ACCOUNTING INFORMATION AGGREGATION AND MANAGERIAL COOPERATION

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ABSTRACT

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When managers face incentives against cooperation, accounting information can increase managerial cooperation when it allows managers to perfectly verify the cooperativeness of others' prior actions. The extent to which accounting information facilitates perfect verification of others' prior actions, however, can depend on its aggregation. This dissertation provides theory-consistent experimental evidence of the effects of accounting information aggregation on managerial cooperation when managers face incentives against cooperation. Based on the psychology theory of non-consequential reasoning, I predict and find that managerial cooperation is higher when accounting information is aggregated and individuals cannot perfectly verify others' prior actions than when accounting information is disaggregated and individuals can perfectly verify others' prior actions. The experimental results indicate that individuals are more likely to use non-consequential reasoning when accounting information is aggregated than when it is disaggregated. As a result, they are more likely to frame decisions as group decisions and cooperate because it is the only action that leads to the best group outcome.

To my grandmother, who was a strong woman

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INTRODUCTION

Managers are often individually responsible and rewarded for their organizational subunits' profits (Antle and Demski 1988; Briers and Chua 2001; Melumad, Mookherjee, and Reichelstein 1992; Pick 1971), but their profits often depend on the actions of other organizational subunits. Cooperation among managers is important in these situations because it can lead to positive financial and psychological outcomes for organizations and their managers such as increased innovation, information sharing, performance, and trust (Coletti, Sedatole, and Towry 2005; Christ et al. 2008; Drake and Haka 2008; Drake, Haka, and Ravenscroft 1999; Rowe 2004; Rowe, Shields, and Birnberg 2008; Tayler and Bloomfield 2011; Young, Fisher, and Lindquist 1993).[1] Managers, however, often face incentives against cooperation; for example, managers face incentives against cooperation when they can maximize their individual profits by choosing non-cooperative actions such as free-riding (Coletti et al. 2005; McCarter and Northcraft 2007; Rowe 2004; Tayler and Bloomfield 2011; Schwartz and Young 2002; Schwartz, Young, and Zvinakis 2000; Zeng and Chen 2003).

Accounting research, however, provides evidence that non-trivial levels of managerial cooperation are common, even when managers face incentives against cooperation (Coletti et al. 2005; Drake et al. 1999; Drake and Haka 2008; Rowe 2004; Rowe et al. 2008; Schwartz and Young 2002; Schwartz et al. 2000; Tayler and Bloomfield 2011). For example, accounting information can increase managerial cooperation by changing managers' implicit incentives to

[1] Collusion is a form of cooperation that can lead to negative financial outcomes for organizations (e.g., decreased effort and performance) (cf. Hannan, Towry, and Zhang 2013 and Towry 2003). Collusion occurs when managers agree to make decisions that maximize their joint profit but not organizational profit. In order to achieve collusion, however, managers must be able to coordinate their decisions, agree to do so, and must be able to enforce their agreement (e.g., through contracting). Collusion is not possible in my dissertation because managers independently and simultaneously decide whether or not to cooperate and therefore face a coordination problem.

cooperate when it allows them to infer with certainty whether or not others have previously cooperated thereby allowing managers to build reputations for cooperation or non-cooperation (Coletti et al. 2005; Schwartz and Young 2002; Schwartz et al. 2000). Accounting information, however, is often a noisy signal of managers' prior actions due to characteristics of the information such as its aggregation. Little is known about the effects of accounting information on managerial cooperation when its aggregation is such that managers cannot infer the cooperativeness of other managers' prior actions with certainty. This dissertation therefore investigates the effects of accounting information aggregation on managerial cooperation when managers face incentives against cooperation.

Managerial cooperation depends on managers' explicit and implicit incentives for cooperation and on their uncertainty about the likelihood that other managers will cooperate. Accounting controls and information can influence managerial cooperation by increasing managers' incentives for cooperation and by influencing their beliefs about the likelihood that others will cooperate. Accounting information, for example, can increase managers' implicit incentives for cooperation when it allows managers to build reputations for cooperation or non-cooperation by allowing them to infer the cooperativeness of other managers' prior actions with certainty. In these situations, accounting information can be used as the basis for rewards (punishments) for other managers' prior cooperation (non-cooperation) (Dickhaut and McCabe 1997; Hales and Williamson 2010; King 1996; Mayhew 2001; Schwartz and Young 2002; Schwartz et al. 2000). The ability to reward (punish) cooperation (non-cooperation) is

fundamental to motivating and sustaining cooperation because reward (punishment) for cooperation (non-cooperation) increases the expected payoffs to cooperation (Axelrod 1984).[2]

Accounting information, however, can be a noisy signal of managers' prior actions and, as such, may not allow managers to perfectly verify the cooperativeness of others' prior actions. Accounting information, for example, can be aggregated in its natural form (e.g., annual lease expense). Alternatively, accounting systems may aggregate information that is disaggregated in its natural form in order to facilitate managerial decision-making. While aggregation can reduce the cognitive demands that large amounts of disaggregated information can place on users with limited cognitive resources, it can also introduce noise and decrease the informativeness of accounting information (Datar and Gupta 1994; Ijiri 1967; Lev 1969; Sorter 1969). If managerial cooperation depends on managers' ability to use accounting information as the basis for rewarding (punishing) other managers for their prior cooperation (non-cooperation), then aggregated accounting information that obfuscates managers' prior actions will reduce the implicit incentive effect of accounting information on managerial cooperation. The effects of accounting information aggregation on managerial cooperation, however, are largely unexplored in the accounting literature.[3]

Psychology research on non-consequential reasoning provides a theoretical basis for predictions about the effects of aggregated accounting information on individuals' decisions to

[2] I use reputation in a manner that is consistent with prior accounting research on managerial cooperation (Hales and Williamson 2010; Mayhew 2001; Schwartz and Young 2002; Schwartz et al. 2000). Reputation-building is possible in situations in which managers can form expectations about other managers' actions based on their prior actions.

[3] One exception is Nikias, Schwartz, Spires, Wollscheid, and Young (2010), who use an experiment to investigate the effects of cost information aggregation and budget request timing on the level of slack contained in subordinates' budget requests.

cooperate when they face incentives against cooperation (Croson 1999; Shafir and Tversky 1992; Tversky and Shafir 1992). Expected utility theory assumes that individuals use consequential reasoning to make decisions (i.e., they evaluate all decision alternatives with respect to their consequences and expected likelihoods) (Hammond 1988; Levi 1991; Savage 1954). Individuals who make decisions under uncertainty, however, sometimes use non-consequential reasoning to make their decisions and fail to appropriately consider all relevant decision outcomes. If aggregated accounting information creates uncertainty about others' prior actions, then managers who rely on aggregated accounting information when they make cooperation decisions may be more likely to use non-consequential reasoning and make cooperation decisions that are inconsistent with the assumptions of expected utility theory.

Shafir and Tversky (1992) propose that non-consequential reasoning explains non-trivial cooperation in prisoner's dilemma games in which individuals face incentives against cooperation. They predict and find that a player who is uncertain about the other player's action choice when she chooses her own action is more likely to choose cooperation than a player who knows the other player's action choice before she chooses her own action, regardless of whether the other player chose cooperation or non-cooperation. When there is uncertainty about the other player's action choice, the game's outcome depends on both players' decisions. As a result, players frame their decision as a group decision and focus their attention on the action that can lead to the highest joint payoff (i.e., cooperation). In contrast, when there is certainty about the other player's action choice, the game's outcome depends only on the decision of an individual player. As a result, players frame their decision as an individual decision and focus their attention on the action that leads to the highest individual payoff (i.e., non-cooperation).

I use the psychology theory of non-consequential reasoning to predict that aggregated accounting information will increase managerial cooperation, even though it does not allow managers to infer the cooperativeness of others' prior actions with certainty. Based on the theory of non-consequential reasoning, I expect that individuals who are provided with aggregated (disaggregated) accounting information will use non-consequential (consequential) reasoning to make their decisions because they cannot (can) use accounting information to infer the cooperativeness of others' prior actions with certainty. As a result, I predict that individuals who are provided with aggregated accounting information will frame the decision to cooperate as a group decision and prefer cooperation because it is the only action that leads to the highest joint profit. In contrast, I predict that individuals who are provided with disaggregated accounting information will frame the decision to cooperate as an individual decision and prefer non-cooperation because it is the only action that leads to the highest individual profit. Thus, I hypothesize that managerial cooperation will be higher when accounting information is aggregated than when it is disaggregated.

To test my hypothesis, I use an experiment in which accounting information aggregation is manipulated at two levels: aggregated and disaggregated profit information. Participants play a repeated one-shot prisoner's dilemma game in which they assume the role of division managers who choose either the cooperative or non-cooperative management action for their division in each period. In the final period, participants are provided with accounting information about the other participant's prior-period profit when the other participant was matched with a different participant. In the disaggregated (aggregated) condition, participants can (cannot) use accounting information to infer the cooperativeness of the other participant's prior-period action with

certainty. The dependent variable, managerial cooperation, is the proportion of participants who choose the cooperative management action in a treatment condition in the final period.

The experimental results support my hypothesis. Managerial cooperation is higher when accounting information is aggregated than when it is disaggregated. The results of two sets of supplementary analyses provide evidence that the pattern of cooperation that I observe in my experiment is consistent with the theory of non-consequential reasoning. Specifically, participants are more likely to use non-consequential reasoning when accounting information is aggregated than when it is disaggregated. Participants who are provided with aggregated accounting information frame the cooperation decision as a group decision and therefore prefer to maximize joint profit, while participants who are provided with disaggregated accounting information frame the cooperation decision as an individual decision and therefore prefer to maximize individual profit.

My dissertation contributes to the accounting literature by addressing an important limitation of prior research, which investigates the effects of accounting information on managerial cooperation only when it allows individuals to perfectly verify the cooperativeness of others' prior actions (Coletti et al. 2005; Schwartz et al. 2000; Schwartz and Young 2002). This is a limitation of prior research because accounting information that is provided to managers in the natural environment is often a noisy signal of other managers' prior actions and, as such, may not eliminate managers' uncertainty about the cooperativeness of others' prior actions. I address this limitation by providing evidence of the effects of accounting information on managerial cooperation when it's aggregation is such that it does not allow individuals to infer the cooperativeness of others' prior actions with certainty (i.e., when accounting information is a noisy signal of other managers' prior actions). Rather than aggregation decreasing managerial

cooperation by hindering reputation-building and preventing individuals from inferring others' prior actions with certainty, my dissertation provides evidence that aggregated accounting information can increase managerial cooperation by influencing how individuals frame their cooperation decisions.

The remainder of my dissertation is organized as follows. Chapter 1 reviews relevant literature and develops the hypotheses. Chapter 2 describes the experimental design. Chapter 3 reports the results and Chapter 4 concludes.

CHAPTER 1: LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

This chapter first reviews the accounting literature on the effects of accounting information on managerial cooperation. Next, it reviews the accounting literature on the effects of aggregation on managerial decision-making and the psychology literature on non-consequential reasoning. Finally, it develops a hypothesis about the effects of accounting information aggregation on managerial cooperation.

1.1 Accounting and Managerial Cooperation

Interdependence among the profits of organizational subunits is ubiquitous and has important implications for the design of accounting and for managerial decision-making (Bouwens and Abernethy 2000; Caglio and Ditillo 2008; Dekker 2004; Galbraith 1973; Thompson 1967). Managerial cooperation is important when there is profit interdependence because it can lead to positive financial and psychological outcomes such as increased organizational performance and interpersonal trust (Coletti et al., 2005; Schwartz and Young, 2002; Schwartz et al. 2000). Managerial cooperation occurs when managers make decisions that lead to the highest joint profit for the group of managers among whom there is profit interdependence. Accounting research investigates managerial cooperation in a variety of intra- and inter-firm settings such as cross-functional teams, joint investments, joint production, and strategic alliances (Caglio and Ditillo 2008; Coletti et al. 2005; Dekker 2004; Drake and Haka 1999; Drake et al. 1998; Rowe 2004; Rowe et al. 2008; Schwartz et al. 2000; Schwartz and Young 2002; Tomkins 2001).

Managerial cooperation depends on at least two factors: managers' incentives for cooperation and their uncertainty about whether or not other managers will cooperate. Managers, however, often face incentives against cooperation such that the actions that lead to the highest

joint profit are not the same actions that lead to the highest individual profits for the managers. As a result, managerial cooperation can be difficult to achieve and sustain (Das and Teng 1996, 1999, 2000; Devetag and Ortmann 2007). Cooperation problems occur when at least one manager does not cooperate. Cooperation problems are common and can lead to negative outcomes such as decreased effort, performance, and trust (Christ et al. 2008; Coletti et al. 2005; Drake et al. 1999; Kachelmeier and Shehata 1997; Drake and Haka 2008; Rowe 2004; Rowe et al. 2008; Tayler and Bloomfield 2011; Young et al. 1993).

Cooperation decisions are often represented in the social science literatures as a prisoner's dilemma game in which individuals face incentives against cooperation and make decisions that can maximize either individual or joint profit (Axelrod 1984; Kollock 1993; McCarter and Northcraft 2007; Taylor 1976, 1987; Zeng and Chen 2003).[4] In prisoner's dilemma, non-cooperation is each player's dominant Nash equilibrium strategy, but it is not the Pareto optimal strategy. If both players chose cooperation, then each player could earn higher profits than they would earn at the Nash equilibrium. Representing managers' incentives for cooperation as a prisoner's dilemma captures the fundamental management control challenge that arises when managerial cooperation is desirable, but managers face financial incentives to choose non-cooperative actions (e.g., free-riding, misrepresentation of private information).

Accounting information can increase managerial cooperation even when managers face incentives against cooperation by allowing managers to build reputations for cooperation or non-cooperation, thereby increasing managers' implicit incentives for cooperation (Coletti et al.

[4] The analysis of prisoner's dilemma in this chapter assumes that the profits associated with the cooperative and non-cooperative actions represent the actual utility payoffs to managers. That is, this analysis assumes that managers have only monetary preferences. If managers have non-monetary preferences, then the utility payoffs to cooperative actions can increase and cooperation can be a Nash equilibrium strategy.

2005; Hales and Williamson 2010; Schwartz et al. 2000; Schwartz and Young 2002). For example, when accounting information allows managers to perfectly verify whether or not other managers have previously cooperated, it enables managers to condition their cooperation decisions on other managers' prior actions and to reward (punish) other managers for their prior cooperation (non-cooperation). The ability to reward and punish individuals for the cooperativeness of their prior actions is important for achieving and sustaining cooperation (Axelrod 1984; Dal Bo 2005; Charness and Rabin 2002; Heide and Miner 1992; Skaperdas and Syropoulos 1996). When managers anticipate a future in which perfect accounting information will be available, they anticipate future financial rewards (punishments) for cooperation (non-cooperation). As a result, their current incentives for cooperation increase in the amount of the present value of the expected future payoffs to cooperation.

Schwartz et al. (2000) use a modified repeated prisoner's dilemma game to provide experimental evidence that accounting information can increase individuals' implicit incentives for cooperation by facilitating reputation-building, even when they cannot build reputations through repeated interaction. They predict and find that individuals in a joint investment decision are more likely to cooperate (i.e., invest resources in a joint investment rather than an individual investment) when accounting information allows others to perfectly verify the cooperativeness of their prior actions. Managerial cooperation is higher when accounting information is present than when it is absent, regardless of the timeliness of the information, because the expected payoffs to cooperation are higher when accounting information is present than when it is absent. When perfect accounting information is present, individuals anticipate future financial rewards for cooperation and future financial punishments for non-cooperation. When perfect accounting information is absent, however, individuals do not anticipate future financial rewards or

punishments for the cooperativeness of their actions because other individuals cannot use accounting information to infer their actions. As a result, the expected payoffs to cooperation are higher (and managerial cooperation is higher) when accounting information is present than when it is absent.

Schwartz and Young (2002) also use a modified repeated prisoner's dilemma game to corroborate and extend the findings of Schwartz et al. (2000). They provide experimental evidence about the incremental effects of accounting information on managerial cooperation when managers can also build reputations through repeated interaction with the same managers. They investigate individuals' ex ante disclosures of their private information in a setting in which joint-profit maximization depends on truthful disclosures, but individuals face incentives to misrepresent their private information. Consistent with Schwartz et al. (2000), they find that when individuals do not interact repeatedly, cooperation is higher when perfect accounting information is present than when it is absent because it facilitates reputation-building and increases implicit incentives for cooperation. Schwartz and Young (2002), however, also find that accounting information does not increase cooperation when individuals interact repeatedly. Although cooperation is higher when individuals interact repeatedly than when they do not, individuals who interact repeatedly are no more likely to cooperate when accounting information is present than when it is absent because repeated interaction serves as a substitute for perfect accounting information in reputation building.

Coletti et al. (2005) provide experimental evidence that accounting can also increase managerial cooperation by increasing managers' explicit incentives to cooperate and by building trust among managers. Coletti et al. (2005) investigate the effects of accounting controls and information on managerial cooperation over time in an existing relationship in which managers

interact repeatedly and face incentives against cooperation (i.e., in a repeated prisoner's dilemma game). Specifically, they investigate a setting in which audits allow organizations to perfectly monitor the cooperativeness of managers' prior actions and enforce cooperation by imposing financial penalties for non-cooperation. Coletti et al. (2005) predict and find that individuals are more likely to allocate high resources to a joint research and development project (i.e., cooperate) when perfect accounting information allows organizations to impose financial penalties for non-cooperation that increase the payoffs to cooperative actions such that cooperation maximizes not only joint profit, but also individual profits. Further, they predict and find that although increased cooperation is attributable to financial penalties for non-cooperation (a situational factor), individuals attribute increased cooperation to others' trustworthiness (a dispositional factor). As a result, individuals judge others to be more trustworthy when accounting is present than when it is absent and cooperate with others more even after the financial penalties for non-cooperation are removed.

While prior accounting research investigates the effects of accounting information on managerial cooperation when it allows individuals to infer the cooperativeness of others' prior actions with certainty, experimental economics research provides evidence that cooperation depends on the certainty with which individuals can infer the cooperativeness of others' prior actions (Bolton, Katok, and Ockenfels 2005; Nowak and Sigmund 2005). One factor that can influence individuals' certainty about others' prior actions is the aggregation of information about others' prior actions. When individuals are provided with accounting information that is a noisy signal of others' prior actions due to characteristics of the information such as its aggregation, I expect the effects of accounting information on managerial cooperation to differ

from those observed in prior accounting research on accounting information and managerial cooperation.

1.2 Accounting Information Aggregation

The extent to which accounting information eliminates individuals' uncertainty about the cooperativeness of others' prior actions depends on characteristics of the information, such as its aggregation (Banker and Datar 1989; Holmstrom 1979). Aggregation can change the informativeness (i.e., noise) of accounting information because it can change the mapping of actions to their financial outcomes (e.g., profits). Specifically, aggregation can increase the number of actions that are mapped to an outcome. Aggregation is a continuum with fully aggregated accounting information and fully disaggregated accounting information as end-points. When accounting information is fully aggregated, all actions are mapped to a single financial outcome (e.g., joint profit). When accounting information is fully disaggregated, individual actions are mapped to separate financial outcomes (e.g., division profits).[5]

The aggregation of accounting information can vary due to measurement capabilities, the costs of aggregation and disaggregation, and to suit the needs of managers with different information demands and decision models. Aggregation is a design choice for organizations that trade-off the costs and benefits of aggregation and disaggregation (Horngren et al. 2012; Lev

[5] Note that division profit may not provide a one-to-one mapping of managers' actions to their financial outcomes. For example, division profit may not provide a one-to-one mapping of managers' actions to their financial outcomes when there is profit interdependence among divisions. In my dissertation, I assume that the disaggregation process sufficiently filters out the effects of profit interdependence such that managers can use disaggregated accounting information to infer other managers' prior actions with certainty.

1969; Sorter 1969).[6] Aggregation can benefit organizations and their managers by summarizing financial outcomes thereby reducing the cognitive demands that large amounts of detailed, disaggregated accounting information can place on managers with limited cognitive resources. Aggregated accounting information, for example, may better suit the needs of centralized managers who require summarized information about organizational subunits' costs and revenues in order to prepare master budgets or evaluate the financial reporting segments' performance.

Empirical accounting research, for example, provides evidence that aggregated accounting information can increase managerial cooperation in cross-functional team settings, even when managers face incentives against cooperation (Rowe 2004; Rowe et al. 2008). Rowe (2004) investigates a public goods dilemma in which information sharing can lead to increased team performance (i.e., information sharing is a cooperative strategy that can lead to Pareto outcomes), but it is costly and individuals can be better off by free-riding (i.e., non-cooperation is the only Nash equilibrium strategy). Using an experiment, he provides evidence that accounting report structure (aggregated, disaggregated) and team structure (face-to-face, dispersed) influence whether individuals frame their information-sharing decisions as either group or individual decisions. Consistent with his predictions, he finds that managerial cooperation is higher when aggregated accounting information and face-to-face team structure align to provide group framing than when accounting information and/or team structure provide individual framing.

[6] The American Institute of Certified Public Accountants provides guidance for organizations on the aggregation of accounting information that is appropriate for organizations to use in order for the accounting information to be presented fairly. The Statement on Auditing Standards No. 5 states that in order for accounting information to be fairly presented, it should be "summarized in a reasonable manner that is neither too detailed nor too condensed." (Nikias et al. 2010, 68)

Experimental economics research provides evidence that organizations can provide aggregated accounting information in order to establish and maintain confidentiality among managers, which can increase managerial cooperation (John, Loewenstein, and Rick 2013). For example, when managers' performance evaluations and compensation depend on disaggregated accounting measures such as division profit, organizations may choose to provide aggregated accounting information such as financial reporting segment profits to managers in order to prevent them from inferring other managers' compensation. When they can (cannot) infer other managers' compensation and their own compensation is lower than the other managers' compensation, managers are more (less) likely to engage in upward social comparison and choose non-cooperative actions such as dishonest communication and free-riding.

Although aggregation can benefit organizations and their managers, it can also be costly to organizations when it decreases the informativeness of accounting information by introducing noise (Datar and Gupta 1994; Ijiri 1967; Lev 1969; Sorter 1969). When it introduces noise, aggregation can obfuscate properties of profit distributions that may be useful inputs to managers' decision models. To the extent that the aggregation of accounting information decreases its informativeness about prior outcomes, managers may not be able to use the accounting information to infer with certainty the cooperativeness of other managers' prior actions.

The effect of accounting information on managerial cooperation when it creates uncertainty for managers about the cooperativeness of others' prior actions is an unanswered question. Next, I review psychology literature on consequential and non-consequential reasoning and consider the possible effects of uncertainty on managerial cooperation when managers face incentives against cooperation.

1.3 Consequential and Non-Consequential Reasoning

Expected utility theory assumes that individuals use consequential reasoning when they make decisions (i.e., they appropriately evaluate each possible decision outcome and its expected likelihood) (Hammond 1988; Levi 1991). When they use consequential reasoning, their decisions satisfy Savage's sure-thing principle, which states that if individuals prefer *x* over *y* for every possible decision outcome, then they should prefer *x* over *y* when the decision outcome is uncertain (Savage 1954). To illustrate, consider an individual who decides whether or not to cooperate in prisoner's dilemma. If the individual prefers non-cooperation when she is certain that the other player will cooperate and if she also prefers non-cooperation when she is certain that the other player will not cooperate, then the sure-thing principle states that she should prefer non-cooperation when she is uncertain about whether or not the other player will cooperate.

Psychology research on non-consequential reasoning, however, provides evidence that individuals sometimes fail to use consequential reasoning when they make decisions under uncertainty (Bastardi and Shafir 2000; Croson 1999; Shafir and Tversky 1992; Tversky and Shafir 1992). When they use non-consequential reasoning to make decisions, individuals do not appropriately consider all of the relevant decision outcomes and their expected likelihoods. As a result, they weight decision outcomes differently and make different decisions than when they use consequential reasoning. Non-consequential reasoning manifests in a pattern of preferences that violates Savage's sure-thing principle. Specifically, individuals who use non-consequential reasoning reveal that they prefer *x* over *y* for each possible decision outcome when outcomes are certain, but reveal that they do not prefer *x* over *y* when there is uncertainty over outcomes.

Shafir and Tversky (1992) propose that the effects of non-consequential reasoning on decision-making are attributable to the effects of uncertainty on individuals' self-assessments of

their preferences. Specifically, they argue that individuals assess their preferences differently when they make decisions under certainty because they use non-consequential reasoning and do not appropriately consider all relevant decision outcomes. Shafir and Tversky (1992) also propose that non-consequential reasoning can explain non-trivial levels of cooperation in prisoner's dilemma. They predict and find that players in prisoner's dilemma who do not know the other player's action choice when they choose their own action are more likely to cooperate than players who know with certainty what the other player's action choice was when they choose their own action. When there is uncertainty about the other player's action choice, the game's outcome depends on both players' decisions and thus players frame the decision as a group decision. As a result, they prefer cooperation because it leads to the best group outcome. In contrast, when there is certainty about the other player's action choice, the game's outcome depends only on the decision of an individual player and players thus frame the decision as an individual decision. As a result, they prefer non-cooperation because it leads to the best individual outcome.

1.4 Hypothesis Development

I use the psychology theory of non-consequential reasoning (Shafir and Tversky 1992; Tversky and Shafir 1992) to develop a hypothesis about the effect of accounting information aggregation on managerial cooperation when individuals face incentives against cooperation. I consider a setting in which individuals play a repeated one-shot prisoner's dilemma game and payoffs (i.e., profits) are common knowledge. Individuals are randomly re-matched in each period such that they are matched with the same individual only once and they do not know the number of periods of play. In the final period, each individual is provided with accounting

information about the other's prior-period profit when there was a cooperation problem (i.e., when one but not both individuals chose the cooperative action). [7]

When accounting information is aggregated (disaggregated), each individual is provided with the other individual's prior-period joint (individual) profit. Aggregated accounting information does not allow the individuals to infer the other individual's prior-period action with certainty because the aggregation of profits in a period in which there was a cooperation problem obfuscates individual profits in the prior period. Disaggregated accounting information, however, allows each individual to infer with certainty the other's prior-period action because disaggregation reveals prior-period individual profits thereby allowing each individual to attribute prior-period actions to the individuals who chose them.

When disaggregated accounting information eliminates uncertainty, I argue that individuals will use consequential reasoning to make their decisions. I expect that they will frame the decision to cooperate as an individual decision and choose non-cooperation because it is the only action that leads to the highest individual profit, regardless of whether or not they expect the other individual to cooperate. In contrast, when aggregated accounting information does not allow individuals to infer the cooperativeness of the other's prior-period action with certainty, I argue that they will use non-consequential reasoning to make their decisions.

[7] I restrict my hypothesis development to situations in which there are prior-period cooperation problems because cooperation problems present an important challenge for individuals who wish to condition their cooperation decisions on the cooperativeness of other individuals' prior actions. In the event of mutual prior-period cooperation or non-cooperation, the role of accounting information in reducing uncertainty about the cooperativeness prior actions is muted if not irrelevant. This is because mutual cooperation (mutual non-cooperation) yields the highest (lowest) joint profit that individuals can earn. In these situations, individuals do not need disaggregated accounting information to be able to infer with certainty the cooperativeness of the other individual's prior-period actions. When there are prior-period cooperation problems, however, individuals cannot infer from prior-period joint profit whether the other individual's prior-period action was cooperative or non-cooperative. As a result, the role of accounting is likely to be especially important when there are prior-period cooperation problems.

Consistent with the psychology theory of non-consequential reasoning, I expect that they will frame the decision to cooperate as a group decision and choose cooperation because it is the only action that leads to the highest joint profit.

> **HYPOTHESIS:** When individuals face incentives against cooperation, cooperation will be higher when accounting information is aggregated than when it is disaggregated.

CHAPTER 2: EXPERIMENTAL DESIGN

2.1 Participants

Forty one upper-level, undergraduate business students at a large public university participate in the experiment, which is conducted in seven sessions on multiple days. A comparison of the dependent variable among the seven sessions does not provide evidence of a session-specific effect (p = .760, two-tailed). Participants in each session work independently in a computer laboratory using personal computers and each session lasts approximately 40 minutes. Communication among participants during the sessions is prohibited.

2.2 Experimental Design and Treatment Conditions

The experiment has a 2 x 5 mixed-factorial design. Accounting information aggregation is manipulated between-subjects at two levels (aggregated and disaggregated) and period is manipulated within-subjects at five levels. The dependent variable, managerial cooperation, is measured as the proportion of participants in a treatment condition who choose the cooperative action in period 5, which is the only period in which participants are provided with accounting information about the prior period.

Profit interdependence is operationalized using a repeated one-shot prisoner's dilemma game in which participants simultaneously and independently choose either the cooperative or non-cooperative action (Figure 1). The profit structure is such that each participant is better off choosing the non-cooperative action no matter what she thinks the other participant will choose. If both participants choose the non-cooperative action, however, then they will each earn lower profits ($2, $2) than they would have earned if each had chosen the cooperative action ($6, $6). The crucial feature of the game is that each participant can earn the highest profit ($8) when she chooses the non-cooperative action while the other participant chooses the cooperative action.

The action labels are purposely abstract because they can influence participants' decisions to cooperate in laboratory experiments (Haynes and Kachelmeier 1998; Liberman, Samuels, and Ross 2004; Rankin, Van Huyck, and Battalio 2000). Abstract operationalization of the action labels minimizes the potentially confounding influence of value-laden labels such as "cooperate" on the dependent variable.

Accounting information aggregation is operationalized in period 5 by manipulating the mapping of participants' period 4 actions to their period 4 profits. When accounting information is aggregated, the actions of *both* participants in period 4 are mapped to one profit amount (i.e., joint profit) (Table 1A). When accounting information is disaggregated, the actions of *each* participant in period 4 are mapped to one profit amount (i.e., division profit). As a result, each participant in period 5 can infer the cooperativeness of the other participant's prior-period action with certainty when accounting information is disaggregated but not when it is aggregated. Because disaggregated accounting information can reveal either cooperative or non-cooperative prior-period actions, participants in the disaggregated condition in period 5 are randomly matched with participants whose period 4 action was either cooperative or non-cooperative (Table 1B and 1C).

2.3 Procedure and Task

Figure 2 illustrates the order of events in the experiment and provides an overview of the task by period. The experiment has three parts. In Part 1, participants read instructions that explain their role in the experiment and their compensation. In Part 2, they make management decisions in each of five experimental periods. In Part 3, they respond to post-experiment questions related to demographic information, factors that influenced their management decisions, and the manipulation of the independent variable (Figure 2A).

2.3.1 Part 1: Instructions

Participants assume the role of division managers who choose a management action for their own division in each of five experimental periods in which there are incentives against managerial cooperation. Their compensation is comprised of a salary of $10 and a bonus of 50% of their division's profit in two periods, which are pre-determined by the experimenter but not identified to participants until the beginning of those periods (i.e., before participants choose an action for their division in those periods).[8] Before the experimental periods commence, participants are informed that their division's profit in each period depends not only on the management action that they choose for their own division, but also on the management action that another division manager chooses for his or her division. Participants are also informed that that there will not be profit interdependence between the same two divisions in more than one period (i.e., that they will not be matched with the same participant more than once) and they are provided with an example of a profit table in order to illustrate profit interdependence.[9]

Next, participants are informed that another participant in the experiment will assume the role of the other division manager in each period except for one of the periods. In one of the periods, participants are informed that the role of the other division manager will be assumed by

[8] Participants' compensation is a function of their action choices in periods 4 and 5 (i.e., the final period and the period preceding the final period). Providing incentive compensation for their decisions in these two periods is intended to motivate participants to allocate as much attention and effort as possible to their decisions in these periods. Participants' decisions in these periods are important because they directly influence the dependent variable.

[9] Participants are informed that the profit table example that they are provided illustrates the format in which division profits will be presented in the five experimental periods in which there is profit interdependence. The example is intended to familiarize participants with the normal form representation of division profits. All participants are provided with the same profit table example. In order to minimize carryover effects, the profit table example that is provided to participants illustrates a division profit structure that is not a prisoner's dilemma.

a computer that is programmed to choose the management action that other participants facing the same conditions made in a prior administration of the experiment.[10] Participants are informed that the period in which a computer will assume the role of the other manager will not be identified. In order to control for end-game effects, participants are not informed that the experiment has five periods or that accounting information about the other participant's prior-period profit will be available in any period.

After reading the instructions but before the experimental periods begin, participants complete a pre-experiment quiz on which they are required to score 100% to ensure that they understand the task, their compensation, and the form of profit interdependence (i.e., the structure of division profits in each period). After successful completion of the quiz, the first of five experimental periods begins.

2.3.2 Part 2: Experimental Periods

In periods 1 – 4, participants make management decisions for their divisions without accounting information about the other participant's prior-period profit. In each of these periods, each participant's profit depends on the decision of another participant who makes a management decision for another division (Figure 2B). At the beginning of each period, the division with which each participant's profit is interdependent is identified by division name

[10] In the period in which a computer assumes the role of the other division manager, the computer's decision rule is determined by data that is collected in a pilot study. The pilot study has a 2 x 4 mixed-factorial design in which accounting information aggregation is manipulated between-subjects at two levels (aggregated and disaggregated) and period is manipulated within-subjects at four levels. The pilot study has two purposes. First, it allows me to observe the frequency with which each of the four possible decision outcomes occurs in each period. Second, it allows me to match participants in the disaggregated condition in period 5 of my dissertation experiment with a mechanical division manager that is programmed to make the same decision that participants who chose either the cooperative or non-cooperative action in period 4 of the pilot study made when facing the same accounting information aggregation and profit interdependence conditions.

only (e.g., Division B), which ensures that participants are matched anonymously in each period. Each participant is then provided with a profit table that illustrates the division profit structure for that period. Next, each participant chooses a management action (i.e., Action X or Y) for his or her own division. After submitting their action choice, participants are directed to a confirmation screen that displays their action choice and the division profit they would earn given their action choice if the other manager chose Action X for the other division and if the other manager chose Action Y for the other division. Next, participants either confirm or revise or their action choice. If they choose to revise their choice, then they are redirected to the action choice screen. If they confirm their choice, then they are directed to a waiting screen if the other participant has not yet chosen and confirmed a management action. After each participant confirms her management action, she is informed of her own profit as well as the other participant's profit for that period.

In period 5, participants continue to assume the role of a division manager, but a computer assumes the role of the other division manager. The task in period 5 is the same as the task in periods 1 – 4, with the following two exceptions (Figure 2C). First, participants are informed at the beginning of period 5 that they will be provided with accounting information about the prior-period profit of the other division (i.e., the division with which there is profit interdependence in period 5). Participants are then provided with the other division's prior-period profit table and either aggregated or disaggregated accounting information about the other division's prior-period profit. Second, after participants make their period 5 management decisions but before they learn the period 5 outcome, they respond to three questions. First, they respond to a question about the informativeness of the accounting information that was provided to them at the beginning of period 5. Second, they respond to a question that is intended to elicit

their beliefs about the likelihood that the other division manager would choose the cooperative action in period 5. Third, they respond to a question that is intended to elicit their beliefs about the other participant's beliefs that they would choose the cooperative action in period 5.

2.3.3 Part 3: Post-experiment

After participants complete all five experimental periods, they respond to post-experiment questions related to demographic information, factors that influenced their management decisions, and the manipulation of accounting information aggregation. Participants are paid immediately following the experiment and their average earnings are $13.83 for approximately 40 minutes of participation.

CHAPTER 3: RESULTS

This chapter first reports the results of manipulation checks and preliminary analysis. Next, it reports descriptive statistics and the results of the hypothesis test. Finally, it reports the results of two supplementary analyses that provide evidence about my proposed causal explanation for the hypothesized relation between accounting information aggregation and managerial cooperation.

3.1 Manipulation Checks

To test whether the accounting information aggregation manipulation is successful, participants indicate the extent to which they agree or disagree with the following statement: "From the information I was given about the other division manager, I knew exactly what his or her division profit was in period 4." This question is asked in period 5 after participants choose a management action for that period, but before they learn the outcome of their decision. The question has a response scale from 1 (completely disagree) to 7 (completely agree). The result of a t-test indicates that the extent to which participants agree with the statement is significantly higher when accounting information is disaggregated than when it is aggregated (means = 6.05, 2.60 respectively; $t = 8.02$, df = 39, $p < 0.01$, two-tailed, untabulated). This provides support that the accounting information aggregation manipulation is successful.

Participants also respond to questions about their game theory experience and knowledge. Fifteen participants (37%) previously studied game theory and eleven participants (27%) previously participated in a research study in which they were a player in an economic game such as prisoner's dilemma. Participants rate their knowledge of game theory by responding to the following question: "How do you rate your knowledge of game theory and/or experimental economics?" The question has a response scale from 1 (no knowledge) to 7 (expert knowledge).

In preliminary analysis, I find no significant effects of game theory experience or knowledge on the dependent variable among treatment conditions (all *p*-values > 0.22, untabulated). Therefore, I do not include these variables in the hypothesis test.

3.2 Descriptive Statistics and Preliminary Analysis

Table 2 reports descriptive statistics. Forty-one participants are assigned to the two treatment conditions. When accounting information is disaggregated and participants can infer the cooperativeness of the other participant's prior-period action with certainty, three (14%) participants choose the cooperative action. When accounting information is aggregated and participants cannot infer the cooperativeness of the other participant's prior-period action with certainty, eight (40%) of participants choose the cooperative action. This pattern of proportions is directionally consistent with the predicted effects of accounting information aggregation on managerial cooperation.

When accounting information is disaggregated, it can reveal either prior-period cooperation or non-cooperation. I therefore randomly match participants in period 5 with a participant whose prior-period action was either cooperative or non-cooperative. Figure 3 illustrates the mean proportions of managerial cooperation in period 5 when accounting information is aggregated and when accounting information is disaggregated and participants are matched with a participant whose period 4 action was either cooperative or non-cooperative. When accounting information is disaggregated and reveals prior-period cooperation, eleven participants (18%) choose the cooperative action. When accounting information is disaggregated and reveals prior-period non-cooperation, ten participants (10%) choose the cooperative action. When accounting information is aggregated, eight participants (40%) choose the cooperative action.

The observed pattern of managerial cooperation reveals preferences that are consistent with non-consequential reasoning. Notice that 10% percent of participants prefer to cooperate when they know that the other participant did not previously cooperate and 18% of participants prefer to cooperate when they know that the other participant previously cooperated. If participants use consequential reasoning to determine their cooperation decisions as expected utility theory assumes, then, by Savage's sure-thing principle, between 10% and 18% of participants should prefer to cooperate when they are uncertain about whether or not the other player previously cooperated. When participants are uncertain about whether or not the other player previously cooperated, however, greater than 18% of participants choose to cooperate.

In order to provide preliminary evidence about the effects of the cooperativeness of participants' prior-period actions on managerial cooperation when accounting information is disaggregated, I use Fisher's exact test of independence to test the significance of the difference in the proportions of managerial cooperation in the disaggregated condition when participants are matched with another participant whose prior action is cooperative or non-cooperative. When disaggregated accounting information reveals prior-period cooperative (non-cooperative) action, 18% (10%) of participants choose the cooperative action. The result of the Fisher's exact test indicates that the difference in the proportions of managerial cooperation between prior-period action conditions is not significant ($p > 0.75$, two-tailed). This provides some support for a single disaggregated accounting condition that combines the cooperative and non-cooperative prior action conditions, which allows me to increase the power of the main hypothesis test.

Based on the result of the Fisher's exact test, I do not distinguish between disaggregated accounting information that reveals prior-period cooperative and non-cooperative actions for the remainder of the data analysis. Caution should be taken, however, in interpreting the result of the

test due to low power (60%). Although I use Fisher's exact test to accommodate my small sample sizes, additional data is required in order to increase the power of the test and strengthen my inference about the possible effects of the cooperativeness of prior-period actions on managerial cooperation when accounting information is disaggregated.

3.3 Hypothesis Test

The hypothesis predicts that managerial cooperation will be higher when accounting information is aggregated than when it is disaggregated. To test the hypothesis, I use Pearson's Chi-square test for independence to test the significance of the difference in the proportions of managerial cooperation between the aggregated and disaggregated accounting information conditions. The result of the Chi-square test indicates that the difference in these proportions is statistically significant ($\chi^2 = 3.45$, $p = 0.032$, df = 1, one-tailed); due to small sample size, however, there is a risk that statistical significance is over-estimated. To address this risk, I report the results of a Fisher's exact test for independence and a Chi-square test with Yates' continuity correction.[11] The Fisher's exact test is intended to accommodate small sample sizes and Yates' continuity correction is intended to prevent over-estimation of statistical significance in small samples (Yates 1934). The result of the Fisher's exact test provides marginal support for the hypothesis that the proportions of managerial cooperation between the two aggregation conditions are independent ($p = 0.065$, one-tailed). The result of the Chi-square test using Yates' continuity correction provides marginal support for the hypothesis that managerial cooperation is higher when accounting information is aggregated than disaggregated ($\chi^2 = 2.27$, $p = 0.066$, df =

[11] Although Pearson's Chi-square test for independence can over-estimate statistical significance for small sample sizes (Greenwood and Nikulin 1996), Fisher's exact test for independence and Yates' continuity correction can under-estimate statistical significance for small sample sizes (Sokal and Rohlf 1981). I report the results of each test for completeness.

1, one-tailed). Taken together, these results provide some support for the hypothesis, although a larger sample is desirable to increase the power of the hypothesis test.

3.4 Supplemental Analyses

Two supplemental analyses are intended to provide evidence that supports my proposed causal explanation for the relation between accounting information aggregation and managerial cooperation. First, I analyze the effects of accounting information aggregation on participants' expectations about the likelihood that other participants will choose the cooperative action in period 5. Second, I analyze factors that influence participants' management decisions in period 5.

3.4.1 Expectations about the Likelihood of Cooperation

In order to provide evidence of participants' expectations about the likelihood that the other participant will choose the cooperative action in period 5, each participant responds to the following question in period 5 after choosing a management action but before learning the outcome of their action choice: "Which action did you expect the other division manager to choose this period (i.e., in Period 5)?" Participants choose "Action X", "Action Y", or "I didn't have an expectation about which action the other manager would choose." Nine (45%) participants in the aggregated accounting condition and nine (43%) participants in the disaggregated accounting condition expect the other participant to choose the cooperative management action in period 5 (Table 3). The result of a Pearson's Chi-square test provides evidence that this difference is not significant ($\chi^2 = 0.019$, $p = 0.89$, df = 1, two-tailed).

Although their expectations about the likelihood of cooperation are similar when accounting information is aggregated and when it is disaggregated, the proportion of participants who respond with cooperative action is significantly higher when accounting information is aggregated than disaggregated. When accounting information is aggregated, 45% of participants

expect the other participant to choose the cooperative action and 89% of these participants respond by choosing the cooperative action. When accounting information is disaggregated, however, 43% of participants expect the other participant to choose the cooperative action and 33% of these participants respond by choosing the cooperative action. Despite similar expectations about the likelihood of cooperation in the aggregated and disaggregated conditions (i.e., 45% and 43% respectively), participants are more likely to choose the action that can lead to the highest joint (individual) profit when accounting information is aggregated (disaggregated). This is consistent with my proposed causal explanation for the relation between accounting information aggregation and managerial cooperation.

3.4.2 Factors that Influence Participants' Management Decisions

Shafir and Tversky (1992) propose that the pattern of managerial cooperation that I observe in my experiment is attributable to the effect of uncertainty on individuals' self-assessments of their preferences. Specifically, they propose that a player will be more likely to frame the decision to cooperate in a prisoner's dilemma game as a group decision when there is uncertainty about the other player's action choice. As a result, players will self-assess stronger preferences for cooperation when there is uncertainty because cooperation is the only strategy that can lead to the best group outcome (i.e., highest joint profit). When there is certainty over prior actions, however, Shafir and Tversky (1992) argue that individuals will be more likely to frame the decision to cooperate in prisoner's dilemma as an individual decision. As a result, these individuals will self-assess stronger preferences for non-cooperation because it is the only strategy that leads to the best individual outcome (i.e., highest individual profit).

In order to provide evidence about participants' self-assessments of their preferences, they respond to the following post-experiment question about factors that influenced their

management decisions in period 5: "When you considered whether to choose Action X or Action Y in this period (i.e., period 5), how important were the following factors?" Participants allocated 100 points to the factors that influenced their management decision; they allocated more points to factors that had more influence on their decision and fewer points to factors that had less influence on their decision (Table 4A).

When accounting information is aggregated, 89% of participants who expect cooperation respond by choosing the cooperative action. Consistent with these participants having stronger preferences for the best group outcome, they allocate, on average, 92 out of 100 points to the following decision factor: "Action X was attractive to me because I wanted the highest total profit for me and the other division manager (i.e., Action X could maximize the sum of our two divisions' profits)" (Table 4B). When accounting information is disaggregated, however, only 33% of participants who expect cooperation respond by choosing the cooperative action. These participants allocate, on average, 78 out of 100 points to this decision factor. The result of a t-test indicates that the difference in mean points allocated to this decision factor is significantly higher when accounting information is aggregated than when it is disaggregated ($t = 3.07$, df = 8, $p < 0.01$, one-tailed). This result is consistent with participants in the disaggregated condition having weaker preferences for the best group outcome than participants in the aggregated condition.

When accounting information is disaggregated, 66% of participants who expect cooperation respond by choosing the non-cooperative action. Consistent with these participants having stronger preferences for the best individual outcome, they allocate, on average, 87 out of 100 points to the following factor: "Action Y was attractive to me because I wanted my division to earn the highest profit." When accounting information is aggregated, however, only one participant (11%) who expects cooperation responds by choosing the non-cooperative action.

This participant allocates only 60 out of 100 points to the same decision factor. The result of a one-sample t-test provides evidence that the mean points allocated to this decision factor is significantly higher than when accounting information is disaggregated than aggregated (t = 4.33, df = 5, $p < 0.004$, one–tailed). Specifically, the result of the one-sample t-test provides supports for rejecting the null hypothesis that there is no difference between the mean points allocated to this decision factor when accounting is aggregated (i.e., 60 points) and when it is disaggregated (i.e., 87 points). This result is consistent with participants in the disaggregated condition having stronger preferences for the best individual outcome than in the aggregated condition.

Taken together, these results provide support for my proposed causal explanation. Although participants in the aggregated and disaggregated accounting conditions face the same financial incentives and have the same expectations about the likelihood that the other participant will cooperate, managerial cooperation is significantly higher when accounting is aggregated than when it is disaggregated. Consistent with the psychology theory of non-consequential reasoning, participants are more likely to prefer cooperation when accounting information is aggregated and there is uncertainty about other participants' prior-period actions because participants frame their decisions to cooperate as group decisions and self-assess strong preferences for actions that lead to the best group outcome.

CHAPTER 4: CONCLUSION

4.1 Summary of Experiment and Results

Accounting research provides evidence that accounting information can increase managerial cooperation when it allows managers build reputations for cooperation or non-cooperation by allowing them to infer the cooperativeness of other managers' prior actions with certainty (Coletti et al. 2005; Hales and Williamson 2010; Schwartz et al. 2000; Schwartz and Young 2002). Reputation-building, however, may be hindered and managers may be uncertain about whether or not other managers have previously cooperated when accounting information is a noisy signal of prior actions due to its aggregation (Datar and Gupta 1994; Ijiri 1967; Lev 1969; Sorter 1969). I investigate the effects of accounting information on managerial cooperation when its aggregation does not eliminate managers' uncertainty about the cooperativeness of other managers' prior-period actions. To the extent that increased managerial cooperation depends on managers' ability to build reputations for cooperation or non-cooperation, prior research has conjectured that noisy accounting information may lead to decreased managerial cooperation by hindering reputation-building (Schwartz and Young 2002). In my dissertation, however, I provide theory-consistent experimental evidence that noisy accounting information can increase rather than decrease managerial cooperation by influencing whether individuals frame their cooperation decisions as either individual or group decisions.

The pattern of managerial cooperation that I observe in my experiment is consistent with psychology research on non-consequential reasoning (Croson 1999; Shafir and Tversky 1992; Tversky and Shafir 1992). When individuals are provided with aggregated accounting information that does not allow them to infer others' prior-period actions with certainty, they make their cooperation decisions using non-consequential reasoning and do not appropriately

consider all relevant decision outcomes when they make their decisions. In these situations, individuals frame their decisions as group decisions and self-assess strong preferences for cooperation because it is the only action that can lead to the best group outcome. In contrast, when individuals are provided with disaggregated accounting information that allows them to infer others' prior-period actions with certainty, they make their cooperation decisions using consequential reasoning and appropriately consider all relevant decision outcomes when they make their decisions. In these situations, individuals frame their decisions as individual decisions and self-assess strong preferences for non-cooperation because it is the only action that can lead to the best individual outcome.

4.2 Limitations and Suggestions for Future Research

There are at least three limitations of my dissertation. First, I make the simplifying assumption that managers know not only how their decisions will influence their own profits, but also how their decisions will influence the profits of the other organizational subunit with which their profits are interdependent (i.e., I assume that payoffs are common knowledge). Although this assumption is conventional and consistent with prior accounting and experimental economics research on managerial cooperation (Camerer 2003), it may limit the generalizability of my results. In natural environments, managers may know the effects of their decisions on their own organizational subunits' profits, but it is unlikely that they will know exactly how their decisions will influence the profits of other organizational subunits or how other organizational subunit managers' decisions will influence their own profits.

Second, I manipulate accounting information aggregation at the end-points of the aggregation continuum. This is a strong manipulation and is therefore useful in a laboratory environment because it provides a strong test of my hypothesis. Accounting information that is

provided to managers in natural environments, however, is unlikely to be either fully aggregated or fully disaggregated. As a result, my aggregation manipulation may limit the generalizability of my results. Further, it is possible that disaggregation may not increase the informativeness of accounting information when the underlying information is aggregated in its natural form (e.g., when aggregated cost information such as annual lease expense is disaggregated by allocating the aggregated cost to different cost objects).

Third, I hold profit interdependence constant at a level that assumes managers face dominant financial incentives against cooperation. Managers, however, may not always face dominant incentives against cooperation. For example, when managers can build reputations and reward (punish) other managers for their prior cooperation (non-cooperation), incentives for non-cooperation can decrease such that cooperation is no longer a strictly dominated strategy. In these situations, a manager's best response can include cooperation (Camerer 2003, 2006; Rankin et al. 2000; Van Huyck, Battalio, and Bell 1990). Experimental economics research suggests that situations in which cooperation can be a manager's best response are common and may be richer decision contexts that have greater generalizability than situations in which individuals' best response can never include cooperation (Harsanyi and Selten 1988). Future accounting research could explore the effects of accounting information aggregation on managerial cooperation when the form of profit interdependence is such that a manager's best response can include cooperation.

APPENDIX

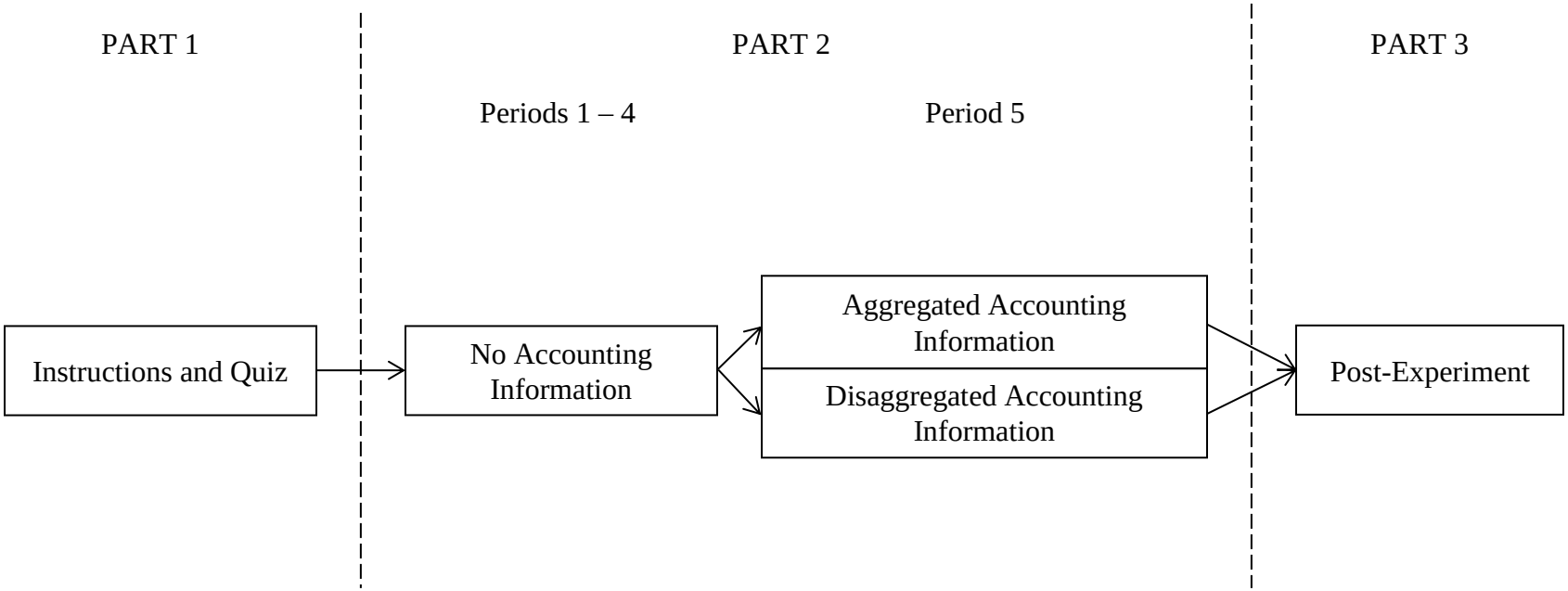
FIGURE 1: Profit Interdependence as a Prisoner's Dilemma Game

Normal-form representation of division profit structure as a prisoner's dilemma game

		Manager B: Action X	Manager B: Action Y
Manager A	Action X	\$6, \$6	\$0, \$8
	Action Y	\$8, \$0	\$2, \$2

Supplemental information: The first number in each cell represents Manager A's profit and the second number in each cell represents Manager B's profit. The sum of the two numbers in each cell is the joint profit that is associated with a decision outcome. This representation of division profits assumes that the division profits that are associated with the cooperative and non-cooperative actions (Actions X and Y, respectively) represent the actual utility payoffs to managers who choose these actions. That is, this payoff structure assumes that managers do not have non-monetary preferences. If managers have non-monetary preferences (e.g., for cooperative outcomes), then these preferences may change the utility payoffs to the action choices.

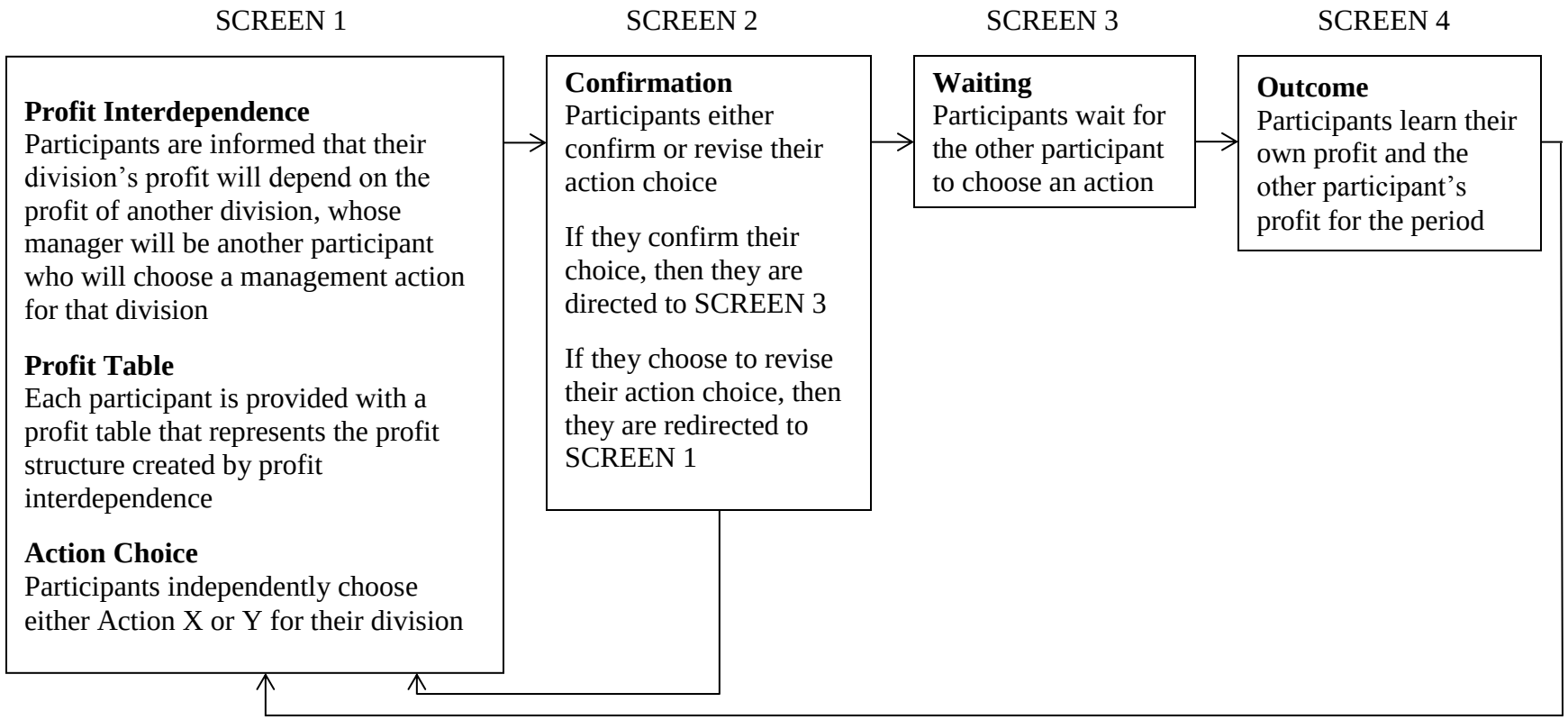
FIGURE 2A: Order of Events
Order of events for Part 1, Part 2, and Part 3 of the experiment



Supplemental information: After reading the instructions and completing a quiz about the instructions (PART 1), participants begin the five experimental periods (PART 2). In each period, they make a management decision that influences their own division's profit as well as the profit of another division. In periods 1 – 4, participants make their management decision without accounting information about the other division's prior-period profit. In period 5, participants are provided with either aggregated or disaggregated accounting information about the other division's prior-period profit before they make their management decision. After completing the five experimental periods, participants complete post-experiment questions (PART 3).

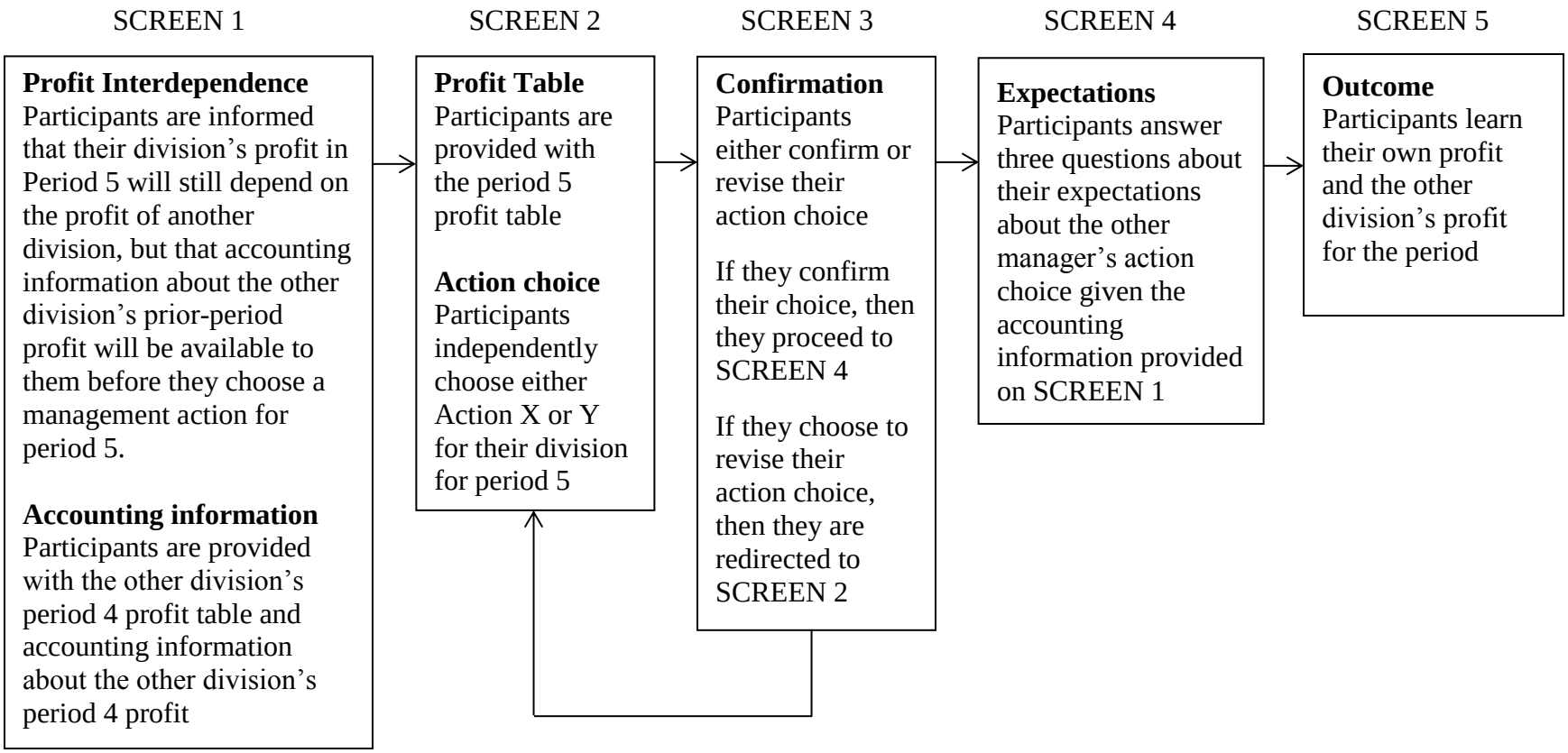
FIGURE 2B: Task Overview (Periods 1 – 4)

Experimental task for periods 1 – 4



Supplemental information: At the beginning of periods 1 – 4, participants are provided with the profit table and the name of the division (e.g., Division B) with which profits are interdependent for that period. They are informed that the same profit table applies to their division as well as the division with which there is profit interdependence for that period. Next, they choose either Action X (cooperative action) or Action Y (non-cooperative action) for their own division. After they choose an action, they either confirm or revise their action choice. If they choose to revise their action choice, then they are redirected to Screen 1. If they confirm their action choice, then they are directed either to the waiting screen (Screen 3) or to the outcome screen (Screen 4). After both participants choose and confirm an action, they are directed to the outcome screen, which provides information about each participant's profit for that period.

FIGURE 2C: Task Overview (Period 5)
Experimental task for period 5



Supplemental information: The task in period 5 is the same as in periods 1 – 4, with the following two exceptions. First, each participant is provided with the other division's period 4 profit table and accounting information about the other division's period 4 profit. Second, each participant answers three questions about his or her beliefs about 1) the likelihood that the other participant would choose the cooperative action in period 5, 2) the likelihood that the other participant would expect him or her to choose the cooperative action in period 5, and 3) the certainty with which he or she could infer the other participant's period 4 action from the accounting information that was provided.

FIGURE 3: Preliminary Analysis
Mean managerial cooperation by accounting aggregation condition

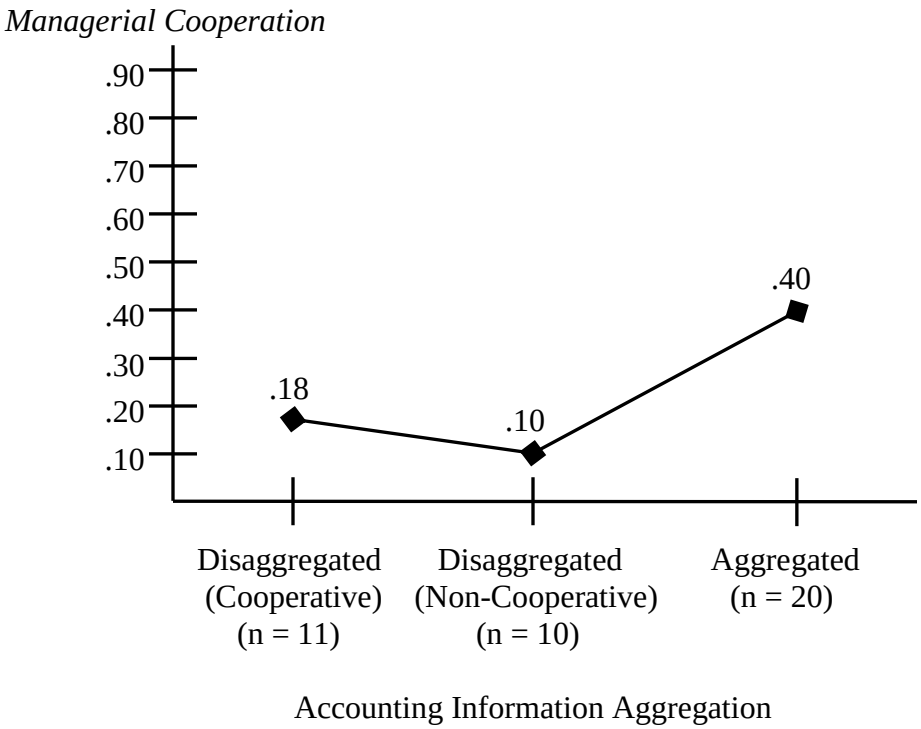


TABLE 1A: Accounting Information Aggregation (Aggregated Condition)

At the beginning of period 5, participants in the aggregated accounting information condition were provided with aggregated accounting information about the organizational subunit with which there was profit interdependence in that period.

		Division T	
		Action X	Action Y
Division F	Action X	\$6, \$6	\$0, \$8
	Action Y	\$8, \$0	\$2, \$2

Participants were provided with the following supplemental information: In this period, you will be paired with Division Manager F. You have not been paired with Division Manager F before, but you will be provided with some information about this manager before you make your management decision in this period. Specifically, you will be provided with information about Division Manager F's profit in period 4 when he or she was paired with someone other than you. This information may or may not help you predict what Division Manager F's management decision will be in this period when he or she is paired with you. Division Manager F will also be provided with information about your profit in period 4.

Division F was paired with Division T in period 4 and the following profit information is available about period 4: the sum of the profits of Division F and Division T was \$8.

In period 4, Divisions F and T were both provided with the division profit table below. This means that Division Manager F could have chosen either Action X or Action Y in period 4.

TABLE 1B: Accounting Information Aggregation (Disaggregated-Cooperative Condition)

At the beginning of period 5, participants in the disaggregated-cooperative accounting information condition were provided with disaggregated accounting information about the organizational subunit with which there was profit interdependence in that period. The organizational subunit with which participants in this condition were paired chose the cooperative management action in period 4.

		Division T	
		Action X	Action Y
Division F	Action X	\$6, \$6	\$0, \$8
	Action Y	\$8, \$0	\$2, \$2

Participants were provided with the following supplemental information: In this period, you will be paired with Division Manager F. You have not been paired with Division Manager F before, but you will be provided with some information about this manager before you make your management decision in this period. Specifically, you will be provided with information about Division Manager F's profit in period 4 when he or she was paired with someone other than you. This information may or may not help you predict what Division Manager F's management decision will be in this period when he or she is paired with you. Division Manager F will also be provided with information about your profit in period 4.

Division F was paired with Division T in period 4 and the following profit information is available about period 4: Division F's profit was \$0 and Division T's profit was \$8.

In period 4, Divisions F and T were both provided with the division profit table below. This means that Division Manager F chose Action X in period 4.

TABLE 1C: Accounting Information Aggregation
(Disaggregated-Non-Cooperative Condition)

At the beginning of period 5, participants in the disaggregated-non-cooperative accounting information condition were provided with disaggregated accounting information about the organizational subunit with which there was profit interdependence in that period. The organizational subunit with which participants in this condition were paired chose the non-cooperative management action in period 4.

		Division T	
		Action X	Action Y
Division F	Action X	\$6, \$6	\$0, \$8
	Action Y	\$8, \$0	\$2, \$2

Participants were provided with the following supplemental information: In this period, you will be paired with Division Manager F. You have not been paired with Division Manager F before, but you will be provided with some information about this manager before you make your management decision in this period. Specifically, you will be provided with information about Division Manager F's profit in period 4 when he or she was paired with someone other than you. This information may or may not help you predict what Division Manager F's management decision will be in this period when he or she is paired with you. Division Manager F will also be provided with information about your profit in period 4.

Division F was paired with Division T in period 4 and the following profit information is available about period 4: Division F's profit was \$8 and Division T's profit was \$0.

In period 4, Divisions F and T were both provided with the division profit table below. This means that Division Manager F chose Action Y in period 4.

TABLE 2: Descriptive Statistics
Number (%) of participants who choose the cooperative action in period 5

	Accounting Information Aggregation	
	Disaggregated	Aggregated
	3 (14%) (n = 21)	8 (40%) (n = 20)

TABLE 3: Supplemental Analysis I
Participants' expectations about the likelihood of cooperative action in period 5

	Expect Cooperative Action	Choose Cooperative Action
Aggregated Accounting Information	9 (45%) (n = 20)	8 (40%) (n = 20)
Disaggregated Accounting Information	9 (43%) (n = 21)	3 (14%) (n = 21)

TABLE 4A: Supplemental Analysis II (Post-Experiment Questionnaire Item)

In Part 3 of the experiment, participants respond to a post-experiment questionnaire item about factors that influenced their management decision in period 5. Participants who expected the other participant to choose Action X (i.e., the cooperative action) in period 5 allocated 100 points to seven factors.

		Division F	
		Action X	Action Y
Your Division	Action X	\$6, \$6	\$0, \$8
	Action Y	\$8, \$0	\$2, \$2

Participants were provided with the following supplemental information: In period 5 (i.e., the final period), you were paired with Division Manager F. In period 5, you and Division Manager F were provided with the division profit table at the bottom of this screen. When you considered whether to choose Action X or Action Y in for your division period 5, how important were the following factors? (Please allocate 100 points to the factors below. Allocate more points to factors that had more influence on your decision and allocate fewer points to factors that had less influence on your decision.)

1. Action X was attractive to me because I wanted the highest total profit for me and the other division manager (i.e., Action X could maximize the sum of our divisions' profits).

2. Action X was attractive to me because I wanted to reward the other division manager for his or her prior period management decision.

3. Action X was attractive to me because I wanted both divisions to earn the same profit.

4. Action Y was attractive to me because I wanted my division to earn the highest profit.

5. Action Y was attractive to me because I didn't want to risk earning zero profit.

6. Action Y was attractive to me because I wanted to punish the other division manager for his or her prior period management decision.

7. Other (please type the other factor that influenced your decision): _____

TABLE 4B: Supplemental Analysis II (Decision Factors)

Descriptive statistics about factors that influenced participants' decisions in period 5. This table reports the mean (standard deviation) points allocated by condition for participants who expected the other participant to choose the cooperative action.

	Aggregated Accounting Information		
Factor	**Choose Cooperation (n = 8)**	**Choose Non-Cooperation (n = 1)**	**Marginal (n = 9)**
COOP-JOINT	91.87 (8.45)	-	81.67 (31.62)
COOP-REWARD	5.63 (6.23)	-	5.00 (6.12)
NON-INDIVIDUAL	-	60.00 (-)	6.67 (20.00)
NON-RISK	-	20.00 (-)	2.22 (6.67)
NON-PUNISH	-	20.00 (-)	2.22 (6.67)
EQUITY	1.25 (3.53)	-	1.11 (3.33)
OTHER	1.25 (3.53)	-	1.11 (3.33)
Total	100.00	100.00	100.00

TABLE 4B (cont'd)

	Disaggregated Accounting Information		
Factor	**Choose Cooperation (n = 3)**	**Choose Non-Cooperation (n = 6)**	**Marginal (n = 9)**
COOP-JOINT	78.33 (10.41)	-	26.11 (39.51)
COOP-REWARD	3.33 (5.77)	-	1.11 (3.33)
NON-INDIVIDUAL	-	86.67 (15.05)	57.77 (44.93)
NON-RISK	-	5.00 (8.36)	3.33 (7.07)
NON-PUNISH	6.67 (11.54)	6.67 (8.16)	6.67 (8.66)
EQUITY	8.33 (2.88)	-	2.77 (4.41)
OTHER	3.33 (5.77)	1.67 (4.08)	2.22 (4.41)
Total	100.00	100.00	100.00

Participants were provided with the following supplemental information: *COOP-JOINT* = Action X was attractive to me because I wanted the highest total profit for me and the other division manager (i.e., Action X could maximize the sum of our two divisions' profits). *COOP-REWARD* = Action X was attractive to me because I wanted to reward the other division manager for his or her prior period management decision. *NON-INDIVIDUAL* = Action Y was attractive to me because I wanted my division to earn the highest profit. *NON-RISK* = Action Y was attractive to me because I didn't want to risk earning zero profit for my division. *NON-PUNISH* = Action Y was attractive to me because I wanted to punish the other division manager for his or her prior period management decision. *EQUITY* = Action X was attractive to me because I wanted both divisions to earn the same profit. *OTHER* = Please type the other factor that influenced your decision in the space provided.

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