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ABSTRACT

Few studies have explicitly focused on risky group decision making in information sharing or examined the manifestation of communication differences in face-to-face (FTF) and computer-mediated communication (CMC) teams. Hypothesizing that information-sharing behaviors could be influenced not only by contextual forces but also by personality and trust, we integrate communication mode, trust and personality into a theoretical framework, and also examine the possible impact of these constructs on risky group decision-making outcomes. Our interdisciplinary study integrates the fields of information system management, investment analysis and financial education by examining both FTF and CMC teamwork in a Stock-Trak portfolio simulation. We find that contrary to the common wisdom, even though FTF team members tend to feel greater levels of trust, affiliation and satisfaction in their team collaboration process, CMC teams eventually outperform their FTF counterparts by having greater portfolio returns and investor utilities.

Keywords

Computer-mediated communication, Face-to-face groups, Risk, Group decision making.

INTRODUCTION

Face-to-face (FTF) communication is no longer the only method used in teamwork to discuss problems and make decisions. Technology not only provides a means of structuring teamwork, enhance the information available to the team, but also provides a communication system for the participants. By using computer-mediated communication (CMC) mode based on information and telecommunication technologies, geographically and/or temporally dispersed individuals can be brought together to work in virtual teams (Jarvenpaa and Leidner 1999; Powell et al., 2004).

Despite the fact that virtual teams make collaboration among dispersed groups more convenient and less expensive, questions arise as to whether CMC enhances or hinders group processes or outcomes, and whether there are negative consequences associated with over reliance upon CMC (Baltes et al., 2002). Factors that affect the propensity of decision makers to make risky decisions have attracted considerable attention from behavioral decision theory researchers. One such factor is the decision-maker's personality traits such as risk aversion, control, affiliation and so on. Once established, risk aversion unfavorable to trust and information sharing is difficult to change (Kao and Hughes, 1993). Other personality types, such as control and affiliation summarized by the interpersonal circumplex model (ICM) (Brown et al., 2004), have often been found associated with communication mode and trust due to computer anxiety (Brown et al., 2004).

Although there has been considerable research that has examined communication mode in teams (Hebert and Vorauer, 2003), few existing studies have explicitly focused on risky group decision making in information sharing. Furthermore, few studies have examined the manifestation of these communicated differences in traditional (FTF) and virtual teams (CMC). Accordingly, this study aims to deepen our understanding of the factors that increase or lessen team members' tendencies to engage in information sharing behaviors. Since information sharing behaviors are likely to be influenced not only by contextual forces (Alge et al., 2003) but also by personality type and trust (Jarvenpaa et al. 1998), we apply a theoretical

frame in which communication mode, trust and personality are integrated in a controlled laboratory experiment involving financial investment teams. We also examine whether risky group decision-making outcomes are influenced by information sharing and trust.

LITERATURE REVIEWS

Risky Decision Making in Collaboration

Mutual fund and other institutional portfolio investors often use investment teams to collectively manage their capital allocated by the institution. We utilize decision quality, which is measured by Sharpe Ratio (Sharpe, 1966) and member satisfaction to compare the performance of FTF and CMC teams. In order to combine objective and perceptual measures to estimate the satisfaction on decision-making outcome and process, we also involve a relatively objective assessment regarding the member satisfaction, namely, "utility" that integrates investment return, risk and an individual's risk aversion level. Unlike satisfaction, utility can not be self-reported but is measured by a formula based on individual's risk aversion, market portfolio return, and individual portfolio risk and return characteristics (Bodie et al., 2004).

Trust and Information Sharing in Collaboration

Trust is defined as the willingness of a party to be vulnerable to the actions of another party (Mayer et al., 1995). Compared with FTF interactions, virtual team members have a harder time establishing trust in a new working relationship because it is difficult to assess teammates' trustworthiness without ever having met them in person (McDonough et al., 2001). Considering that CMC team interactions can be lengthy and even confusing, periodic FTF meetings among virtual team members may help to make team developments more successful (Saunders, 2000).

However, no matter what kind of team communication mode selected, proactive information sharing is always a challenging issue faced by investment teams in effectively making critical decisions under time pressure in areas related to financial market investments. A shared knowledge base is achieved when all members possess the same information and also know that other members possess the same information. For teams unable to establish such a shared knowledge base, they typically experience numerous problems including failure to communicate, difficulty understanding the importance of information, and difficulty interpreting the meaning of silence by others (Crampton, 2001).

Risk Aversion/Tolerance in Different Team Environments

The model for describing risky decision outcome has practical implication that the risk aversion of team-collaboration investors (such as mutual fund or even hedge fund managers) could be dominant to determine the utility, which measures the investor satisfaction on portfolio return-risk performance. Besides the direct effect of risk aversion on utility based on market and individual portfolio risk-adjusted return (which is not presented in the model), risk aversion can also indirectly affect decision outcomes through the mediation effect of trust and information sharing. The existing literature has widely supported the view that greater risk aversion (i.e., lower risk tolerance) leads to less trust and less willingness to acquire information (Zhang, 1998).

RESEARCH MODEL AND GROUP-LEVEL PROPOSITIONS

This study compares the effects of using different communication modes on risky decision-making outcomes. We anticipate that communication mode should affect personality (control, affiliation and risk aversion) which in turn influence information sharing and trust. Risky decision outcomes, in terms of decision quality, member satisfaction and utility, are influenced by information sharing and trust. This section elaborates on the underlying theories and derives the hypotheses, with the research model being depicted in Figure 1.

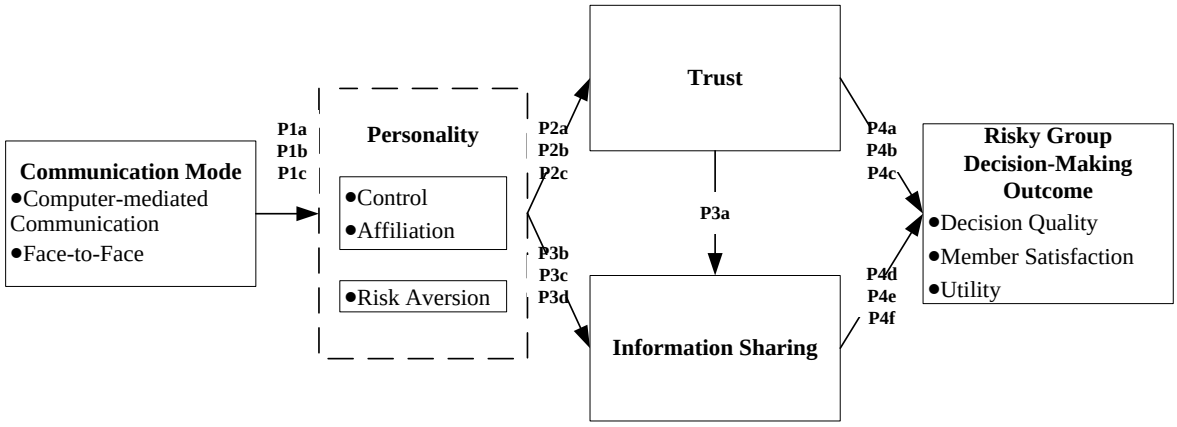

Figure 1: Research model for the study

Personality Exhibition in Different Communication Modes

Brown et al. (2004) introduced the interpersonal circumplex model (ICM) for explaining the role of personal traits in collaboration in virtual contexts. The model proposed that interpersonal traits defined by the circumplex should affect an individual's disposition to trust, perceived trustworthiness, communication, and thereby would affect the individual's willingness to collaborate. The circumplex arrays 16 distinct personality traits, according to their relation to the constructs of Control (from Dominant to Submissive) and Affiliation (from Friendly to Hostile). The two constructs, control and affiliation, are the basic personality types to be examined in our study. Since this study particularly focuses on the decision-making in a high risk environment, individual's risk aversion as a specific individual characteristic is added into the personality pool. An investor is "risk averse" if he prefers less risk to more risk, all else being equal. According to the portfolio theory introduced by Markowitz (1952), an investor with greater risk aversion level will require relatively greater returns as compensation for taking extra risk.

Existing empirical evidence suggests that personality characteristics are related to distinctive modes of communication (Heaven et al., 2006). Communication mode is the media of communication used by group. Prior cross-media research has found that for small decision making or problem solving groups, the medium used for communication makes a significant difference in group performance, and the level of an Individual's control has been found to be negatively related to computer anxiety (Brown et al., 2004). Since there is no computer anxiety existing in FTF communication, members working in FTF teams could presumably exhibit higher levels of control generally compared with those working in CMC teams. Excluding the potential negative effect of computer anxiety, and with the fact that group members in FTF communication will provide more positive feedback for each other than they are in CMC meetings (Hebert and Vorauer, 2002), individuals who working in FTF teams and more likely to receive positive feedback could exhibit higher levels of affiliation than those in CMC teams. However, for risk aversions, it may not be related to communication mode. All risk measures have the common key parameter – confidence levels, and the degrees of risk aversion are obtained from users of those risk measures. Since there is no difference between virtual team and traditional team on confidence levels, CMC teams could thus exhibit similar degrees of risk aversion as FTF teams. Therefore, we derive the following propositions regarding communication modes and personality in risky decision-making collaboration.

Proposition 1a: CMC teams will exhibit lower degrees of control than FTF teams.
Proposition 1b: CMC teams will exhibit lower degrees of affiliation than FTF teams.
Proposition 1c: CMC teams will exhibit similar degrees of risk aversion as FTF teams.

The Importance of Personality to Trust and Information Sharing

Propensity to trust, as an attribute of trust, is a general personality trait that conveys a general expectation of how trusting one should be (Jarvenpaa et al. 1999). In terms of personality, individuals in low control will perceive constraint on their ability to participate in collaboration more than individuals high in control (Brown et al. 2004). For team members who have lower levels of control, they are lack of self-confidence also reluctant to trust in the other members and even more reluctant to commit themselves to anyone. Given this perspective, a higher degree of Control should lead to higher levels of trust among

group members. Similar to low control, low affiliation would also tend to increase individuals' distrust of their relationship partners (Kelly, 1980). The association between trust and risk attitude has been widely studied in prior research. The decision by someone whether to trust another person is viewed as similar to placing a risky bet on the trustworthiness of a counterpart (Eckel and Wilson, 2004). The behaviors of individuals who decide to trust the others can be viewed as risk taking. Indeed, Ben-Ner and Putterman (2001) posit the proposition that greater risk aversion leads to less trust.
Proposition 2a: The degree of control is positively correlated with trust in teams.
Proposition 2b: The degree of affiliation is positively correlated with trust in teams.
Proposition 2c: The degree of risk aversion is negatively correlated with trust in teams.

Trust plays a key role for effective information sharing in collaborative teams. Collaboration involves both aligning the economic goals and aims of the group and the development of mutual trust (Batt and Purchase, 2004). Trust is considered as the way to manage people who cannot meet face-to-face (Handy, 1995), and facilitate effective interactions when members are willing to open themselves to each other and cooperate to solve a problem (Jarvenpaa et al., 1998). If team members distrust each other, however, they may refuse to provide needed cooperation or make contributions essential to team performance.
Proposition 3a: Trust is positively correlated with information sharing in teams.

Besides trust, an individual's personality may also affect information sharing. Since individuals in low control and affiliation are hostile and submissive, they could loaf and be a free rider in a team because they perceive that they are not part of the group, or even they are part of the group but the group performance does not directly reflect their own effects (Brown et al., 2004). Due to the free-rider problem, a complete diversification of the organization's risk, where each shareholder holds just a fraction of the equity, may leave no one willing to acquire information (Zhang, 1998). Therefore, members with low control and affiliation may be reluctant to share information with the others. As for risk aversion, considering the more risk-averse controlling shareholder has the tendency to reject too many projects from the standpoint of other shareholders and is thus less willing to acquire information (Zhang, 1998), the degree of risk aversion should be negatively correlated with the level of information sharing.
Proposition 3b: The degree of control is positively correlated with information sharing in teams.
Proposition 3c: The degree of affiliation is positively correlated with information sharing in teams.
Proposition 3d: The degree of risk aversion is negatively correlated with information sharing in teams.

Trust, Information Sharing and Risky Group Decision Making

The existing research directed toward the study of personal relationships often considers trust as a major factor in relationship development. Relation trust refers to a person's level of confidence in the strength of the relationship and his/her partner's positive feelings toward the person (Rempel et al., 1985). In the group working environment, trust is an important premise of successful group decision-making in terms of decision quality, satisfaction and utility, because collaboration can be effective only if both parties perform task with a willingness to open themselves to one another and cooperate in carrying out a task, solving a problem, and learning (Jarvenpaa et al., 1998).
Proposition 4a: Trust is positively correlated with decision quality in teams.
Proposition 4b: Trust is positively correlated with member satisfaction in teams.
Proposition 4c: Trust is positively correlated with utility in teams.

Like trust, information-sharing effectiveness has been found to positively affect group performance (Stasser and Titus, 1987). Since the tasks involved in group decision making are the high interdependence tasks (McGrath, 1984), team members are thus required to play different roles in a group, and they must effectively share knowledge in order to reach the highest quality decisions (Stasser and Titus, 1987). Also, if an individual works in a group to earn financial profits through speculative actions (i.e., risky decision making) in fuzzy environment, the person must acquire knowledge from the others so as to solve the problems with imprecise information (Tiryaki and Ahlatcioglu, 2005). Prior research also reports that effective information sharing or effective communication, as part of task process, is positively associated with decision outcomes in terms of performance and satisfaction (Powell et al., 2004).
Proposition 4d: Information sharing is positively correlated with decision quality in teams.
Proposition 4e: Information sharing is positively correlated with member satisfaction in teams.
Proposition 4f: Information sharing is positively correlated with utility in teams.

EXPERIMENT DESIGN, DATA AND METHODOLOGY

Questionnaire Design and Data Collection

A survey-based field study was designed to estimate both "subjective" team-experience perceptions and "objective" geographic characteristics of risky financial investment team-decision makers. The survey questions were measured on a Likert-type scale, ranging from 1 ("strongly disagree") to 7 ("strongly agree").

The survey was administered to undergraduate and graduate students who took "financial investments" courses at a state university located in the Midwestern US. The university provides various courses in both on-campus FTF and on-line CMC formats. All students taking financial investments courses are required to register for the Stock-Trak financial market simulation program, which is the most comprehensive online trading simulation created specially for classroom use. According to their course syllabi, each student will be randomly assigned into one of the teams consisting of 3-4 members. Teams in on-campus FTF classes are required to communicate at least twice a week during regular class hours (and also during out-of-class hours at students' own discretions), discussing, screening and voting for their portfolio reshuffling strategy. Teams in on-line CMC classes are required to communicate only on Blackboard Discussion Board (including "virtual classroom" and real-time chat features), with each team having its own private forum blocked from any non-members except for the supervising instructor. All final trading decisions must be made through a group discussion and voting process, i.e., no individual member is allowed to place any orders without being pre-approved by his/her team. Hence, the numbers of trades completed by each team can be considered as an appropriate proxy for measuring effective information sharing in a team's joint decision-making process. To summarize personal learning outcomes and team collaboration experience, each student is required to submit both an individual project report (which will be graded) and a questionnaire survey (which will not be graded). All survey inputs and Stock-Trak team portfolio outcomes (among which project grade, portfolio return, Sharpe ratio and investor utility for "decision quality" measurements, numbers of trade for "information sharing effectiveness" measurements) were summarized in the data sample.

Descriptive Statistics for Data Samples

The final sample consists of 237 Stock-Trak student participants covering Fall 2005 - Spring 2007 semesters, after excluding those who provided incomplete answers. Each of them is assigned into one of 35 FTF or 40 CMC teams. On team-level average, our sample Stock-Trak participants earned a return of 4.54% per semester on their team portfolios. When measuring their return against risk undertaken, the average Sharpe ratio for each team was approximately 1.38. Each team averagely completed 45.71 trades throughout the simulation period. Out of all participants, 45.2% were males, 21.0% were graduate students, and each participant has averagely 8.38 years job experience, 1.81 years of financial investment experience, 7.17 years of FTF teamwork experience and 1.95 years of CMC teamwork experience.

Scale Development and Reliability Analysis for Perception Item Constructs

We used various survey items above to measure the perception characteristics of the risky Stock-Trak group decision process, including investors' member satisfaction (MS), risk tolerance (RT), trust (TRUST), affiliation (AFF), control (CON), growth vs. value preference (PF1), short- vs. long-term preference (PF2) and external advice preference (PF3). The scale scores are calculated as a mean of the items constructing each scale.

To assess the internal consistency of these measurement items, we conducted a reliability analysis by computing Cronbach's Alpha for each scale. All scales are within the commonly accepted (e.g., Kline, 1999) psychological value range greater than 0.70. To assess the convergent validity of the measures, we also conducted a factor analysis by computing rotated component matrix coefficients (i.e., standardized item loadings) corresponding to each factor. By applying a principal component extraction method with varimax rotation, we found that all measurement items loaded significantly (greater than 0.50, according to Hair et al., 1998, pp. 112) as expected on their corresponding factor. This type of factor analysis has been commonly used in prior research (Gefen et al., 2003). In summary, we consider our item measurement and scale development to have acceptable reliability and validity.

RESULTS

Pearson Correlation Analysis

Based on 75 team averages, we found no significant correlations between CMC and CON ($R = -.076$, $p = .515$) or between CMC and RT ($R = -.127$, $p = .277$). However, there was evidence for significant relationship between CMC and AFF ($R = -$

.269, p = .046). Such evidence fails to strongly support Propositions 1a, but does support both 1b and 1c. It appears to us that the levels of control and risk aversion/tolerance are comparable between FTF and CMC team modes, while the virtual CMC mode tends to lower the affiliation level within a team.

On the other hand, we found significant relationships between TRUST and CON (R = .301, p = .009), between TRUST and AFF (R = .333, p = .003), but not between TRUST and RT (R = .157, p = .178). Such evidence does strongly support Propositions 2a and 2b, but does not strongly support 2c. The level of mutual trust among team members is positively and significantly affected by the levels of control and affiliation, though less significantly affected by risk tolerance.

The variables TRADE and TRUST are positively and significantly related to each other (R = .250, p = .020). Such evidence does strongly support Proposition 3a. So is the case between TRADE and AFF (R = .194, p = .044), strongly supporting Proposition 3c. However, the correlations are statistically insignificant either between TRADE and CON (R = .028, p = .812) or between TRADE and RT (R = .122, p = .299), failing to strongly support Propositions 3b or 3d. It appears that the information sharing effectiveness (in terms of numbers of trades executed by the team) relies on the levels of trust and affiliation more than on the levels of control and risk aversion.

When the team decision quality measures are brought into attention, the correlation coefficients between TRUST and GRADE, between TRUST and RET, between TRUST and SHARPE are.155 (p = .183), -.086 (p = .461) and -.150 (p = .200), respectively. Such evidence fails to strongly support Propositions 4a, whether grade, return or Sharpe ratio is used to measure decision quality. It is interesting to note that the Stock-Trak portfolio performance (especially in terms of portfolio returns and Sharpe ratios) does not seem to rely on the level of trust within a team. In other words, even a high level of trust among team members might improve information sharing effectiveness (as Proposition 3a is supported), but it would not guarantee the team's investment success (more trades are completed, though returns do not necessarily improve).

TRUST is correlated positively and significantly with MS (R = .593, p = .000) but negatively and insignificantly with UTI (R = -.025, p = .832), strongly supporting Proposition 4b but failing to support 4c. Moreover, TRADE is correlated positively and significantly with GRADE (R = .264, p = .022) and RET (R = .395, p = .000), but negatively and insignificantly with SHARPE (R = -.026, p = .827). Such evidence does strongly support Propositions 4d when grade or return is used to measure decision quality, but fails to do so when the Sharpe ratio (which measures return against risk) is employed as the proxy for decision quality. One possible explanation is that an increase in trade frequency (i.e., more focusing on day-trading or short-term trading might cause the increase in volatility (risk) to even outweigh the return improvement, therefore "diluting" the reward-to-risk Sharpe ratio.

Our results fail to support Proposition 4e (the TRADE-MS R = -.060, p = .611) while strongly supporting 4f (the TRADE-UTI R = .362, p = .000). When the information sharing effectiveness is improved and more trades are completed by a team, the "purely subjective" member satisfaction appears to be less responsive than does the "partially subjective, partially objective" investor utility which combines portfolio return, volatility and risk tolerance. Table 1 summarizes the test results for Propositions 1a through 4f as follows:

Table 1: Hypotheses Supported or Rejected based on Correlations

Possible Correlation	Proposition	Test Result
MODE (CMC) vs. CON	1a	Unsupported (negative but insignificant)
MODE (CMC) vs. AFF	1b	**Supported (Negative and Significant)**
MODE (CMC) vs. RT	1c	**Supported (Insignificantly Different)**
TRUST vs. CON	2a	**Supported (Positive and Significant)**
TRUST vs. AFF	2b	**Supported (Positive and Significant)**
TRUST vs. RT	2c	Unsupported (positive but insignificant)
TRADE vs. TRUST	3a	**Supported (Positive and Significant)**
TRADE vs. CON	3b	Unsupported (positive but insignificant)
TRADE vs. AFF	3c	**Supported (Positive and Significant)**
TRADE vs. RT	3d	Unsupported (positive but insignificant)

GRADE vs. TRUST	4a	Unsupported (positive but insignificant)
RET vs. TRUST	4a	Unsupported (negative but insignificant)
SHARPE vs. TRUST	4a	Unsupported (negative but insignificant)
MS vs. TRUST	4b	**Supported (Positive and Significant)**
UTI vs. TRUST	4c	Unsupported (negative but insignificant)
GRADE vs. TRADE	4d	**Supported (Positive and Significant)**
RET vs. TRADE	4d	**Supported (Positive and Significant)**
SHARPE vs. TRADE	4d	Unsupported (positive but insignificant)
MS vs. TRADE	4e	Unsupported (negative but insignificant)
UTI vs. TRADE	4f	**Supported (Positive and Significant)**

The correlation analysis in this section covered the co-movement relevance between variables, but did not specify the causal relationships. To clearly identify the possible determinants which drive risky financial decision making outcomes (such as decision quality), we extended our research further by applying the OLS regression methodology. The regression results are consistent to our correlation results.

CONCLUSIONS

This study empirically examined the risky group financial decision making process, and estimated the influence of a set of possible determinants impacting the team decision quality outcomes. Our findings are based upon the experimental investment activity records and a post-experiment survey of 237 students who took "financial investments" courses from a state university within the Midwestern US and participated as either FTF or CMC teams (as a part of required coursework) in the famous Stock-Trak portfolio simulation program between Fall 2005 and Spring 2007. The evidence shows that:

- Consistent with prior findings, in our Stock-Trak team simulation the levels of trust and control are not only positively but also significantly correlated; so are trust and affiliation, trust and information sharing effectiveness (as measured by the number of trades jointly approved by team), affiliation and information sharing effectiveness. Trust and information sharing effectiveness are also positively correlated with risk tolerance (i.e., negatively correlated with risk aversion), though the statistical significance is not sufficiently strong.
- When team decision qualities (simulation outcomes) are concerned, we find that portfolio return, project grade and investor utility score are positively and significantly correlated with information sharing effectiveness, whereas member satisfaction is positively and significantly correlated with trust.
- Correlation analysis indicates that compared against FTF Stock-Trak teams, CMC teams have lower (and significantly) affiliation level, lower (but insignificantly) control level, and comparable risk tolerance. Group mean comparisons indicate that CMC Stock-Trak teams significantly outperform their FTF counterparts in terms of portfolio return, number of trades completed and investor utility, slightly outperform FTF teams in risk-adjusted Sharpe ratio, even though CMC teams have comparable risk tolerance and considerably lower levels of trust, affiliation and member satisfaction to their teamwork experience.
- Regression results indicate that after controlling for team members' geographic background variations, team decision quality outcomes (project grade, portfolio return, Sharpe ratio, number of trades completed, investor utility, and in particular, member satisfaction) are still considerably associated with team members' perceived trust, control, affiliation, risk tolerance and/or investing style preference. Moreover, SHARPE, TRADE and UTI are positively and significantly associated with the CMC team mode.

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