' farmer type at 54%. To a lesser extent the same pattern is observed for keeping debt low as a risk management strategy among the three farmer types. However, the distribution also confirms that almost all the farmers did manage debt, planned capital spending and used practical planning steps to manage risk. The lower percentage of farmers 'using practical planning steps' in the entrepreneur/gambler group is of interest as that does not fit with the parallel drawn between entrepreneurship and business skills, the careful deliberation towards clearly formulated business ideas in the literature (Olsson 1988; Phillipson et al. 2004, McCarthy 2000) so would suggest more of the gambler and less of the entrepreneur.

### *Farmer Typology and Business Growth Stage*

There is a mild association between business growth stage and risk typology, the distribution of proportion of the farmer types in each of the growth and consolidation stages are similar across farm types but slightly different across the stage. More of the farmers in each farmer type are in the consolidation stage compared to the growth stage. Of those in the growth stage a higher percentage are the 'entrepreneur/gambler' type which fits with the literature's description of entrepreneurs having a growth orientation (Vesala et al. 2007) and that risk taking is also related to stage of business growth (McCarthy 2000).

**Table 5.** Summary Characteristics of the Farmer Typologies

Farmer risk attitude typology	The proportion of farmer type using the selected risk management strategies (%)					The proportion of farmer type represented in the selected business growth stage		The proportion of farmer type having a positive risk perception	
	Not producing to full capacity	Managing debt	Keeping debt low	Planning of capital spending	Using planning steps	Growth stage	Consolidation stage	Within season	Over long term
Entrepreneurs (N = 28)	21.4	92.9	46.4	96.4	85.7	32.1	50.0	71.4	75.0
Competent conservative (N = 33)	39.4	100.0	72.7	93.9	100.0	30.3	51.5	63.6	57.6
Experienced but cautious (N = 37)	54.1	94.6	64.9	91.9	91.9	24.3	51.5	59.5	62.2

### *Farmer Typology and Risk Perception*

In the full data set the farmers' perception of sources of risk showed higher scores for the perceived benefits than for the disadvantages. When broken down into farmer typologies the distributions confirm the association between risk typology and risk perception as more of the 'entrepreneur/gambler' farm type have a positive risk perception, see the upside, within season and over the long term compared to the other groups that have a less positive perception of risk, see the downside. The 'entrepreneur/gamblers' believe they are more likely to benefit from uncertainty and that the benefit is more likely to happen. Such optimism is noted by Ray (1986) and Patrick (2013) with Olsson (1988) recognizing it as a feature of both an entrepreneur and a gambler. Whether they successfully exploit such perceived opportunities (de Lauwere 2005) and deliver outcomes or not is then the distinguishing feature between the two.

### *Farmer Typology Characteristics Summary*

The three typologies summarized from Table 4 as follows:

1. The 'experienced but cautious' farmer typology is less likely to be in a business growth stage, is as likely to perceive the upside as the downside of risk and plays it safe by not producing to full capacity.
2. The 'entrepreneur/gambler' is more likely to be in a business growth stage, perceives mostly upside risk from uncertainties, produces to full capacity, does not prefer to keep debt low as a risk management strategy and is less likely to use practical planning steps.
3. The 'competent conservative' sits for the most part between the other two typologies except they state they are more likely to keep debt low, and all of them managed debt and used practical planning steps.

## **Farmer Typology and Production and Financial Performance KPIs**

One-Way ANOVA test results of difference among the three typology groups from six years of data are presented in Table 6. There are a number of points of interest especially as these performance results often contradict the indications given by the farmers through their self-assessments.

*Physical performance:* There is a significant difference in some farm physical KPIs among the three typology groups. The kilograms of milk solid (kgMS) per cow are different at the 10% level; cows and kgMS per full time equivalent (FTE) of labor is different at the one percent level. There was no significant difference between the typologies in stocking rate or milk production per hectare. If the 'experienced but cautious' farmers were 'not producing to full capacity' as they indicated they were in Table 3 it is of interest that this is not reflected in these two physical KPIs.

The 'experienced but cautious' had a higher kgMS/cow followed by the 'competent conservative' group and 'entrepreneur/gamblers' in that order. However the 'competent conservative' group had higher cows per labor unit and consequently produced more milk per unit of labor.

**Table 6.** Mean Key Performance Indicators

KPIs		Entrepreneurs (N = 64)	Competent conservative (N = 55)	Experienced but cautious (N = 80)	ANOVA p- value
<b>Farm Physical KPIs</b>					
K01	Cows/ha	3.1	3.0	2.9	0.277
K02	Kg Milksolids/ha	1080.8	1122.3	1106.5	0.666
K03	Kg Milksolids/cow	352.9	366.5	375.4	0.079 *
K04	Cows/FTE	137.0	157.7	136.9	0.001 ***
K05	Kg MS/FTE	48,537.9	58,832.0	51,469.6	0.005 ***
<b>Profitability (Dairy)</b>					
K06	Gross Farm, Revenue/ha	6,928.	7,701.2	7200.0	0.189
K07	Operating Expenses/ha	4,813.6	5,544.	4,863.5	0.015
K08	Operating Profit (EFS)/ha	2,115.3	2,156.8	2,336.4	0.640
K09	Gross Farm Revenue/kg MS	6.4	6.8	6.5	0.269
K10	Operating Expenses/Kg MS	4.5	4.9	4.4	0.001 ***
K11	Operating Profit (EFS)/Kg MS	1.9	1.9	2.1	0.528
K12	FWE/Kg MS	3.7	4.1	3.4	0.000 ***
K13	Operating Profit Margin (%)	28.4	26.6	30.8	0.182
K14	Asset Turnover (%)	20.0	18.2	19.4	0.843
K15	Operating Return on Dairy Assets (%)	5.0	5.3	6.0	0.759
<b>Profitability (Total Business)</b>					
K16	Interest & Rent/total Revenue	24.9	21.9	16.2	0.000 ***
K17	Interest & Rent/Kg MS	1.5	1.4	1.0	0.000 ***
K18	Total Return on Assets (%)	5.4	9.7	9.6	0.207
K19	Return on Equity %	1.6	3.0	6.5	0.002 ***
K20	Total Return on Equity %	0.4	13.7	11.8	0.005 ***
<b>Liquidity</b>					
K21 <sup>1</sup>	Net Cash income \$m	0.8	1.5	1.0	0.000 ***
K22	Farm Working Expenses \$m	0.5	0.9	0.6	0.000 ***
K23 <sup>2</sup>	Cash operating Surplus \$m	0.3	0.5	0.4	0.014 ***
K24	Discretionary Cash \$m	0.1	0.2	0.2	0.098 ***
K25	Cash Surplus/Deficit '000	-31.4	-8.0	45.7	0.603
<b>Total Wealth</b>					
K26	Closing Dairy Assets \$m	6.1	10.2	6.7	0.000 ***
K27	Closing total Assets \$m	6.8	10.7	6.8	0.000 ***
K28	Closing total Liabilities \$m	2.7	4.7	2.3	0.000 ***
K29	Closing Total Equity \$m	4.0	6.1	4.5	0.011 ***
K30	Growth in Equity \$m	0.1	0.8	0.5	0.323
K31	Growth from profit ('000)	7.2	27.2	124.7	0.040 ***
K32	Growth from Capital (\$m)	0.1	0.7	0.3	0.342
K33	Growth in Equity %	17.4	14.9	12.1	0.863
K34	Debt to Asset %	44.6	45.0	34.3	0.001 ***
K35	Opening Liabilities/kg MS	18.8	20.7	21.1	0.001 ***
K36	Closing Liabilities/kg MS	21.1	22.2	15.1	0.000 ***

Notes. <sup>1</sup>\$6,814/ha, \$7,481.8/ha, \$7,063.3/ha for type 1, 2 and 3 respectively (0.285 significance level)

<sup>2</sup>\$1,069/ha, \$1,037/ha, \$1832/ha for type 1, 2 and 3 respectively (0.006 \*\*\* Significance level).

Over six years of data of Farmer Typologies: \*\*\*, \*\*, \* indicating significance at 1%, 5% and 10% respectively.

***Financial Performance:*** Among the dairy profitability KPIs, operating expenses per ha is slightly different (15%) among the groups, operating and farm working expenses per kgMS are both different at the one percent level. The ‘competent conservative’ group spent more in terms of operating expenses and farm working expenses (FWE) per kgMS. Neither operating return on dairy assets nor operating profit margin, both key distinguishers of farm performance in previous analyses of this database (Shadbolt et al. 2011; Beux-Garcia 2013), differed between typologies suggesting more variation within typologies than between them.

However most of the total business profitability KPIs did differ amongst the three typologies at the one per cent level. Return on Equity (excluding change in capital value) is the return after debt servicing and is the measure used by Purdy & Langemeier (1995) as a proxy for business risk – their premise being the higher the value the more likely the business will withstand adversity. The ‘experienced but cautious’ group with lower interest and rent costs had a higher return on equity followed by the ‘competent conservative’ and entrepreneur/gamblers in that order.

The total return on assets and total return on equity KPIs include any change in the underlying capital base value over time with the operating returns. This change could be the result of inflation (common to all) or astute development, selling and purchasing of land. For these KPIs it is the ‘competent conservative’ group that outperforms the ‘experienced but cautious’ and the ‘entrepreneur/gamblers’ in that order, delivering 13.7%, 11.8% and 0.4% total return on equity respectively.

The liquidity KPIs, except the cash surplus/deficit, are also different among the three typologies at one percent. They reflect the larger farm size of the ‘competent conservative’ group. When examined per hectare the net cash income on a per hectare basis is not different between the typologies but the cash operating surplus per ha basis is different, with the ‘experienced but cautious’ group delivering the higher amount.

In terms of total wealth the groups are also different except in growth in equity and growth in capital. All groups therefore benefited from the same increase in asset values but there was a significant difference between the equity growth from profit (retained earnings) with the ‘experienced but cautious’ group at \$124,700, the ‘competent conservative’ group at \$27,200 and the entrepreneurs at \$7,200. The ‘competent conservative’ group had higher wealth in absolute terms but also had higher debt and higher closing liabilities per kgMS with a similar debt to asset ratio to the entrepreneurs. If the ‘competent conservative’ farmers were ‘keeping debt low’ as they indicated they were in Table 3 it is of interest that this is not reflected in debt to asset % KPI. Or maybe their assessment of ‘low levels of debt’ is higher due to their confidence and competence as business managers. Their debt levels are higher than the risk taking entrepreneur/gamblers but their interest and rent/kgMS (K17) is lower reflecting their higher gross farm revenue per kgMS (K09) and possibly their ability to negotiate better financing terms due to their scale and performance.

### *Farmer Typology KPIs Summary*

There is no significant difference between the commonly used KPIs of operating profit per hectare and operating return on dairy assets and the typologies, however other KPIs do differ and enable the typologies to be better explored.

Of particular interest given the assumption in some literature that risk seeking and high performance go hand in hand, was that the 'entrepreneur/gambler' typology delivered lower returns. They were similar size businesses to the more risk averse 'experienced but cautious' typology but produced less milk per cow, less milk per FTE, had equivalent operating expenses per hectare and per kilogram milksolids, paid more interest and rent as a percentage of gross farm income and per kilogram milksolids and achieved lower cash operating surplus per hectare, return on equity and total return on equity.

In contrast the 'competent conservative' typology had bigger farms, higher debt, higher operating expenses per hectare and per kilogram milksolids, more cows and milk production per FTE and the highest total return on equity. The latter the result of positive leverage on debt achieved off a 9.7% total return on assets.

Growth in equity (K30) in absolute terms is the sum of both growth from profit (K31) and growth from capital (K32). To achieve high growth from profit requires both a higher profit to be achieved and more of it being retained in the business, which means less profit leaving the business in the form of drawings. The risk averse 'experienced but cautious' typology achieved significantly higher cash surplus and the highest growth from profit. Growth in equity (K33) is also measured in DairyBase® as the difference between opening and closing equity as a percentage. The higher figure for the entrepreneur/gamblers, while not significant, possibly reflects the slightly greater proportion of those farmers in the growth stage of their business.

## **Conclusions**

The expectation from the literature was that the risk seeking farmers would have higher debt, be more profitable and be growing their businesses faster. The results show a more complex situation. The debt to asset percentages indicate little difference between the 'entrepreneur/gamblers' and the 'competent conservatives' with respect to solvency yet the 'entrepreneur/gamblers' paid more interest and rent as a percentage of gross farm revenue so were paying more for their debt. The growth of the businesses is also not significantly different. Although there is no significant difference between operating return on assets between typologies of note is the lower return on equity and growth from profit of the 'entrepreneur/gamblers'. The risk averse 'experienced but cautious' farmers had a lower debt to asset percentage, produced the highest milk production per cow and return on equity (excluding change in capital values), more cash surplus and reinvested significantly more profit back into the business. The larger 'competent conservative' farmers with a similar debt to asset percentage to the entrepreneurs delivered the highest milk production per labor unit, spent more per kgMS but delivered the highest total return on equity, successfully leveraging debt against profit and capital gain.

While the strategies of managing debt, planning of capital spending and using practical planning steps were common to all three typologies the two less highly ranked strategies of 'not producing to full capacity' and 'keeping debt low' were the ones that distinguished between the three typologies most. 'Entrepreneur/gamblers' were less likely to think either of these two strategies was important, they also displayed a more positive perception of sources of risk, the ability to see the glass half full rather than half empty. However these traits did not reflect in better average business performance over the six years than the 'competent conservative' and 'experienced but cautious' farmers.

The entrepreneur/gambler typology was therefore more typical of the gambler defined by Olsson (1988); not afraid to take risks, overestimating their ability to manage and delivering below par business results. Their businesses could be suffering from what Olsson (1988) describes as growth sacrifices or 'speed wobbles'. The 'entrepreneur/gambler' differed from the other typologies specifically in the response to 'playing it safe', it could be that the McCarthy (2000) caution against assuming all risk takers were entrepreneurs is valid in this instance. However their more positive perception of sources of risk is quite similar to the observation both Olsson and McCarthy make of entrepreneurs having a positive attitude to change.

The 'competent conservative' with their strong business skills, delivering excellent performance, taking risks (high debt levels) despite their belief that they weren't, can be likened to McCarthy's pragmatic entrepreneur and Olsson's entrepreneur. The risk averse 'experienced but cautious' also with good performance is very similar to Olsson's cautious strategists, "successful producers unlikely to be interested in opportunities outside their field of competence".

This quantitative analysis of the attributes of those farmers by typology over a six year period has provided some useful insights of farmer behavior in volatile times. It is not as simple as some literature suggests. Farmers cannot be assumed to be successful catalysts for change just from their attitude to risk and a belief in their ability to manage risk; instead they are those whose results prove that they are successfully taking risks, have strong business skills and run efficient farm businesses. More in depth research is required to delve into other attributes—flexibility, motivation, perseverance, as well as optimism, in order to determine the characteristics best associated with strong business outcomes.

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## Appendix

Description of the DairyBase® KPIs	
KPIs	Description
<b>Physical Performance</b>	
Stocking Rate (cows/ha)	Peak Cows Milked divided by Milking area
Kg Milksolids/ha (KgMS/ha)	Milksolids Kilograms divided by Milking area
Kg Milksolids/cow (Kg MS/cow)	Milksolids Kg divided by Peak Cows Milked
Cows/FTE	Peak Cows Milked divided by Total Full Time Equivalent labor units (FTEs).
Kg MS/FTE	Total Milksolids Kg produced divided by Total FTEs.
Net Cash Income per ha (\$/ha)	Net Cash income from milk sales; net (sales-purchases) dairy livestock sales and other dairy farm related revenue. This value is divided by milking area.
<b>Liquidity</b>	
Discretionary cash per (\$/ha)	This is the cash available from dairy, non-dairy and off-farm operations to meet capital purchases, debt repayments, drawings, and extraordinary expenses (discretionary items). The calculation is Cash Operating Surplus less rent, interest and tax plus net non-dairy cash income, change in income equalization and net off-farm income. This value is divided by milking area.
Cash Surplus/Deficit per ha (\$/ha)	The cash surplus from dairy, non-dairy and off-farm operations over the year. The calculation is total discretionary cash plus introduced funds less net capital purchases, net change in debt, drawings and extraordinary expenses. This value is divided by milking area.
Drawings per ha (\$/ha)	This includes all owners' household cash expenditure eg. living expenses, holidays, donations, life insurance and private portion of farm cash expenditure. Any off-farm wages and Salaries earned are netted off drawings. This value is divided by milking area.
<b>Solvency</b>	
Interest and Rent/Total Revenue:	Interest and Rent (excluding run-off rent) paid as a percentage of Total Revenue: Total GFR + Net off-farm income where GFR = net cash income plus value of the change in dairy livestock numbers.
Interest and Rent/Kg MS (\$/kgMS)	Interest and Rent (excluding run-off rent) paid divided by Milk solids Kg.
Debt to Assets % (%)	Closing Total Liabilities as a percentage of Closing Total Assets. This measures the proportion of the business value that is borrowed by the owners.
<b>Profitability</b>	
FWE/Kg MS	Farm Working Expenses divided by Milksolids Kg.
Operating expenses per ha (\$/ha)	Total Dairy Operating Expenses: (FWE plus depreciation, feed inventory adjustment, value of unpaid family labor, owned run-off adjustment) divided by Milking area.
Operating expenses/Kg MS(\$/KgMS)	Total Dairy Operating Expenses divided by Milksolids Kg.
Operating Profit Kg MS(\$/KgMS)	Dairy Gross Farm Revenue per Kg MS less Total Dairy Operating Expenses per Kg MS.
Operating profit margin (%)	Dairy Operating Profit (Dairy GFR less Operating Expenses) as a percentage of Dairy GFR.
Asset turnover (%)	Dairy Gross Farm Revenue as a percentage of Opening Dairy Assets.
Operating return on dairy assets (%)	(Dairy Operating Profit plus owned run-off adjustment less rent) as a percentage of Opening Dairy Assets.
Total Return on Assets (%)	(Total Operating Profit plus owned run-off adjustment less rent plus change in capital value) divided by Opening Total Assets. The TRoA is the profit generated by the assets employed plus capital gains or losses. It measures the overall financial performance of the business.
Return on Equity (%)	(Total Operating Profit plus owned run-off adjustment plus net off-farm income less rent less interest) as a percentage of Opening Equity. The RoE measures the return on the funds of the owner but does not include the change in capital value.

