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Measuring risk attitude of agricultural producers using a mail survey: how consistent are the methods?

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A mail survey is used to examine the consistency of alternative risk preference elicitation procedures using five commonly used methods. These elicitation procedures have been used in previous studies to characterise risk preference. Results show little consistency across procedures, supporting strength-of-preference studies. A general recommendation for mail surveys is the development of relatively easy-to-understand risk-preference elicitation procedures that are framed according to the situational construct in question.

Key words: mail surveys, risk preference elicitation.

1. Introduction

Economists frequently use mail surveys to investigate management and marketing behaviour, incorporating questions soliciting information on risk attitude. The intention is generally to use the results of risk-attitude-elicitation questions as independent variables in analyses dealing with producer or consumer decision making. An array of risk-attitude measurement instruments (RAMI) have been developed for mail questionnaires, with economists relying more heavily on expected utility theory and psychologists relying generally on multi-item scale approaches. The final selection of a RAMI to be included in a mail questionnaire has depended largely upon the informed opinion of the researcher. Although this is generally as expected, there has been little information available to researchers concerning RAMI consistency. This paper addresses that issue.

A wealth of experimental research has dissected decision-maker responses to risk-preference-elicitation methods. Potential inconsistencies across experimental procedures or with actual decisions may be attributed to framing (Slovic 1969; Payne and Braunstein 1971), violations of the axioms of expected utility (Allais 1953; MacCrimmon 1968; Machina 1987), situational differences (Weber and Milliman 1997), strength of preference versus relative risk attitude (Dyer and Sarin 1982; Krysztofousez 1983; Smidts 1997), understanding of questions (Fausti and Gillespie 2000), or a host of other reasons. This research suggests

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that different RAMI may not measure the same preferences across alternatives. Most RAMI, including recently developed ones, have been developed for in-person survey techniques (Bard and Barry 2001; Pennings and Garcia 2001). RAMI used in mail surveys, however, rarely have the objective of obtaining precise risk-attitude measures, but are used to achieve broader categorical ratings of individuals from more to less risk averse. Different RAMI are designed to result in varying degrees of measurement precision, depending largely upon the number of alternatives that may be chosen by the respondent.

Early attempts to elicit decision-maker risk preferences generally used personal interviews to collect data for utility-function estimation, with results being compared by Officer and Halter (1968) and Knowles (1984). More recent personal interview techniques have included the 'closing-in' method, a software-based approach developed by Abdellaoui and Munier (1994) and used by Bard and Barry (2001); and provision of a choice of alternative hypothetical investments allowing for categorisation of individuals into an interval of the coefficient of relative risk aversion (Gunjal and Legault 1995).

Procedures using mail survey have included but are not limited to: (i) the interval approach to determine the interval of the coefficient of absolute risk aversion (CARA) in which an individual falls (King and Robison 1981); (ii) self-rank procedures (Cardona 1999; Basarir 2002); (iii) hypothetical choices similar to actual decisions, such as a choice between cattle-marketing strategies used by Fausti (1998); (iv) analysis of actual decisions involving risk (Yaron *et al.* 1992); and (v) use of behavioural/attitudinal questions to develop indices of risk preference (Farley 1988). Studies comparing procedures include Schurle and Tierney (1990), who compared Farley scores with self-rank and interval-approach results, finding correlation between self-rank and Farley procedures; and Bard and Barry (2001), who compared self-rank, 'closing-in', and an attitudinal procedure suggested by Patrick and Musser (1995). They concluded that self-ranking results were inconsistent with the other two procedures, biasing results toward less risk averseness.

The question this study addresses is 'Are producer risk-attitude responses across RAMI, commonly used in mail surveys, consistent when the decision context or situational construct changes?' This question has continually arisen in our and colleagues' research programs during the design stages of mail questionnaires. The paper is arranged as follows: first, data and methods are presented, followed by results and discussion of how the results compare with previous studies. Although this study does not attribute inconsistency to a particular phenomenon, we provide discussion as to possible reasons for inconsistency based upon previous research.

2. Data and methods

2.1 Survey design

A mail questionnaire was designed and sent to Louisiana and South Dakota cow–calf producers. The questionnaire included five RAMI questions and a

series of personal-profile questions found in Fausti and Gillespie (2000). Dillman (1978) was used as a guide in preparing the questionnaire. RAMI questions were similar to those that had been previously used in mail surveys to estimate risk attitude. All RAMI questions except for one were framed in the context of income to the producer. Risk-aversion intervals, probability distributions, and sizes of gambles were consistent across three expected utility-based RAMI designs. This approach allowed for analysis of responses within and across respondents to determine whether varying the situational construct across question design generated consistent risk-attitude estimates. A limitation is that questions are included on each survey form in the same order for all respondents. Thus, a producer could attempt to answer consistently throughout the survey or learning effects could conceivably occur. It is the authors' opinions that, if either were to occur, this would only lead to greater response consistency. Thus, if no consistency is found, it is doubtful this would be remedied if the questions had been asked in separate formats or at different times. All questions are found in the Appendix.

Question I was a self-rank question involving self-assessment on three options. Cardona (1999) provided a continuous line between two extremes (risk averse and risk taker) and asked respondents to indicate where they fell on this line. Basarir (2002) asked respondents to rate themselves according to their preference for risk in investment decisions. Self-rank results have also been compared with other RAMI results (Thomas 1987; Schurle and Tierney 1990; Fausti and Gillespie 2000).

Question II was designed by Barsky *et al*. (1997) and administered as part of a personal interview. This question adheres to the premise that risk aversion measures must be based on income. This RAMI provides respondents with a hypothetical choice of keeping their current job or taking an alternative employment opportunity. The question incorporates varying probabilities associated with the new job doubling respondent income or cutting it by one-third. A decision-tree approach is used.

Three of the five RAMI questions were designed in accordance with the certainty equivalence framework associated with the expected utility model: (i) a hypothetical investment question with five differing expected returns and variances (Gunjal and Legault 1995), denoted as Question III; (ii) the interval-approach method (King and Robison 1981), denoted as Question IV; and (iii) a hypothetical two-stage cattle-marketing question (Fausti 1998), denoted as Question V. Each of these questions was designed using triangle distributions. CARA intervals for these three questions were chosen according to the recommendation of Babcock *et al*. (1993), consistent with the risk premium percentage intervals, (66.7, +∞), (33.3, 66.7), (0, 33.3), (–33.3, 0), and (–∞, –33.3). Base distributions used in deriving corresponding intervals of the CARA were (i) a degenerate lottery of \$10 000 and (ii) an equal-probability, three-element distribution, (\$0, \$10 000, \$20 000). Corresponding Arrow–Pratt coefficient of absolute risk aversion ranges were estimated using a negative exponential utility function, $U(x) = \theta - e^{-\lambda x}$, where $U(.)$ is utility, x is net return, and θ and λ are the parameters estimated. See Fausti and Gillespie (2000) for greater discussion.

2.2 Survey population

During the summer of 1999, surveys were sent to 81 Louisiana and 62 South Dakota cow–calf producers who were involved in extension beef programs. Louisiana producers were involved in either the Calf-to-Carcass or the Bull Test programs. South Dakota producers were involved in the Retained Ownership program. South Dakota producers had been previously surveyed and asked if they would be willing to fill out another questionnaire involving risk attitudes. Those indicating 'yes' were sent the questionnaire and told that a drawing would be held for a South Dakota State University cap for all producers who returned it. Louisiana producers were offered $10 to complete the questionnaire. Being involved in extension programs, they are likely the more progressive producers in their respective states.

Questionnaires were completed by 102 producers, for a 71 per cent return rate. Only 75 of the surveys were completely filled out – 36 from Louisiana and 39 from South Dakota. This sample size was considered large enough to test consistency. Sample size robustness was checked according to the procedure suggested by Zar (1984, p. 312). Defining the correlation coefficient as ρ, the null hypothesis is H_0: $\rho = 0$. A minimum sample size of $n = 64$ is needed to generate a 99 per cent confidence interval for correlation estimates.

2.3 Testing for consistency between RAMI procedures

We explore RAMI consistency in five ways: (i) Pearson correlation (PC) and Cochran–Mantel–Haenszel non-zero correlation (CMH) statistics to test for correlation across RAMI; (ii) difference in population proportions tests for consistency of individual responses across Questions III, IV, and V based on the individual being placed in a specific interval of the CARA; (iii) a test similar to that used in (ii), but based on the individual being classified as strictly versus not strictly risk averse; (iv) correlation analysis between respondent level of understanding and respondent consistency across RAMI questions; and (v) PC and CMH correlation analysis between RAMI responses and behavioural/personal characteristics.

The first procedure tests for consistency across RAMI questions. Data for each RAMI were used to rank respondents from most risk averse to most risk prone. Next, ordinal rankings for each RAMI were checked for group consistency by conducting two-way cross-comparisons using PC and CMH statistics. The PC provides information on general association and direction of association, and the CMH statistic is suitable for rank–order data in which there are not necessarily the same numbers of ranks in each measure (Stokes *et al*. 2000). The number of risk-attitude categories in which a respondent could be placed varies across RAMI procedures. However, we were interested in the ordinal ranking of risk-attitude estimates for respondents in each RAMI. We define consistency across RAMI procedures as consistency in ordinal rankings across procedures. If ordinal risk-attitude rankings were inconsistent across

RAMI procedures, this would indicate that risk-attitude estimates across procedures were not comparable.

The second analysis involves determining percentages of responses falling within the same interval of the Arrow–Pratt CARA for Questions III, IV, and V. Questions I and II are not included as they do not categorise respondents into specific ranges of absolute risk aversion. Hypothesis H_0: $p_1 = p_2$, is tested, where p_1 is the proportion of responses that are consistent between two Arrow–Pratt measurement procedures and p_2 is the proportion of responses that would be consistent had selection been random. A discussion of this testing procedure is found in Zar (1984, p. 395). The third empirical procedure relaxes the strictness of the second procedure to test the consistency of individual responses identified as being strictly risk averse across these questions.

The fourth consistency check tests for a 'question–comprehension effect.' The following follow-up questions are posed to respondents of Questions III–V: 'Please circle the statement that describes your understanding of the preceding question.' Potential answers include: 'I had difficulty understanding the question', 'Although I had some difficulty understanding the question, I felt I was able to provide a reasonable answer', and 'I felt I understood the question fully'. Similar questions were not asked for Questions I and II because of their relative simplicity. To determine whether there is a relationship between consistency and level of understanding, dummy variables were created indicating whether each individual was consistently classified as risk averse in each of the three questions. These two variables would take values of '1' if consistent and '0' if inconsistent. PC and CMH analyses were run between the newly created dummy variables and each of the three questions dealing with level of understanding. Significant relationships would indicate a relationship between consistency and level of understanding.

The final consistency check employs a common approach to investigate theoretical consistency of RAMI estimates by evaluating relationships between RAMI procedures and variables hypothesised to be related to risk attitude (Halter and Mason 1978; Wilson and Eidman 1983; Thomas 1987; Schurle and Tierney 1990; Riley and Chow 1992). Examples of individual attributes hypothesised to influence risk preferences collected in the survey include age, income, and farm location. Examples of individual attributes hypothesised to be influenced by risk preference include debt level, gambling behaviour, investment practices, tobacco use, and alcohol use. Relationships between these variables and RAMI responses are investigated using PC and CMH tests. Table 1 defines variables tested (that were correlated with one or more RAMI) and provides expected signs.

3. Results

Table 2 presents summary statistics for the questions. All procedures indicate that the typical producer was risk averse. Coefficients of variation indicate the self-rank question has the lowest response variation and the calf-marketing question the highest, partially a function of the number of response levels for each RAMI.

Table 1 Definitions and expected signs of behavioural/financial attributes and risk attitude

Variable	Wording of question	Expected relationship with risk proneness	Coding
Financial risk attitude dependent variables			
Debt–asset ratio	What is your debt–asset ratio? This is your Total debts divided by your total assets.	Positive†	1 = No debt; 2 = 1–10%; 3 = 11–20%; 4 = 21–30%; 5 = 31–40%; 6 = 41–50%; 7 = 50–60%; 8 ≥ 60%.
Short-run invest	Suppose you were to inherit $10 000 today. You decide to invest this money in a short-term investment. You have the following options for investing the money. Which of these options would you most likely choose?	Positive	1 = CDs, passbook savings, money market funds, or treasury bonds; 2 = stocks from large corporations, mutual funds that are pretty reliable, or high-quality corporate bonds; 3 = Predominantly small company stocks or aggressive mutual funds.
Long-run invest	Same as Short-Run Invest except replace 'short term investment' with 'long-term investment'.	Positive	Same as short-run invest.
Low-risk invest	Respondents asked to provide the percentage of total assets in low-risk investments, such as CDs, passbook savings, money market funds, treasury bonds, or checking account.	Negative	Continuous variable, in percentages.
High-risk invest	Respondents asked to provide the percentage of total assets in higher-risk investments, such as stocks, mutual funds, speculative contracts, etc.	Positive	Continuous variable, in percentages
Behavioural risk attitude dependent variables			
Tobacco use	Do you or have you ever used tobacco products?	Positive‡	1 = No, I do not use tobacco products; 2 = I used to use tobacco products, but no longer do; 3 = Yes, I do use tobacco products.
Alcohol use	Do you drink alcoholic beverages?	Positive‡	1 = No, I do not drink alcohol; 2 = Yes, I drink less than 5 drinks per week; 3 = Yes, I drink 5 or more drinks per week.

Table 1 *Continued*

Variable	Wording of question	Expected relationship with risk proneness	Coding
Poker	In the past year, how often have you played video poker?	Positive	1 = Never. I am against gambling on moral grounds; 2 = Never, but not because I am against gambling; 3 = 1–3 times; 4 = 4–6 times; 5 = 7 or more times.
Casino	In the past year, how often have you gambled at a casino?	Positive	Same coding as Poker.
Risk attitude determining variables			
Net income	Which of the following best describes your annual household after-tax net income?	Positive§	1 ≤ $15 000; 2 = $15 000–$29 999; 3 = $30 000–$44 999; 4 = $45 000–$59 999; 5 = $60 000–$74 999; 6 = $75 000–$99 999; 7 = $100 000.
Age	What is your age?	Negative¶	1 = #20 years; 2 = 21–30; 3 = 31–40; 4 = 41–50; 5 = 51–60; 6 = 61–70; 7 = 71–80; 8 = Over 80.
Location	Louisiana or South Dakota producer	Indeterminate	0 = South Dakota; 1 = Louisiana.

† Consistent with findings of Wilson and Eidman (1983). ‡ Consistent with findings of Barsky *et al.* (1997). § Consistent with findings of Wilson and Eidman (1983), Riley and Chow (1992), and Barsky *et al.* (1997). ¶ Consistent with findings of Halter and Mason (1978), and Barsky *et al.* (1997). Inconsistent with findings of Wilson and Eidman (1983).

From Questions III, IV, and V, the proportion of the group classified as risk preferring was determined to be 20 per cent, 28 per cent, and 34.5 per cent, respectively. Questions I and II did not allow for specific categorisations of risk proneness, although 21.3 per cent of Question I respondents indicated they tended to take on more risk than other investors.

3.1 Testing for group rank order consistency across RAMI techniques

Table 3 presents PC and CMH results for each of the questions, with only Questions I and III being positively correlated. One expects these responses to be correlated as situational constructs of both questions involve investment decisions. Questions IV and V might also have been expected to be correlated, as both dealt with net return to the cattle operation. However, the situational construct is dissimilar with respect to a single marketing decision in Question

Table 2 Summary statistics for the five risk assessment methods

Method	Mean	Median	Mode	SD	Coefficient of variation	Minimum/ maximum	Interpretation of coding
Question I Self-rank	1.84	2	2	0.75	0.407	1/3	1 = tend to avoid risk in investment decisions 2 = neither seek nor avoid risk in investments 3 = tend to take on substantial risk in investments
Question II Job choice	1.96	2	1	1.10	0.561	1/4	1 = would not take new job; 2 = accept job if 0.5 prob. of double income, 0.5 prob. of cutting 20%; 3 = accept job if 0.5 prob. of double income, 0.5 prob. of cutting 33%; 4 = accept job if 0.5 prob. of double income, 0.5 prob. of cutting 50%
Question III Investment choice	2.64	3	2	1.09	0.412	1/5	1 = choose investment 1; 2 = choose investment 2; 3 = choose investment 3; 4 = choose investment 4; 5 = choose investment 5
Question IV Interval approach	4.13	5	5	2.21	0.535	1/8	1 = choose distribution H; 2 = choose distribution G; 3 = choose distribution I; 4 = choose distribution J; 5 = choose distribution L; 6 = choose distribution K; 7 = choose distribution N; 8 = choose distribution M.
Question V Calf marketing	13.86	15	1	9.42	0.679	1/29	1–14 indicate the respondent chose Alternative A, with progressively lower amounts needed to change his or her mind. 15 indicates indifference between the marketing alternatives. 16–29 indicate the respondent chose Alternative B, with progressively higher amounts needed to change his or her mind.

Table 3 Matrix of Pearson correlation coefficients (upper figure) and Cochran–Mantel–Haenszel statistics (lower figure) for each of the five risk preference elicitation procedures

	Question I Self-rank	Question II Job choice	Question III Investment choice	Question IV Interval approach	Question V Calf marketing
Question I	1.000	–0.0078	0.3211**	0.1179	–0.0262
Self-rank		0.0045	7.6287**	1.0279	0.0507
Question II		1.000	–0.0897	–0.0308	0.0706
Job choice			0.5954	0.0700	0.3687
Question III			1.000	0.0089	0.0797
Investment choice				0.0058	0.4698
Question IV				1.000	–0.0374
Interval approach					0.1034
Question V					1.000
Calf marketing					

** indicates significance at the 0.05 level.

V versus management strategies and income distributions in Question IV. Statistical evidence provides little empirical support for rank order consistency.

3.2 Testing for individual response consistency across RAMI techniques

Analysis of individual response consistency across Questions III, IV, and V using the test of proportions found no evidence of consistency. A two-way comparison of Questions III and IV showed CARA interval consistency in only 27 cases (36 per cent). Had selection been random, one would expect consistency in 30 per cent of the cases. For Questions III and V, CARA interval consistency was found in only 21 cases (28 per cent). Had selection been random, one would expect consistency in 21 per cent of the cases. For Questions IV and V, CARA interval consistency was found in only 19 cases (26 per cent). Had selection been random, one would expect consistency in 22 per cent of the cases. Tests of proportions were not significant at the 5 per cent level for any of the pairs.

The second test examined individual response consistency based on an individual being identified as strictly risk averse. The weakening of the condition did not improve the case for consistency across RAMI procedures involving Question IV. However, 65 per cent of the respondents were response consistent between Questions III and V. The probability of this proportion being a random event is 0.0072, providing evidence that these procedures are able to differentiate individuals, at an aggregate level, based on risk attitude, although one-third of respondents' risk preferences were inconsistent.

3.3 Respondent assessment of understanding of the questions

Of Questions III, IV, and V, Question III was the best understood RAMI procedure (Table 4). Seventy-seven per cent felt they understood the question fully, and only 4.1 per cent had difficulty understanding it. Question V had

Table 4 Results of analysis regarding understanding of questions III, IV, and V: percentages

Response	Question III Investment choice	Question IV Interval approach	Question V Calf marketing
I had difficulty understanding the questions	4.1	24.3	5.4
Although I had some difficulty understanding the questions, I felt I was able to provide reasonable answers.	18.9	35.1	28.4
I felt I understood the questions fully.	77.0	40.5	66.2

the second-highest level of understanding. Only 40.5 per cent of respondents reported that they fully understood question IV. Correlation analysis to determine whether there was a relationship between individual respondent consistency across RAMI procedures and respondent understanding of RAMI questions found no evidence of relationships at the 5 per cent level.

3.4 Testing for robustness of risk preference elicitation results using behavioural attributes

Evidence from the correlation analysis between RAMI estimates and personal and financial attributes suggests that structural context affects risk-attitude measurements. Behavioural and financial attributes were separated into three categories: financial risk attitude dependent variables, behavioural risk attitude dependent variables, and financial and personal risk attitude influencing variables (Table 5). Variables that were non-significant in any of the analyses are not included in Table 5, including playing the state lottery, off-farm employment, insurance coverage, seatbelt use, crop diversification, driving habits, being on an exercise program, vaccination of cattle, stocking rate, education, and consulting with county agents.

Results indicate little consistency across RAMI procedures. Estimates for Questions III and IV provided little evidence of relationships with financial and behavioural attributes. Of the three categories of attributes, financial decisions hypothesised to be affected by risk attitude had the greatest number of significant and theoretically consistent relationships with RAMI responses.

Variables hypothesised to affect risk attitude had no correlation with Questions III and IV. For two of three of the other RAMI questions, the correlation estimates with net income were inconsistent with theory. Furthermore, for Questions II and V, results indicate that Louisiana producers are more risk averse than South Dakota producers. Why is the difference in risk attitude detected in only the calf-marketing question? One possible answer is that the situational construct for Question V is less abstract than the other four RAMI questions because the question's scenario reflects the types of decisions a producer may confront on a regular basis.

Table 5 Pearson correlation coefficients (first) and Cochran–Mantel–Haenszel statistics (second) of the relationship between RAMI estimates and behavioural/financial attributes

Question Variable	I Self-rank	II Job choice	III Investment choice	IV Interval approach	V Calf marketing
Financial risk attitude dependent					
Debt–asset ratio	0.254, 4.756**	0.323, 7.733**	NS	NS	NS
Short-run investments	0.253, 4.737**	NS	NS	NS	NS
Long-run investments	0.203, 3.049*	NS	NS	NS	NS
Low-risk investments	0.247, 4.521**	NS	NS	NS	NS
High-risk investments	NS	NS	NS	NS	−0.215, 3.426*
Behaviour risk attitude dependent					
Tobacco use	–0.207, 3.166*	NS	NS	NS	NS
Alcohol use	NS	0.229, 3.876**	NS	NS	NS
Poker	NS	0.268, 5.320**	NS	NS	NS
Casino	NS	NS	NS	0.232, 3.979**	NS
Risk attitude determining variables					
Net income	0.199, 2.935*	–0.206, 3.132*	NS	NS	−0.333, 8.207***
Age	NS	–0.390, 11.236***	NS	NS	NS
Location	NS	NS	NS	NS	−0.350, 9.057***

$n = 75$; ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

3.5 Possible explanations for inconsistencies across RAMI

The published work on risk-preference elicitation in experimental situations provides several potential explanations for inconsistencies among RAMI. One should use caution in concluding that inconsistencies occurred due to a lack of understanding of the questions, as no relationship was found between level of understanding of the questions and responder consistency. Inconsistency may, however, be partially attributed to responders not providing sufficient time and attention to the survey questions. This problem may arise in any mail survey, given the interviewer is not present to encourage greater contemplation when it is evident that the respondent is not providing adequate concentration. If this explains the inconsistency, then a strong case is made for easily understood, relatively simple RAMI procedures.

A non-exhaustive list of other possible factors that might influence response includes the reflection effect (Kahneman and Tversky 1979), the isolation effect (Tversky 1972), framing effects (Slovic 1969), and response-mode effects (Schoemaker 1990). However, perhaps the most helpful published work in explaining inconsistency in these cases addresses the effect of situational construct on risk-attitude measures.

Dyer and Sarin (1982) showed that risk attitude, as determined by elicitation of certainty equivalents of sequential lotteries and resulting in a calculation of the Arrow–Pratt CARA, constitutes both a marginal valuation of outcomes effect (or a strength-of-preference value function) and a relative risk attitude effect, which is a 'pure' risk attitude measure. They found that Arrow–Pratt coefficients and relative risk attitude measures differed within respondent. Three of the risk-preference elicitation procedures in our study, Questions III, IV, and V, measured risk preference according to the Arrow–Pratt CARA, classifying respondents according to magnitude of the coefficient. These measures include both strength of preference and relative risk attitude. On the other hand, Questions I and II elicit information according to relative risk attitude, but not necessarily strength of preference, as they do not utilise specific income levels. Thus, the two implicitly different definitions of risk among the five questions might have impacted consistency. It is noted that Keller (1985) did not find greater consistency in risk preference across different domains when utilising relative risk preferences than when the Arrow–Pratt measure was used. Thus, these results do not suggest that converting all questions to one or the other would necessarily lead to greater consistency.

The published work on situational construct has extended beyond strength of preference and relative risk attitude concerns. Weber and Milliman (1997) discuss how, in addition to risk attitude, risk perception may influence respondent answers to risk-preference-elicitation questions. If a respondent does not perceive the risk in the given situation to be equal to that presented in the elicitation procedure, then he or she may not give answers that provide a basis for measuring pure risk attitude. For purposes of the present study, this issue raises questions such as, can respondents imagine a situation where they have a choice between a job

with a certain income and one with a 50–50 chance of two alternative outcomes? Do cattle producers see the returns in the marketing question as realistic outcomes? Can the respondents imagine investments with three discrete outcome levels? If answers to any of these questions are 'no', one questions whether respondents' risk perceptions with respect to the given questions influence their answers.

Another possible explanation for inconsistency across RAMI is that individuals have been shown to respond differently to alternative risky situations. For example, purchasers of insurance may gamble at a casino. Researchers have shown such behaviour under experimental conditions, partially explaining it via alternative characterisations of the utility function (e.g., Kahneman and Tversky 1979). The concern with respect to the present study is whether respondents can be expected to provide consistent risk attitude proxies under different situational constructs, even in cases where the same relative risk attitude is measured and risk perception does not influence response. One questions whether, for instance, the downside risk associated with a $100 000 investment that may have been inherited can be compared with returns from a sole source of income, which could be the case with the cattle-marketing question. Further evaluation along these lines would be warranted.

4. Conclusions, limitations and future research

A number of alternative RAMI procedures have been used in mail survey contexts, with little knowledge of the consistency among procedures or consistency with actual decisions. A comparative study of five RAMI procedures was conducted to determine whether consistency could be verified. Each question was framed using a different situational construct, so one might expect some inconsistency among them. In designing the questions, however, risk-aversion intervals, probabilities, and the magnitude of the gamble are consistent across three questions. The contribution of this study is the extensive discussion of risk-preference-elicitation procedures and the difficulties associated with designing RAMI questions to be used in mail surveys. The empirical analysis highlights the 'consistency' issue.

Results show little rank–order consistency among the five RAMI procedures. Only Questions I and III were rank–order consistent, supporting the published work dealing with the effect of situational construct in eliciting risk preferences. Both questions were framed in the context of choice of investment. Little evidence suggests that the remaining questions measure the same risk preference. Furthermore, consistency of risk-preference measurement among Questions III, IV, and V was not found.

In addition to situational construct concerns, one must also consider that some respondents indicated that they did not understand some of the questions. This calls for serious consideration of how RAMI questions should be written so that respondents can understand them well enough to provide correct answers. Respondents are unlikely to spend considerable time answering mail questionnaires if there are no rewards for 'correct' answers. This would lead one

to select a simpler elicitation method. Our simplest method was arguably the self-rank question. Although our results do not provide evidence that it performed 'globally' better than the other methods, some evidence suggests that, within its situational construct (investments), it performed relatively well. Note that it was correlated with Question III on investments, as well as questions dealing with short- and long-run investment decisions. However, the lack of any empirical evidence of a relationship between individual respondent consistency across RAMI procedures and the respondent's 'level of understanding of the RAMI question' could be viewed as additional empirical support for the situational construct hypothesis.

Overall, one can conclude from this study that these RAMI measures cannot be used interchangeably as proxies for risk attitude. Even with previous studies showing inconsistencies in experimental situations, this is not necessarily the conclusion expected prior to the study, given that the procedures tended to result in relatively 'wide' intervals – Question I, for instance, had only three relatively wide intervals of response. Given these observations, the authors suggest careful consideration of the situation in selecting a RAMI. Unfortunately, our study cannot conclude that one procedure is 'best', but rather that inconsistencies in responses are rampant with mail survey elicitation procedures.

Design of a 'global' risk attitude question for mail survey could present serious challenges, given the complex nature of risk attitudes and the lack of concentration that some respondents are likely to provide to the question. However, the work by Dyer and Sarin (1982) and Weber and Milliman (1997) suggest that designing questions that can independently measure strength of preference and pure risk attitude may lead to the development of RAMI that will yield greater consistency in a mail survey context.

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Appendix: risk preference elicitation questions

Question I: self-rank question

Relative to other investors, how would you characterise yourself? (Circle one). A = I tend to take on substantial levels of risk in my investment decisions; B = I tend to avoid risk when possible in my investment decisions; C = I neither seek nor avoid risk in my investment decisions.

Question II: job choice

Suppose you are the only income earner in the family, and you have a satisfying job guaranteed to give you the level of income you now maintain every year for life. You are given the opportunity to take a new and equally satisfying job, with a 50–50 chance it will double your current income and a 50–50 chance that it will cut your family income by 33 per cent. Would you take the new job? (Yes or No). (If you answered 'Yes', please go to Question 2. If you answered 'no', please skip to Question 3)

2. Suppose the chances were 50–50 that the new job would double your family income and 50–50 that it would cut it in half. Would you still take the new job? (Yes or No).
3. Suppose the chances were 50–50 that the job would double your family income and 50–50 that it would cut it by 20 per cent. Would you then take the new job? (Yes or No).

Question III: investment choice

Suppose you have $100 000 to invest. Suppose there are five different options in which you might invest your money. These options are illustrated below both in the chart and table. With the first option, you are certain to receive $10 000, or a 10 per cent return. Thus, at the end of the year you will have $100 000 + $10 000 = $110 000. Money in a savings account would be an example of such an investment. However, you can increase your average net income by increasing the riskiness of your investment. In Option 2, for instance, you have a 1/3 chance of receiving an average net return of $10 600. However, in this investment, you

increase the riskiness as you would also have a 1/3 chance of receiving $8170 and a 1/3 chance of receiving $13 030. Please examine the five options and answer the following questions.

(A chart and table include the following triangular distributions: Investment 1: $10 000 with certainty; Investment 2: $8170, $10 600, $13 030; Investment 3: $6420, $11 200, $15 980; Investment 4: $5420, $11 200, $16 980; Investment 5: $3440, $10 600, $17 760) Of these investments, please circle the investment that you would choose.

Question IV: interval approach

In the following questions, you are asked to compare distributions of after-tax net returns to your cattle operation that could be used for family living expenses, expansion of your farm, and accelerated debt repayment. The distributions should be thought of as alternative levels of possible after-tax net income for the next year that can occur under different weather and economic conditions. Three income levels are listed under each choice, and each income is considered to have one chance in three of actually occurring next year. Consider the different income distributions as resulting from different management strategies available to you. Please choose the distribution in each question that you would prefer. Your answers should reflect your own attitudes and your situation. After each question, please follow the directions as to which question to answer next.

Compare the following distributions and circle the one you prefer. (The respondent is directed among seven choices of distributions, similar to the format used by King and Robison 1981.) Triangular distributions are used, with outcomes ranging from $0 to $19 800).

Question V: calf marketing

Assume you have 100 newborn calves on the ground and plan to wean and sell them when they reach 500 pounds. Assume the quality of these calves is consistent and they are of similar quality to those raised by other producers in your area. Assume the cost per head of raising and transporting your calves to market is $275. Thus, once you are ready to sell all 100 of the animals, you will have $27 500 invested in your animals.

With your new calf crop, you are considering how you will market them once they are weaned. Suppose a buyer with a solid reputation has recognised the quality of your calves from past observation and offers you Marketing Alternative A. He will agree today to pay you $375 per calf once the calves are weaned. Total revenue from the sale of animals under marketing alternative A will be $37 500, for a certain profit of $10 000 ($37 500–$27 500). This will require you to sign a binding contract with the buyer today for the sale of your weaned calves.

Alternatively, you could select Marketing Alternative B, which would involve marketing your calves at a local auction. You are uncertain today of the price

your newborn calves will bring at the auction once they are weaned. Under Marketing Alternative B, assume there are three equally likely possible outcomes. Either the price per head will be low, at $300 per calf, medium, at $375 per cal, or high, at $450 per calf. (A table is provided showing prices, revenue, cost, and profit.)

If you select Marketing Alternative A today, you will be assured of earning a guaranteed $10 000 profit upon sale of the animals. If you select Marketing Alternative B, your outcome will not become known until after the animals are sold.

Given the information presented above, which marketing alternative would you select? (A = Marketing Alternative A; B = Marketing Alternative B; C = I am indifferent between Marketing Alternative A and Marketing Alternative B.)

The respondent is then asked, 'The buyer to whom you did not sell offers you a cash payment to change your mind and select his marketing alternative. How much would you require to select his alternative?' (Categorical answers vary from $0 to $7000 in $500 increments.)