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Gender differences in risk behaviour in financial decision-making: An experimental analysis

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Abstract

This paper examines whether gender differences in risk propensity and strategy in financial decision-making can be viewed as general traits, or whether they arise because of context factors. It presents the results of two computerised laboratory experiments designed to examine whether differences in risk preference and decision strategies are explained by the framing of tasks and level of task familiarity to subjects. The results show that females are less risk seeking than males irrespective of familiarity and framing, costs or ambiguity. The results also indicate that males and females adopt different strategies in financial decision environments but that these strategies have no significant impact on ability to perform. Because strategies are more easily observed than either risk preference or outcomes in day to day decisions, strategy differences may reinforce stereotypical beliefs that females are less able financial managers. © 1997 Elsevier Science B.V.

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1. Introduction

Recent interest in gender differences in business decision-making under risk has arisen from the increased participation of women in the work force and the recognition that stereotypical attitudes can generate discrimination and institutional barriers to career progression in the workplace. Gender differences in attitudes to risk and in risk related behaviour have been found in many studies, but despite recent contradictory evidence, stereotypical beliefs about gender differences prevail. It has been suggested that these gender differences are artifactual, resulting from the different methodologies adopted, particularly when the framing of questions and the influence of familiarity and skill on decision making are not taken into account (Bromiley and Curley, 1992; Eagly, 1995; Unger, 1990).

This study aims to assess the degree to which women display a common trait of less risk-seeking behaviour than men in financial decision-making. The decision behaviour of males and females in financial instances of differing familiarity and framing are compared to examine the hypothesis that gender differences are largely determined by contextual instance factors rather than trait factors. The general context has been limited to financial decisions as these form a core activity in management, business and personal decision-making, and relatively few studies of gender risk behaviour differences have focused on this area. The evidence on gender differences relating to risk behaviour in business and financial decision-making is examined in Section 2, together with the importance of differing contextual instances in explaining such differences. The experimental methodology using realistic data to minimise the impact of the methodological problems is outlined in Section 3 and the results are presented and discussed in Sections 4 and 5.

2. Gender differences in decision-making

Evidence on the existence of gender differences in business decision-making stems from the general psychology literature and specific demographic studies of sub-groups of professional and managerial working populations. There is no consensus on the size of gender differences, the methodological consistency of studies, the validity of measuring gender differences and the direction of any statistical bias in the literature (see the debate in American Psychologist, 1996, 51 (2) 153–162).

The general psychology literature contains many primary and meta-analytic studies of gender differences in social, sexual and motor behaviour, attitudes, cognitive ability, decision-making, and personality traits. In a recent and extensive review, Eagly (1995) concludes that psychologists "are in general agreement that their meta-analytic findings yield evidence of differences" (p. 148). The extent to which these gender differences represent evidence of general traits rather than contextual responses to social and environmental factors is still unresolved. The findings of these general studies are important, however, because they shape and reinforce stereotype images of men and women in the specific context of finance and management.

In a review of the specific literature on gender differences in business decision-making, Johnson and Powell (1994) argue that the research findings before 1980 were instrumental in establishing a dominant view that substantial gender trait differences exist in the nature and outcomes of management decisions involving risk. These studies suggest that women are more cautious, less confident, less aggressive, easier to persuade, and have inferior leadership and problem solving abilities when making decisions under risk compared to men, reinforcing stereotypical views that women are less able managers.

Johnson and Powell (1994) re-examine the early business decision-making literature and conclude that the evidence on gender differences is no longer clear cut. More recent evidence also supports this view. For example, no significant gender differences are found in studies which examine management decision-making values or styles (Chaganti, 1986; Powell, 1990), and more similarities than differences in personality traits are found in studies of male and female entrepreneurs (Birley, 1989; Sexton and Bowman-Upton, 1990). Males and females are found to be equally capable of performing in terms of achieving desired outcomes from decision-making under risk (Hudgens and Fatkin, 1985; Johnson and Powell, 1994), equally effective in leadership roles (Eagly et al., 1995; Hollander, 1992), and equally capable of processing and reacting to information (Stinerock et al., 1991; Hyde, 1990).

However, the one gender difference which is persistently found in both the general and business specific literature is a lower preference for risk amongst females. Hudgens and Fatkin (1985) examined military personnel using a computerised military game and found that females showed lower preference for risk than males, when subjects repeated a previously undertaken task. Johnson and Powell (1994) examined betting behaviour in the general population and an investment decision amongst management students, and found a lower preference for risk amongst women, but only in the general population. The study of Sexton and Bowman-Upton (1990) on entrepreneurs

found lower scores amongst females for four types of risk-taking using self-administered psychometric measures, with the strongest effect for monetary risks. Levin et al. (1988) similarly reported a lower risk preference amongst women in a gambling experiment and found this effect to be invariant to framing the question in terms of gains or losses for women in contrast to males.

Studies of financial decision-making have also identified a lower degree of confidence amongst women in their ability to make decisions and in the outcome of these decisions (Estes and Hosseini, 1988; Stinerock et al., 1991; Zinkhan and Karande, 1991; Masters, 1989). In a study of expert and general investors, Estes and Hosseini (1988) found that gender was the most important explanatory factor affecting confidence in investment decisions. Females were less confident about their decisions after controlling for factors such as age, experience, education, knowledge, and asset holdings. In a study of financially oriented savers, Stinerock et al. (1991) found that women had a lower risk preference and a higher degree of anxiety in financial decisions than men, plus a stronger desire to use financial advisers.

To summarise, whilst there is little support for the view that male and female decision-makers have different personality profiles or abilities, there is consistent evidence of gender differences in risk preference in business and financial decision-making. Where this evidence and the evidence of more general gender differences are interpreted as resulting from general traits, it lends support to stereotypical attitudes about women as less able managers.

Gender differences, however, could be explained by differences in the methodological approach of the studies. Bromiley and Curley (1992) argue that gender differences in behaviour and attitudes towards risk vary with the behavioural context, such as financial decisions or leisure choice. So gender differences should not be interpreted as general traits if they are context specific. A trait in this case is defined as a general predisposition which is stable across time and situations. The lack of attention to context in interpreting gender difference has also been used as a critique of the general gender difference literature (Archer, 1996; Eagly, 1995; Lott, 1996; Marecek, 1995). Moreover, within each type of general context, different instances generate differing risk behaviour, depending on the nature of the instance. Where a study focuses only on one type of instance, context based responses are more likely to be interpreted as gender trait responses.

An important factor affecting the characteristic of any one instance in determining behaviour under risk is the subject's familiarity with or experience of the situation. For example, Levin et al. (1988) found that gender differen-

ces in experimental gambling decisions were determined by experience or frequency of real betting activities. Familiarity is also linked to the extent to which individual subjects identify with their own gender role in decision-making (Levin et al., 1988; Voelz, 1985). Specifically, Radecki and Jaccard (1996) found that gender role identification measured by masculine instrumentality and feminine expressivity, were significant determinants of decision-making skills and decision orientation. Most studies of decision-making have used instances in which males have more experience, more familiarity or stronger gender role identification, all of which emphasise gender differences as traits.

Sexton and Bowman-Upton (1990) also found lower scores for energy level and risk taking amongst female entrepreneurs, but female scores were high relative to published norms. This implies a female bias towards male role identification in entrepreneurial populations which is absent from non-specialist populations. Studies which use non-specialist populations will also tend to show stronger gender differences and support gender differences as traits.

The framing of decision questions can also affect risk behaviour in any situation. Diskson (1982) found evidence that behavioural differences were more pronounced when decision problems were framed in terms of losses than gains. Risk managers were found to have a lower preference for risk than general managers when faced with loss situations, but equal risk preference when faced with gains. Gender differences, therefore, may appear more pronounced when decisions are framed in terms of losses, and less pronounced when framed in terms of gains, particularly when confounded by the use of a gender biased task. Few studies have considered the impact of alternative framing on gender differences.

Similarly, the nature of the decision problem can vary in the level of ambiguity or costs associated with the risk. Ambiguity is the degree of uncertainty about the nature and type of probability distribution underlying a risky situation. Hudgens and Fatkin (1985) found gender differences in risk preference only in tasks with low probabilities of success (for any given distribution) and argued that gender differences will be more pronounced where there is a greater degree of ambiguity in the decision instance. Most studies use a single or limited range of decisions which do not explore the impact of ambiguity or costs on gender differences.

Differences in decision-making strategies may also be affected by the familiarity or gender appropriateness of a task. For example, Hudgens and Fatkin (1985) found that males took longer to make decisions under risk than females, and subject discussions revealed that males usually looked for numer-

ical information whereas females looked for visual patterns, consistent with the view that females have superior verbal skills whilst males have superior numerical skills on average (Hyde, 1990; Quereshi and Seitz, 1993). However, the difference in strategy should not be interpreted as a general trait. The gender difference in time taken may be reversed if the gender appropriateness of the task is changed.

The methodological issues identified above suggest that the persistent evidence of gender differences in risk preference may be more closely linked to instance variation in any context than general traits. This study, therefore, aims to examine the importance of factors which vary between different instances in the general context of financial decision-making. The hypotheses addressed are that females have a lower preference for risk than males when tasks are framed in terms of losses rather than gains, when tasks are familiar, and when levels of ambiguity or costs associated with decisions are high; and that these gender differences are associated with a difference in decision strategy.

3. Study design and procedure

The use of a simple monetary lottery as the experimental instrument was rejected for several reasons. Experimental studies which use gambling examples are appropriate in terms of gains and losses for financial decision-making, but lack salience (Butler and Hey, 1987) if they do not involve real winnings. In addition, experimental gambles have been shown to have limited generality because they produce different results when compared to real betting (Anderson and Brown, 1984; Wagenaar, 1988). Even when real betting data are used, gambling involves an element of utility derived from leisure (as distinct from the utility associated with winning money) which may not be reflected in financial decisions (Johnson and Bruce, 1992). Instead, a computerised experimental approach was adopted using a series of realistic financial decisions, based on real financial data.

The computer based decision environment was also felt to be appropriate for other reasons. Many financial decisions are based on information derived from computer screens and this approach realistically represents a financial decision environment, whilst also ensuring that all individuals receive the same information. The use of the computer screen also removes the artefactual problems of an interaction between the researcher and the subject and

reduces the likelihood of gender effects from peer group pressure, public performance and perception of others relative to self (Eagly, 1995; Unger, 1990).

Subjects were drawn from the population of undergraduate and post-graduate students in the business school to ensure that any gender differences found would not be associated with non-specialist populations. The population also provided subjects who were familiar with financial decisions and had experience of viewing information on a screen. This would minimise the gender effects of familiarity with the general context and with the use of information technology and key board skills.

The study consisted of two separate experiments representing financial decisions taken under uncertainty but incorporating different instances of task frames and levels of familiarity. The first experiment involved a choice of insurance cover designed to represent a financial decision that would be familiar to both males and females, for which most individuals would have a similar amount of prior real world experience, and which could be framed in terms of losses. The second experiment involved decisions about entering or leaving a currency market, on the basis of information about exchange rates and the costs of re-entering the market. This experiment was designed to represent an unfamiliar financial decision about which most subjects would have no experience, but one for which their education would be relevant, and which could be framed in terms of gains. The overall study design is summarised in Table 1.

To ensure that subjects had appropriate incentives to perform in each experiment, they were paid the value of their results from one decision chosen at random from all the decisions taken in that experiment. This procedure

Table 1
Overall study design

	Financial instance 1 Insurance cover decisions	Financial instance 2 Currency market decisions
Between experiment factors		
Familiarity	Familiar	Unfamiliar
Frame	Losses	Gains
Overall impact	Emphasis on gender trait differences	Emphasis on situational instance differences
Within experiment factors		
Treatments	Costs (affecting losses) differ Ambiguity levels differ	Costs (affecting gains) differ

has been well tested in experimental economics as a method of inducing good performance and encouraging subjects to treat each decision as an independent decision. When subjects undertake a series of separate decisions knowing that they will be paid for their performance from one randomly selected decision (and the average reward is set higher than the likely marginal wage for subjects), they will treat each decision as if it is the one for which they will be paid (Butler and Hey, 1987; Hey, 1991). The mean rate of reward was set above the average expected hourly wage for a student.

Both experiments had a within subject design where all subjects undertook all treatments. The cost structure varied in both experiments to allow an investigation of the impact of cost on gender differences, and the degree of ambiguity about the underlying distribution generating the loss event also differed in the insurance experiment. Both experiments involved chance elements associated with risk, but also required choice associated with skill to give subjects a perception of control to simulate realistic financial decisions. Previous work has shown that subjects find it difficult to accept situations based only on chance (Wagenaar, 1988).

The degree of risk preference is measured by the frequency of actual choices in each experiment, as explained below. Differences in decision strategies are measured by decision latencies or the time taken to make a decision. In addition, gender differences in ability to achieve an outcome are also measured in terms of the final payments made to subjects.

3.1. Insurance study method

Subjects were an unmatched sample of 64 male and 62 female volunteers from the undergraduate and postgraduate population with a mean age of 20.57 years and a standard deviation of 3.08 years. All information for the insurance problem was provided on the screen and no interaction was allowed between subjects. Subjects were given both written and verbal instructions before the start of the experiment.

Participants were told that they would make 12 completely separate insurance decisions. They were advised that before each decision they would be given some wealth (assets and cash), information about the price of insurance and the risk of loss, and then asked to make a choice about insuring their assets. It was explained that the aim was to maximise wealth holdings in each decision separately, noting that buying insurance makes the asset value certain but reduces cash holdings. They were also told that for each decision one of three factors would change; the insurance premium, their wealth, or

the nature of the risk, and that they should read the information about these factors on the screen before making each decision.

Subjects were then told that one of the three events would occur after they had made each insurance decision; the value of their assets would remain the same, the value of their assets would be halved through damage, or the value of their assets would fall to zero if a disaster occurred. Before the event, they could choose from one of five insurance options: to insure against damage, to insure against disaster, to insure against both damage and disaster, not to insure at all, or to "pass" and let the computer make a random choice for them. Subjects were told that they might choose the pass option for any reason at all, including being indifferent or not knowing what to do. After each decision, the associated event and their resulting level of wealth was permanently recorded on the screen to help them log their performance over the 12 decisions.

Subjects could take as much time to make their decisions as they wanted, but they were not aware that the time taken was monitored within the program. The method of payment was explained and subjects were advised to maximise their total wealth and treat each decision independently. A pilot experiment confirmed that the experiment lasted approximately 30 min and mean earnings were £4.50 with a maximum earning of £12.00. In addition to the verbal and written instructions, all subjects were guided through three practice decisions in which they could familiarise themselves with the information and instructions provided on the screen and ask questions. (Further information on the programme, written in Turbo Pascal, is available from the authors.)

In the first screen, subjects were shown their actual level of wealth for that decision, the cost of each type of insurance, and an indicator of the nature of the risk they faced. Subjects were given a sheet at the start of the experiment showing five charts representing different distributions of the possible events. Fig. 1 shows an example of one of the five charts. They were told that for each decision, one of the five distributions would be randomly picked to generate the event. If the risk indicator said 'Chart B' they would know the distribution, but otherwise it would say just 'low' or 'high' risk, and they would have to guess. There were two levels of premiums set to reflect realistic levels of low and high cost household insurance in the UK, and two levels of wealth set to reflect a low level of typical student income, and a higher level. The decision conditions are set out in Table 2.

At the end of the experiment, a screen appeared generating random numbers. Subjects chose when to stop the generator, knowing the next unrevealed

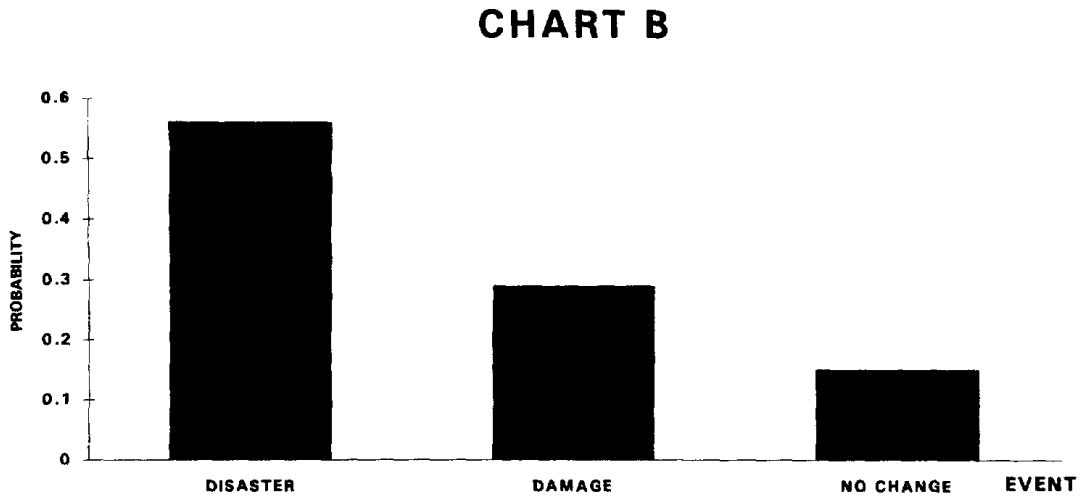

Fig. 1. Example of one of five different distributions of outcomes.

number determined the decision on which they were paid. Subjects then completed a post-experiment questionnaire.

3.2. *Insurance study results*

Examination of the post-experiment questionnaire data revealed no significant gender differences in past experience of insurance cover as measured by the number of different types of insurance policies ever bought ($p = 0.6445$).

Table 2
Treatments in the insurance experiment

Conditions	Wealth (cash + assets)	Price of insurance	Risk level
1	Low	Low	Low
2	Low	Low	High
3	Low	High	Low
4	Low	High	High
5	High	Low	Low
6	High	Low	High
7	High	High	Low
8	High	High	High
9	Low	Low	Chart B
10	Low	High	Chart B
11	High	Low	Chart B
12	High	High	Chart B

The majority of subjects, 68% of males and 77% of females, had bought at least one insurance policy. In addition, there was no significant gender difference in subjects' reported understanding of the experiment process ($p = 0.8296$) or perception of the difficulty of the task ($p = 0.4668$).

A standard lottery question, used to measure risk preference, showed that 63% of males and 73% of females declared themselves risk averse (preferring a certain value less than the expected value of a lottery). This difference was not significant ($p = 0.1949$). Fig. 2 shows a typical example (from one of the 12 decision conditions) of the frequency distributions of insurance cover chosen by males and females after each of the three possible events in the insurance experiment. The shape of the distribution is similar for males and females, after each event and across all decisions. Both males and females behave as if they are risk averse, preferring insurance (against damage, disaster or both) to no cover in all situations.

To test the hypothesis that females have a lower preference for risk than males in all situations, a repeated measures ANOVA was conducted on the frequency of cover chosen against gender and prior event. The between subject differences attributed to gender were significant ($F = 8.3$; $p = 0.043$; $df = 125$), whilst the differences attributed to prior event ($F = 3.5$; $p = 0.062$; $df = 252$) and interaction effects ($F = 2.6$; $p = 0.156$; $df = 252$) were not significant. Females chose damage cover less frequently and disaster cover more frequently than males, whatever the prior event. All subjects are generally risk averse in insurance decisions, but females show a lower preference for risk than males in their behaviour measured by their frequency of choice of insurance cover.

Differences in strategies adopted were measured by the time taken to make decisions. Time taken is an imperfect indicator of strategy as it may pick up a more general preservation effect. However, strategy differences such as processing numerical information rather than patterns will affect mean time taken directly. It is also reasonable to assume that a more general gender difference in preservation will affect strategy and the mean times taken if there is no bias in the task frame. Gender difference in the variation of times taken, as measured by the standard deviation, can be explained by a difference in the number of strategies tried by males and females, and by the extent to which they adopt extreme strategies. More widespread use of extreme strategies such as simple heuristics, taking little time, and calculated risk taking a longer time, would increase the standard deviation.

The mean times and standard deviation of time taken for a single decision, aggregating across all 12 decisions for all subjects, are shown in Table 3.

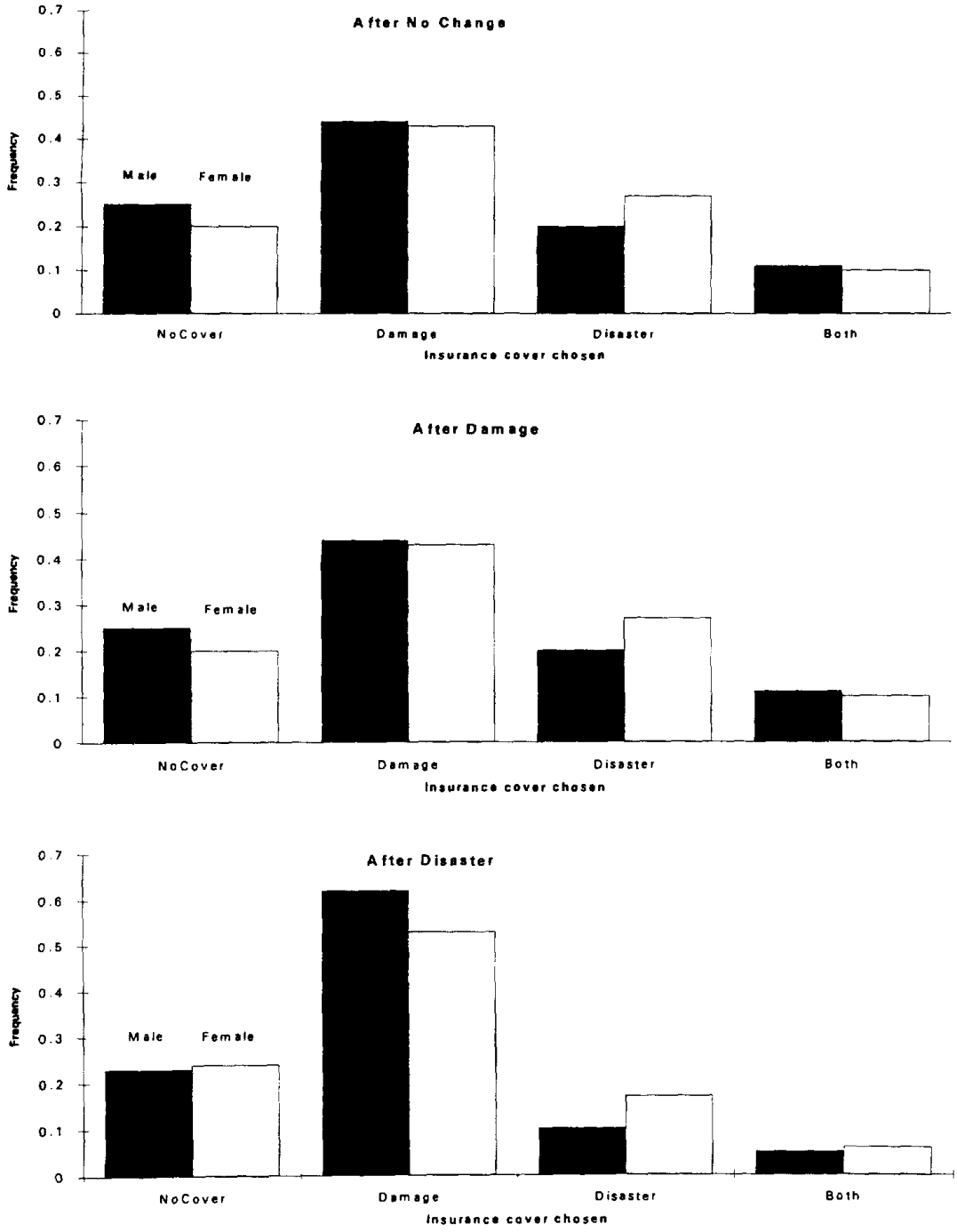

Fig. 2. Frequency distributions of insurance cover chosen by gender and prior event.

Table 3
Decision time means and standard deviations by gender

	Mean	SD	n
Males	32.28	20.20	704
Females	30.38	15.85	682

Males took significantly longer overall time to make decisions ($Z=2.114$, $p=0.017$), taking longer in 10 out of 12 decisions. Although the experiment structure is designed to make subjects treat each decision as independent, it could be argued that decisions are not independent, invalidating the test. An alternative approach is to use a non-parametric test such as the Wilcoxon paired signed rank test, to focus on the pattern of differences in means across the 12 decisions. A Wilcoxon test ($W=70$, $\alpha=0.05$) also confirms a significant difference in mean times. Similarly, on the assumption that the 12 decisions are independent, the standard deviation of times taken by males is significantly higher than for females ($F=1.573$, $p<0.001$), being higher in 10 out of the 12 decisions. On the assumption that the decisions are not independent, a Wilcoxon test also confirms a significant difference in standard deviations across the 12 decisions ($W=73$, $\alpha=0.05$).

From the post-experiment questionnaire, males reported that both price and risk affected their decisions more frequently than females, whilst females reported wealth as a factor more frequently than males. These results show that both male and female strategies involve observing numerical information and patterns of change, but that males report considering more sources of information more frequently.

To explore the impact of ambiguity on gender and risk strategy, Table 4 shows a clear pattern of difference in time taken across risk levels, with the least times taken by all subjects when there was no ambiguity and the distribution was known. When the degree of ambiguity was higher, the longest time taken was when the risk indicator said 'low'. This might be explained by the difficulty of choosing whether to insure only against damage or not at all. When the risk indicator said 'high', most subjects may have had a clear strategy. A repeated measures ANOVA confirms that risk has a main significant effect on strategy measured by time taken ($F=173.93$; $p=0.000$; $\mathrm{df}=125$) but sex does not have a significant main effect ($F=1.74$; $p=0.190$; $\mathrm{df}=252$) or interaction effect ($F=0.25$; $p=0.776$; $\mathrm{df}=252$). This evidence implies that the level of ambiguity is a more important determinant

Table 4
Mean times and standard deviations ( ) by gender and risk indicator

	Male	Female
Low risk	48.13	43.28
	(27.61)	(23.51)
High risk	38.05	36.48
	(19.22)	(15.84)
Known risk	25.50	23.32
	(16.66)	(12.69)

of risk strategy than gender, and there is no evidence to suggest that gender differences in strategy are affected by the ambiguity of the task.

The mean female payment of £5.10 was higher than the male mean payment of £4.78, but the difference was not significant ($p = 0.441$). The analysis of the post-experiment questionnaire also showed no significant gender differences in self-reported perception of performance (irrespective of earnings), but found that females felt significantly less confident at the start of the experiment ($p = 0.01$) and significantly luckier during the experiment ($p = 0.046$).

3.3. Currency market study method

Subjects were a similar unmatched sample of 66 males and 35 female volunteers from the undergraduate and post-graduate population. The information provided, the laboratory environment, program system and practice runs were set up in the same way as for the insurance experiment. Details of the pilot experiment can be found in Ansic (1994). In this experiment, subjects were asked to trade currency within a time constraint using a computer-based simulated trading market. The experiment was a within subject design where all subjects undertook all conditions, over four treatments. Each treatment represented a different season (summer, autumn, winter and spring) which was distinguished by different entry costs into the market.

Subjects were given an initial endowment of cash (100 ECU) to pay for entry into the US dollar market in order to make gains. The gain from being 'in the market' was that holdings of US dollars earned interest determined by the going ECU-dollar exchange rate. If dollars appreciated relative to ECUs after entry, the interest earnings increased, but if dollars depreciated after en-

try, interest earnings declined. The higher the exchange rate rose above the entry rate, the more subjects earned. Subjects could avoid interest earnings declining by leaving the market at any time, but when 'out of the market' although their current wealth was safe, no additional gains could be made. Additional income could only be earned 'in the market', and if subjects wanted to re-enter the market, they had to pay an entry fee. The entry fee represents the sunk cost to trading which might reasonably arise in realistic trading where initial investment is required to acquire information, legal and financial advice.

After receiving written and verbal instructions, subjects practised for one season. Each season lasted 8 min and a clock on the computer screen kept subjects informed about the amount of trading time remaining in the season. The end of day rates, drawn from the actual ECU/$ values from Datastream between 1980 and 1993, were posted on the screen and uprated every second. In the 8 min season, subjects were presented with approximately 480 days of actual exchange rate movements. The cost of entry in the practice round was 1%, and then 5%, 10%, 25% and 35% in each subsequent round. The cost of entry was posted clearly on the screen at all times.

To help subjects develop a trading strategy, a graphical history of the past 100 days worth of rates could be put on the screen at any time. The clock stopped when subjects were viewing the chart and when they were actually entering or exiting the market. Their last entry or exit price was also logged on the screen together with a record of their current wealth, upgraded every second. The screen changed colour from green to blue to remind subjects when they were 'in' or 'out' of the market. Subjects were paid a participation fee of £2.00 and a fee for every ECU earned above the original endowment on one randomly chosen session. The average payment per subject was £4.20, representing an approximately hourly earnings rate of £5.70.

3.4. Currency market results

The currency market experiment represented an unfamiliar environment for the subjects, who were acting without prior experience. Given that the subjects were drawn from the same population as for the insurance experiment, they were assumed to have similar keyboard familiarity, experience of information on screens, and knowledge of the business environment.

As the time available for decision-making is restricted in this experiment, a more appropriate measure of difference in risk preference is the time actually 'in the market'. Once an individual enters the market, they have incurred a

sunk cost for entry but they are gaining if price stays above their entry price. If price falls below their entry price, they can avoid eroding their gains by exiting, but subjects may still stay in the market if they think they have not covered their cost of entry, or if they are optimistic and believe that the price will rise. The more an individual stays in the market when price falls below entry price, the higher their risk preference as they prefer to accept the possibility of unknown losses in the market against the certain knowledge of no gains or losses out of the market (plus a known re-entry price). Time 'in the market' is measured as time in the market when price is below entry price. As the known re-entry cost rises, however, most individuals will need to be more sure of making gains on re-entry, and will spend less time in the market overall. Hence, if females have a lower risk preference, they are more likely to withdraw from the market before they maximise their profit. They will stay in the market for less time than males, at all levels of entry cost.

The results of the currency experiment are shown in Table 5. Females stay 'in the market' less on average across all levels of cost than males, suggesting they have a lower risk preference, whatever the level of sunk costs. In addition, it is clear that both males and females spend less time in the market as the re-entry costs rise, although, there could be an element of learning effect in this pattern. Because subjects make decisions on the basis of past prices in a dynamic choice setting over time, the decisions cannot be interpreted as independent in any way. For this reason, the Wilcoxon test was used to test mean time in the market for each subject across the four cost conditions. Females spend significantly less time 'in the market' ($W = 10$, $p = 0.014$), indicating a lower preference for risk. A Wilcoxon test also shows that the standard deviation of times for females is significantly lower than for males ($W = 10$, $p = 0.014$) across the range of re-entry costs. This finding is similar

Table 5
Mean times and standard deviations ( ) in and out of the market by gender and entry costs (min)

	Time 'in' the market				Time 'out' of the market			
Entry costs (%)	5	10	20	35	5	10	20	35
Males	5.03 (3.53)	2.53 (2.35)	1.73 (1.26)	0.95 (0.83)	5.39 (3.68)	3.12 (2.26)	1.97 (1.34)	1.48 (0.86)
Females	4.46 (3.03)	2.34 (1.23)	1.66 (0.71)	0.86 (0.29)	4.89 (3.06)	3.06 (1.20)	1.91 (0.82)	1.37 (0.42)

to that found in the insurance experiment, where subjects had prior experience and were familiar with the task.

Table 5 also shows time spent 'out of the market', but this is more difficult to interpret in terms of risk preference. If we assume that everyone will be content to stay 'out of the market' all the time the price is falling, the decision of interest is time 'out' when price is rising, because paying the cost of re-entry allows the potential for income to be gained (or lost). The longer an individual stays out when price is rising, the more potential profit (minus re-entry cost) they are foregoing. This could be described as riskier than re-entry as individuals are waiting for more information, at a higher cost. However, it could also be that the longer individuals stay 'out', the more pessimistic they are about price rises and the lower their risk preference. The mean and standard deviations of times are smaller for females than males as they were 'in the market'. These differences are also significant to the same degree ($W = 10$, $p = 0.014$).

The results indicate some similarity in strategy as both males and females spent more time out of the market than in. This is not unexpected as they faced the same pattern of prices. However, the gender difference in the pattern of choices may indicate a difference in strategy. The pattern of times suggests that when males are 'in the market' they value the current position (expected returns) above the cost of re-entry associated with going 'out of the market'. When males are 'out of the market', they value the current position (cost of re-entry) above the expected returns associated with going back 'in the market'. Females appear to do the reverse, valuing the current position below the alternative position. This pattern of behaviour is also consistent with the finding that females have a lower risk preference than males.

Finally, no gender differences emerged in the ability to achieve results in this financial decision instance. The mean female payment of £4.68 was greater than the mean male payment of £3.95, as in the insurance experiment, but the difference was not significant ($p = 0.55$).

4. Discussion

The analysis of the post-experiment questionnaire for the insurance experiment confirmed widespread use of insurance amongst subjects and no significant difference in prior experience between males and females. It also revealed that subjects found the task and environment equally acceptable.

Given that Levin et al. (1988) found that relevant real-world risk-taking experiences predict responses to hypothetical scenarios, both experiments should have elicited appropriately unbiased responses. In which case differences in outcomes between the two experiments can be attributed to differences in framing and familiarity as subjects were drawn from managerial educated populations.

From the overall design, we would expect differences to occur in the insurance experiment which emphasised general trait factors, rather than in the currency experiment, which emphasised context instance factors. However, females were found to have significantly lower preference for risk in both studies, irrespective of the degree of familiarity, frame, or cost. This finding does not support the view that gender differences in risk preference are context related in these instances of financial decision-making.

The results of both experiments also suggest that males and females adopt different strategies in financial decision-making, irrespective of ambiguity, framing or familiarity. Males clearly spent more time on average making decisions and displayed a higher variability in decision time in the insurance study. In the currency experiment, the difference in strategy emerged as a tendency for males to (relatively) overvalue the current state of the world, and for females to (relatively) undervalue the current state of the world, whatever the risk implications of the alternative. The post-experiment questionnaire showed no difference between males and females in their use of guess work or random choice over distinct strategies ($p = 0.89212$), but males reported using multiple strategies more frequently than females and reported observing more sources of information more frequently. Use of more information sources would explain longer decision times, and where males have a higher preference for risk than females, they might be prepared to experiment with a wider range of strategies, explaining the greater variance.

The strategy differences could be linked to risk preference through motivational theory (Schneider and Lopes, 1986). Females would have a lower risk preference if they have a greater desire for security, and males a higher risk preference if they have a greater desire for returns. As females are less risk propensive, they tend to focus on strategies which avoid the worst situation to gain security. This will lead them to a strategy to select the widest insurance cover and a loss avoiding strategy in the currency decision, such as staying out of the market longer. As males are more risk propensive, they tend to focus on strategies which they think will achieve the best possible gains, such as choosing lowest cost cover in the insurance situation and being in the market for longer in the currency situation.

Despite the difference in risk propensity and strategies, both experiments confirm that there were no significant differences between males and females in their ability to perform in financial decision-making. However, females were more likely to attribute their performance to good luck and were less confident than males for a similar level of prior experience and education. This is also consistent with motivational theory in which attributing good performance to luck implies a lower attribution of outcome to skill or internal control (Arch, 1993; Atkinson, 1983; Schneider and Lopes, 1986). Hence females undervalue and males overvalue their current position in the currency market because females are less confident in the value of their last decision. The fact that strategy differences are more easily observable than outcomes in financial decision-making in the short term, may explain the persistence of stereotypical attitudes about ability.

Whilst these results lend support to the view that gender differences in risk propensity are a general trait, other factors work against this. These results cannot be generalised beyond the general context of financial decision-making, and are based on a limited subset of instances. Even though the differences are significant, the magnitude of the differences are small. Also the level of ambiguity was found to be a more important influence on strategy than gender in the insurance study and other situational factors not included in this study may have explanatory power. For example, there may be aspects of gender role identification in the instances that are not correlated with familiarity and experience, and there may be less evidence of differences in populations of different ages and managerial experience.

5. Conclusions

This paper reviews recent evidence on gender differences in risk behaviour relevant to financial decision-making. Inconsistent results in previous studies were attributed to the methodological differences in approaches which might make context influences appear as general gender trait differences. This study provides evidence from two new experiments which examine the impact of familiarity, framing, cost and ambiguity as context factors on risk preference in financial decision-making.

The evidence supports the view that gender differences in financial risk preference exist in management populations and are not explained by the context instance of familiarity, ambiguity or gains and loss framing. Gender differences in risk propensity are also associated with a difference in decision

strategy, which may arise from an underlying differences in motivation. These differences could clearly affect choices and opportunities in the labour market, domestic decisions in financial planning and the purchase and marketing of financial products. Caution should still be exercised in interpreting these gender differences as a general trait as these may further foster stereotypical views that women are less able financial decision makers.

Further research is required to assess the robustness of the risk preference results in other contexts and other financial instances before these gender differences can be treated as general traits. Future research should also examine the role of motivational theory, and investigate the nature of gender differences in decision strategies, particularly in relation to the use of numerical and visual information. This could be achieved through further experimental studies of subject pairs drawn from a broader managerially trained population. There is also potential for developing theoretical explanations of differences in underlying motivation in terms of socialisation and perhaps through evolutionary psychology.

Appendix

QUESTIONS ABOUT THE EXPERIMENT (please ring appropriate number/answer)

1. Understanding what to do. Was the experiment:

1	2	3	4	5
very hard				very easy

2. Understanding how to do it. Was the experiment:

1	2	3	4	5
very hard				very easy

3. Before you signed up for the experiment, how did you feel?

1	2	3	4	5
Not at all confident				very confident

4. How lucky do you think you were:

1	2	3	4	5
very unlucky				very lucky

5. Despite what you have earned, how do you feel you have performed?

1	2	3	4	5
very poorly				very well

6. Did the following factors affect your decision
(tick one box in the row for each factor)

	often	sometimes	rarely	never
Speed of marble eater				
Value of the marbles				
Speed of the marbles				

7. Briefly describe the strategy you used in the second dynamic session?

8. Which of the following best describes your approach

to your choice throughout this experiment?

Random choice	
Learning from the last few events	
Reliance on gut feeling	
Assessing each choice separately	
Adopting a single strategy	
Other	

PLEASE TURN OVER

code

9. How old are you? (years) ☐

10. Have you ever studied the following at any level?
(Please tick appropriate boxes)

Insurance theory	☐
Statistical decision making	☐
Probability theory	☐

11. Have you ever bought insurance cover for any of the following?
(Please tick appropriate boxes)

Personal/household contents	☐
Cars	☐
Travel	☐
Your life	☐
Buildings (including your home)	☐
Health	☐
Unemployment	☐
Other things	☐

12. What sort of paid work do you normally do as a student?
(Please tick one box only)

Summer work only	☐
Part-time term time work only	☐
Part-time term and summer work	☐
No paid work	☐

13. Typically, what is your weekly income?
(Include all sources for all expenditures)

<£20	☐
£20 <£50	☐
£50 <£70	☐
£70 <£90	☐
>£90	☐

14. What is your ethinic origin

White	☐	Asian Indian	☐
Black Caribbean	☐	Asian Pakistani	☐
Black African	☐	Asian Chinese	☐
Black other	☐	Asian other	☐
		Other	☐

15. In general, if we offered you £5 cash or a chance to gamble on a 50:50 chance of either £10 or £0, which would you prefer?

The £5 payment	☐	The 50:50 chance	☐

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