European Journal of Information Systems (2012) 21, 643–663

www.palgrave-journals.com/ejis/

RESEARCH ARTICLE

Understanding overbidding behavior in C2C auctions: an escalation theory perspective

Sang Cheol Park[1], Mark Keil[1], Jong UK Kim[2] and Gee-Woo Bock[2]

[1]*Computer Information Systems, Georgia State University, U.S.A.;* [2]*School of Business, Sungkyunkwan University, Republic of Korea*

Correspondence: Mark Keil, Computer Information Systems, Georgia State University, PO Box 4015, Atlanta, GA 30302-4015, U.S.A.
Tel: +404 413 7365;
Fax: +404 413 7394;
E-mail: mkeil@gsu.edu

Abstract
With millions of online auctions per day, sites such as eBay have revolutionized how consumers buy and sell goods. Despite the benefits associated with online consumer-to-consumer (C2C) auctions, there can be drawbacks. Consumers who purchase goods in online auctions may get caught up in auction fever, causing them to engage in overbidding, and sometimes leading to what has been referred to as the winner's curse. While several theoretical explanations have been proposed to explain overbidding behavior (OB), there has been little empirical work in this area. Drawing on escalation theory, this study develops and tests a model of the OB exhibited by individuals in online auction settings. Our model posits that certain escalation drivers such as sunk cost (SC), the completion effect (CE), and self-justification affect an individual's willingness to continue bidding (WCB) which, in turn, influences OB. Survey data collected from 250 online auction participants were used to test the model using partial least squares analysis. SC and CE were found to have significant impacts on OB that were either partially or fully mediated by WCB. We also found that competition intensity moderates the relationship between willingness to continue and OB such that when competition is more intense, the relationship becomes even stronger. The implications of these findings for both research and practice are discussed.
European Journal of Information Systems (2012) **21,** 643–663.
doi:10.1057/ejis.2012.11; published online 13 March 2012

Keywords: online auctions; escalation; overbidding behavior; competition intensity

Introduction

While consumer-to-consumer (C2C) online auctions have revolutionized how individuals can buy and sell goods, consumers who purchase goods in online auctions may be prone to engage in overbidding behavior (OB). Overbidding can be said to occur when an individual bids past his/her pre-set limit, or reservation price. Much of the prior work on online auctions has assumed that a bidder behaves rationally (Stafford & Stern, 2002; Johns & Zaichkowsky, 2003; Bapna *et al*, 2004; Walley & Fortin, 2005; Chia-Hui & Hsi-Peng, 2008). Rational choice suggests that individuals will stop bidding when they hit their pre-set limit (i.e., the price at which they value the product), at least in the case of private value auctions in which 'an individual's valuation of the item is independent of and unaffected by others' values' (Ku *et al*, 2005, p. 91). In common value auctions (i.e., when the item has a 'true' value that is independent of who owns the item), individuals may overbid for both rational and irrational reasons. Rational overbidding in this context may occur because the bids of others can carry information as to the item's value. OB can thus occur in both private and common value auctions contexts.

Received: 8 March 2011
Revised: 6 September 2011
2nd Revision: 21 December 2011
Accepted: 8 February 2012

While there are undoubtedly numerous factors that can influence overbidding, in many instances the behavior may be the result of what has been termed 'auction fever'. Ku *et al* (2005) define auction fever as 'the emotionally charged and frantic behavior of auction participants that can result in overbidding' (p. 90). Empirical research on individual bidder behavior has tended to focus on the so-called 'winner's curse' in which the winning bidder pays more than an auction item is worth. When this occurs, the winning bidder ends up regretting the purchase (Oh, 2002; Ku *et al*, 2005). The winner's curse can occur, however, due to a lack of information regarding the value of an item being auctioned. Thus, while both the winner's curse and auction fever can both result in overpaying for an item, the winner's curse is said to occur primarily from uncertainty about an item's true value, whereas auction fever is based on an emotional response (Ku *et al*, 2005). Comparatively little research has been conducted on auction fever and the factors that give rise to irrational overbidding. While several theoretical explanations have been proposed to explain OB, there has been little empirical work in this area.

It is important to gain a better understanding of what drives overbidding, for several reasons. First, from the buyer's perspective, overbidding can lead to negative consequences (such as buyer's remorse) that can adversely affect one's willingness to participate in future online auctions. Therefore, research that can shed additional light on OB may ultimately prove beneficial to both consumers and to the online auction industry itself.

Second, while escalation of commitment has been suggested as a possible theoretical lens to better understand overbidding (Ariely & Simonson, 2003; Ku *et al*, 2005), there has been very little empirical work that has investigated the application of escalation theory to this domain. Moreover, the work that has been done in this area examines only a single factor that is known to cause escalation (i.e., sunk cost (SC)) and does not provide an understanding of how this and other factors may contribute to OB by affecting an individual's willingness to continue bidding (WCB). Thus, the theoretical mechanism that connects escalation factors to overbidding is underdeveloped and represents a significant theoretical gap in our understanding of the phenomenon.

Third, while previous studies have focused mainly on how bidders should behave at the outset of an auction or in the initial stages of the bidding process, comparatively less attention has been placed on later phases of the auction in which emotions can reach fever pitch as the bidding process continues, and competition intensifies (Johns & Zaichkowsky, 2003; Ku *et al*, 2005). Thus, there is a need to understand the role of competition intensity (CI) and how it may influence overbidding. Prior work has suggested that competition during the later phases of the auction process creates a state of competitive arousal in which bidders lose sight of their pre-set limits and bid past (Ku *et al*, 2005). While this would seem to suggest that CI could have a direct effect on overbidding, we contend that the relationship between CI and overbidding is more nuanced. In particular, we argue that CI actually serves to moderate the relationship between WCB in an online auction context and actually engaging in OB. In light of the above, we sought to address the following research question:

> How does escalation of commitment influence a consumer's overbidding behavior in online auctions and what role does competition intensity play in this process?

In order to address this research question, we draw upon multiple theories that have been used to explain escalation (e.g., prospect theory (PT), self-justification theory (SJT), and approach avoidance theory (AAT)) in order to construct and test a mediated model of how three specific escalation factors (completion effect (CE), self-justification (SJ), and SC) can influence an individual's WCB in an online auction context, and how this, in turn, causes individuals to exceed their pre-set limit, or reservation price (i.e., to overbid).

In testing our model, we contribute to the extant literature in a number of ways. First, we provide empirical evidence that escalation of commitment influences a bidder's OB in online auctions. Specifically, all three escalation factors were found to influence an individual' WCB. Furthermore, WCB was found to have a positive influence on OB. Second, the relationship between CE and OB was fully mediated by WCB, and the effect of SC on OB was partially mediated by WCB.

Third, consistent with information cascade theory, we found that CI positively moderated the relationship between an individual's WCB and OB, such that the relationship becomes stronger as bidding competition becomes more intense.

By addressing our proposed research questions, we not only contribute to the existing body of knowledge on OB, but also contribute to the escalation literature by introducing and testing an integrative model of escalation that combines constructs derived from multiple theories.

The remainder of the paper is organized as follows. The next section provides a brief background on online auctions and some of the research that has been done in this area, particularly focusing on those studies that relate to overbidding. Then, we introduce our research model and hypotheses, followed by the data analysis and results of our study. The implications of our findings are then discussed.

Literature review and theory base

Online auctions and OB

Online auctions differ from traditional auctions in that they are conducted over the internet, thereby eliminating the geographical constraints of traditional auctions and enabling worldwide participation (Ariely & Simonson,

2003; Peters & Bodkin, 2007). Online auctions can also last for several days and can allow for asynchronous bidding, which makes them more flexible than traditional auctions and open to broader participation.

Despite their advantages, prior research has documented a number of problems that can arise when individuals participate in online auctions. These include psychological distress (i.e., anxiety, aggression, anger, and depression), habitual usage, negative impacts on finances or social relations, and dependency and withdrawal symptoms (Peters & Bodkin, 2007). While such concerns principally relate to the addictive qualities associated with online auctions, our interest focuses on the specific behavior of overbidding. There is extensive anecdotal evidence that online auction participants frequently overpay. On the basis of an analysis of 500 online auctions for CDs and DVDs, for example, Ariely & Simonson (2003) reported that 98% of all winning bidders overpaid. On the basis of a sample of 416 online auctions, Amyx & Luehlfing (2006) found that 8.7% of the winning bidders overpaid even though all of the auctions were linked to e-tail websites that allowed bidders to check the reference price of identical retail merchandise available for sale at the same website. Overbidding becomes an issue of concern for both research and practice because it represents a behavior that is not well understood theoretically and which can lead to the so-called 'winner's curse', thus promoting customer dissatisfaction (Amyx & Luehlfing, 2006). While overbidding is of significant concern to both research and practice, surprisingly little work has been done to develop a theoretical model of the factors that can explain such behavior. Indeed, while online auctions have received attention from several different academic disciplines (e.g., economics, marketing, information systems (IS), and psychology), most of the research has been devoted to topics other than overbidding, a point that becomes clear in our brief review of the literature in this area.

In economics, many studies have focused on traditional auctions, with only a few featuring online auction studies as their topic. These studies have tended to assume that bidders are likely to behave rationally during an auction process (Milgrom & Weber, 1982; McAfee & McMillian, 1987; Lucking-Reiley, 1999), and thus provide limited insight concerning OB. Marketing studies have tended to focus on the effects of providing reference prices and price assurance, as well as various strategies for winning an online auction (e.g., Sinha & Greenleaf, 2000). Carmon & Ariely (2000) focus on the question of why buyers and sellers perceive auctioned goods to have different values. They suggest that 'sellers pay close attention to forfeiting the item (or experience) whereas buyers focus on the expenditure' (Carmon & Ariely, 2000, p. 361). Easley & Tenorio (2004) investigate the use of jump bidding as a signaling mechanism to deter others from entering the auction.

In the IS area, there have been a number of studies that have focused on online auctions and we will not attempt to provide an exhaustive review here. Stafford & Stern (2002) have examined consumer-bidding behavior on online auction sites primarily from a technology acceptance perspective. They suggest that consumer behavior is influenced by cognitive and affective behavioral intentions, and that actual use of online auctions is influenced by the acceptance of auction site technology and involvement with the auction process. Bapna *et al* (2004) examined whether heterogeneity exists in bidder behavior in online auctions. They developed an empirically driven taxonomy of bidder behavior in online auctions based on time of entry, time of exit, and the number of bids placed. Using cluster analysis, they identified five different types of bidder behavior. While their findings suggest that different bidding strategies do exist and that they can result in different economic consequences, they do not inform our understanding of OB. Oh (2002) examined the winner's curse in C2C auctions, which is clearly a possible outcome associated with OB. He concluded that most bidders in a C2C auction do not behave rationally because they tend to bid on items not on the basis of utility from purely monetary terms, but solely from the sheer enjoyment that is intrinsic in an online competition. However, his study failed to concretely examine what kinds of factors can motivate such behavior. Amyx & Luehlfing (2006) examined the winner's curse in the context of parallel sales channels (i.e., online auctions linked within e-tail websites). Their results suggest that nearly 10% of the time, people overpay for products in online auctions even when they have access to reference prices and the ability to purchase the same product at a lesser price without having to go through an auction process. Easley & Tenorio (2004) examine jump bidding (i.e., entering a bid larger than what is necessary to be the highest bidder at a particular point in time) in internet auctions. On the basis of their analysis, it appears that jump bidding can be used as a signaling mechanism and that early jump bidding can deter others from entering the auction. Jump bidding was found to be related to the expected level of competition.

In the psychology area, online auction studies mostly focus on individual decision-making behavior, and there have been a handful of studies that provide some insight into OB. Ariely & Simonson (2003), for example, present a framework for understanding online bidding behavior that considers both value assessment and decision dynamics at the beginning, middle, and end phases of an online auction. In the beginning, or entry phase, of the auction the consumer makes value assessments that drive the decision of whether or not to enter the auction. The middle phase of the auction is characterized by value assessment based on others' bids and decision dynamics that can lead to escalation of commitment. The end phase of the auction involves decision dynamics that drive final bidding decisions that are 'clearly consequential and often irreversible' (Ariely & Simonson, 2003, p. 117). Ariely & Simonson (2003) suggest that theoretically escalation can play into the decision dynamics of

online auctions and could therefore be a useful lens from which to examine OB, but the empirical portion of their paper deals only with value assessment in online auctions.

Ku *et al* (2005) investigate the auction fever phenomenon, suggesting that auction fever is consistent with irrational and emotional overbidding. They propose a 'competitive arousal' model of decision making, noting that live auction bidders tend to explain their OB with statements that indicate 'high levels of arousal and auction fever' (Ku *et al*, 2005, p. 90). From a theoretical perspective, they suggest that both escalation of commitment and competitive arousal (which also accounts for the emotional aspect of auction fever) may be viewed as 'complementary rather than mutually exclusive' angles from which to understand and explain OB (Ku *et al*, 2005, p. 90). Ku *et al* (2005) conducted two studies, one based on archival and survey data from a field study of live and online auctions, and one based on a laboratory experiment in which they manipulated rivalry and SC and asked subjects to indicate their likelihood of bidding, but did not conduct an auction *per se*. The results of their first study suggested that overbidding occurred due to rivalry, time pressure, and the amount of time bidders had invested in an auction. In their second study, Ku *et al* (2005) found that both rivalry and SC were predictive of the likelihood of continuing to bid. The results of both studies were interpreted as being consistent with both a competitive arousal and an escalation theory perspective on why OB occurs. With the exception of testing for the SC effect, however, there was no exploration of how constructs associated with other theories of escalation may also contribute to escalation in the auction context. Moreover, the theoretical mechanism linking escalation (i.e., WCB in spite of negative feedback) to OB (i.e., exceeding one's reservation price) was neither specified nor tested.

In summary, our reading of the literature suggests that there is a dearth of theoretically grounded research on OB, especially studies that focus on the factors that drive OB as the auction process starts to heat up. Table 1 provides a classification of previous studies on online auctions based on the three-phase framework described by Ariely & Simonson (2003).

As indicated in Table 1, most of the prior research on bidding behavior in an online auction has been conducted by examining the initial and final stages of the auction where the focus has been on value assessment and the intention to make an initial bid, and the likelihood of winning the auction and experiencing the so-called winner's curse.

In this study, we focus on the decision dynamics that emerge after the beginning phase of the auction, when escalation is most likely to come into play. In this paper, we build on prior work (Ariely & Simonson, 2003; Ku *et al*, 2005) and adopt an escalation theory perspective on overbidding in order to develop and test a causal model of OB that integrates constructs from multiple theories of escalation and accounts for the role of CI.

The escalation of commitment perspective

Escalation of commitment has been defined as continued commitment in the face of negative information about prior resource allocations coupled with 'uncertainty surrounding the likelihood of goal attainment' (Brockner, 1992, p. 40). The escalation literature provides a solid theoretical base for explaining commitment to failing courses of action and may therefore shed light on OB. Within the escalation literature, different theories have been proposed to explain the phenomenon and three of these would appear to be relevant in an online auction context. These include: self-justification theory (SJT), prospect theory (PT), and approach avoidance theory (AAT).

Self-justification theory Grounded in Festinger's (1957) theory of cognitive dissonance, SJT holds that individuals escalate in order to self-justify prior behavior (Staw & Fox, 1977). SJT is based on the notion that 'individuals seek to rationalize their previous behavior' (Staw & Fox, 1977, p. 432). In the context of online auctions, SJT suggests that individuals exhibit a WCB because they convince themselves that their initial bid for the item was indeed a good idea.

Table 1 Categorization of previous studies based on the auction stages

Focal points of examining the online bidding behavior		*Auction stages*		
		Auction choice/entry (formation of intention to bid)	*Middle of the auction*	*End of auction (winning a bid or winner's curse)*
Research areas	Economics	NA	NA	Milgrom & Weber (1982); Lucking-Reiley (1999)
	Marketing and Psychology	Ariely & Simonson (2003); Johns & Zaichkowsky (2003)	Ariely & Simonson (2003)	Sinha & Greenleaf (2000); Ariely & Simonson (2003); Gilkeson & Reynolds (2003)
	IS (online studies)	Stafford & Stern (2002); Walley & Fortin (2005); Chia-Hui & Hsi-Peng (2008)	NA	Oh (2002); Ku *et al* (2005)

Source: Ariely & Simonson (2003) framework.
NA: not applicable.

Prospect theory PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981) provides a framework for understanding the cognitive biases that influence human decision making under conditions of risk and uncertainty. PT suggests that someone who has not yet come to terms with an earlier loss is likely to adopt a negative frame of reference and is therefore more likely to engage in risk-seeking behavior. Whyte (1986, p. 319) has suggested that PT could explain the so-called SC effect in which decision makers exhibit a tendency to 'throw good money after bad'. In particular, he suggests that SCs may influence decision makers to adopt a negative frame, thereby promoting risk-seeking behavior, which can be observed as escalating commitment to a failing course of action. In the context of online auctions, previous efforts to bid and the auction timing both manifest SCs (Ku *et al*, 2005). Therefore, individuals may exhibit a WCB because they have already invested their time and effort in the bidding process.

Approach avoidance theory Under AAT, escalation is conceptualized as a behavior that results when driving forces that encourage persistence seem to outweigh restraining forces that encourage abandonment (Brockner & Rubin, 1985). CE, which represents one facet of AAT, captures the notion that an individual's motivation to attain a goal increases, as s/he gets closer to it (Conlon & Garland, 1993; Keil *et al*, 2000a). Conlon & Garland (1993) suggest that the motivation to complete a task that has already been started and is perceived to be near completion can, in itself, bring about escalation behavior through a form of goal substitution (Garland & Conlon, 1998). Noting that: 'there may be a strong positive correlation between sunk costs and project completion in many instances', Conlon & Garland (1993, p. 403) point out that they are two 'theoretically different concepts'. Empirical work suggests that both SCs and the degree of CE can influence escalation (Moon, 2001). In the context of online auctions, CE suggests that as the auction progresses and competition intensifies individuals will be willing to continue bidding in order to complete the purchase of the item.

Most of the prior research on escalation has tended to focus on one particular theory at a time. In a few instances, researchers have incorporated constructs from more than one theory of escalation to test their relative power in predicting or explaining escalation. For example, in order to explain why IT projects escalate, Keil *et al* (2000a) examined the predictive capability of several different models, but each model was based on a single theory of escalation. While they found that constructs associated with each individual theory were predictive of escalation, they did not attempt to develop an integrative escalation model incorporating constructs from multiple theories. Since escalation is a complex phenomenon, and multiple theories have been suggested to explain escalation behavior, it stands to reason that a model that combines constructs from multiple theoretical perspectives has the potential to explain more variance. To date, however, there has been no attempt to develop or test an integrative model of escalation that incorporates constructs from multiple theories of the phenomenon. In this research, we develop a research model that combines constructs from three different escalation theories in order to explain individuals' WCB in an online auction context, and how this, in turn, influences OB. We believe that such an approach represents a theoretical contribution both to the online auction literature and the escalation of commitment literature.

Research model and hypotheses

Figure 1 illustrates our proposed research model, which consists of three constructs derived from three different theories that can explain escalation of commitment (Staw, 1976; Staw, 1981; Brockner & Rubin, 1985; Whyte, 1986; Keil *et al*, 2000b). The three constructs of interest, which serve as predictors in our model, are SJ, SC, and CE. Each of these factors should, in theory, influence an individual's WCB in an online auction situation, which in turn, can give rise to OB. WCB is defined here as an individual's willingness to make further bids. Throughout the online auction process, one is at risk of being outbid and when this occurs, one must decide whether or not to continue bidding. Whenever the current auction price exceeds an individual's last bid, this represents a form of negative feedback for the individual. WCB thus taps into the notion of persistence and serves as a proxy for escalation intentions in the face of negative feedback. According to escalation theory, it is reasonable to assume that escalation intentions will drive actual behavior (i.e., overbidding).

The model posits that the effects of the three escalation factors on OB are mediated by WCB. While we have not depicted direct paths from the escalation factors to OB, in order to test each of our mediation hypotheses, we will examine whether the effects of each of these factors is partially or fully mediated by WCB. Finally, CI, which can be an indicator of the auction fever phenomenon, is posited to moderate the effect of WCB on OB.

Research hypotheses

Completion effect In this study, CE is defined as the increasing motivation to finish a task that an individual has started, as s/he gets closer to the goal (Conlon & Garland, 1993; Keil *et al*, 1995; Moon, 2001). In the online auction context, individuals enter the auction because they want to acquire a particular item. Thus, it is reasonable to assume that a bidder's goal is to win the auction so as to acquire the particular item of interest. We posit that as the auction progresses, individuals will perceive themselves to be closer to attaining their goal and will be tempted to engage in overbidding due to the CE. We further posit that the relationship between CE and OB will be mediated by an individual's escalation tendencies as evidenced by his/her WCB.

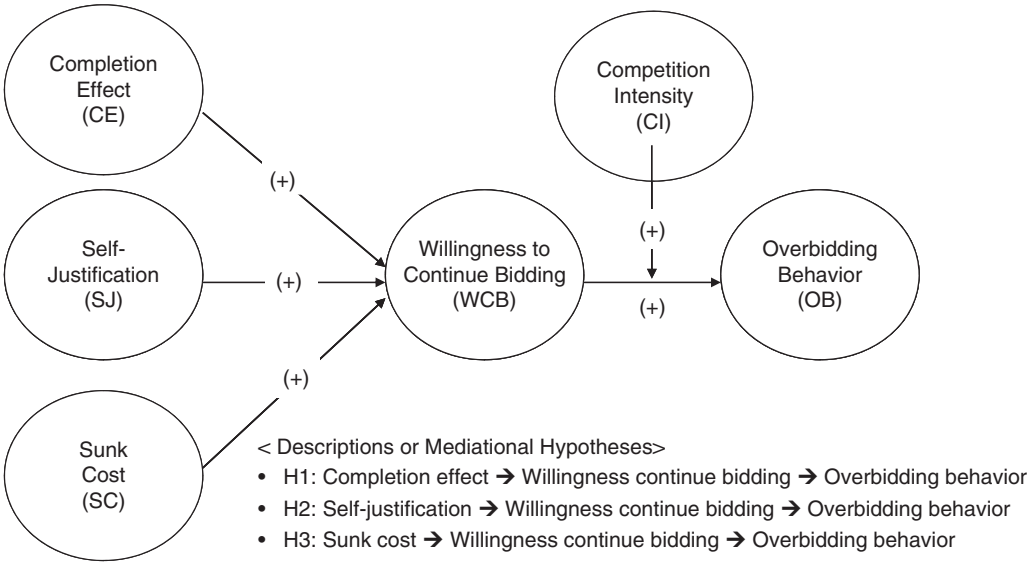

Figure 1 The proposed research model.

The relationship between CE and escalation is well established in the literature and is consistent with Fox & Hoffman's (2002) conceptualization of escalation behavior as a specific case of goal-directed activity. Seen in this context, the perceived proximity to one's goal drives persistence and produces escalation behavior. Conlon & Garland (1993) provided the first major piece of empirical evidence for the CE. In the IT project context, Keil *et al* (2000a) demonstrated that the CE increased a decision maker's willingness to continue a project. Moon (2001) provided further evidence showing how the CE can influence escalation. In the online auction context, we posit that if an individual's goal is to acquire a particular item, CE will become a powerful motivating factor and can increase an individual's WCB. As the auction progresses and moves closer to its conclusion, CE is likely to grow stronger because bidders will begin to feel that they are close to achieving their goal. Drawing on escalation theory, the influence of the CE on OB is likely to be mediated by WCB, which is an indication of persistence. In other words, when the CE is strong, this should increase an individual's WCB, which in turn should lead to an increase in OB. This leads us to our first hypothesis:

H1: *The completion effect promotes overbidding behavior because it increases an individual's willingness to continue bidding. Specifically, the relationship between completion effect and overbidding behavior will be mediated by willingness to continue bidding.*

Self-justification Here, we define SJ as the extent to which an individual attempts to psychologically defend himself against a perceived error in judgment. In the online auction context, individuals enter the auction presumably because they decide that it would be a good idea to acquire a particular item and they judge that there is a reasonable chance of winning the auction. We posit that as the auction progresses, individuals may seek to self-justify their decision to enter the auction, thereby engaging in overbidding in order to win the item, as failing to do so would be tantamount to admitting failure, thus creating cognitive dissonance.

Staw (1976) proposed SJ as the underlying mechanism behind escalation behavior and provided the first empirical evidence consistent with such an explanation. Since then, a growing body of research has emerged suggesting that the tendency to escalate is generated or heightened by SJ. In this study, we focus on the important role that psychological SJ is believed to play in promoting escalation of commitment (Staw & Ross, 1987). Whyte (1986) suggests that under SJT, a decision maker is psychologically compelled to justify prior actions in order to demonstrate and maintain a form of retrospective rationality (i.e., to reinforce the rationality of an earlier decision). In the online auction context, we posit that if an individual makes an initial decision to try and acquire an item through a bidding process, this will set in motion a SJ process whereby the individual may exhibit a greater WCB simply in order to justify the initial decision that the item was worth acquiring. Thus, once an individual commits to the bidding process, it will be difficult for him/her to stop. Drawing on escalation theory, the influence of SJ on OB is likely to be mediated by WCB. In other words, when SJ is strong, this should increase an individual's WCB, which in turn should lead to an increase in OB. Thus, we state the following hypothesis:

H2: *Self-justification promotes overbidding behavior because it increases an individual's willingness to continue bidding. Specifically, the relationship between self-justification and overbidding behavior will be mediated by willingness to continue bidding.*

Sunk cost SC can involve money, but can also involve investments of time or effort. SC is defined here as the amount of time or effort already invested in the auction. Once again, it is reasonable to presume that individuals enter the auction with the purpose of acquiring a particular item. We posit that as the auction progresses, individuals will tend to perceive their SC to be greater and greater as their investment of time and effort becomes higher. The only way to recover their SC is for individuals to engage in overbidding.

Arkes & Blumer (1985) presented the first major empirical study documenting the so-called SC effect (i.e., that the level of SC had an effect on human decision making). Garland & Conlon (1998) also found that a higher percentage of SC could lead to a greater willingness to continue with a course of action. In addition, Keil *et al* (1995) revealed that people tended to make decisions to continue a project based on the level of SCs. The effect of SC on escalation behavior has been well documented (see, e.g., Keil *et al*, 2000b; Moon, 2001). While there have been different explanations offered for the SC effect, the most common explanation is that SCs put individuals in a loss avoidance frame, which promotes risk-seeking behavior.

In the online auction context, 'previous bids and/or time invested in the auction represent sunk costs' (Ku *et al*, 2005, p. 92). In the context of reverse auctions, Yeniyurt *et al* (2011, p. 67) present evidence that 'as subjects submit bids in an auction, they are likely to increase their bidding activity'. Such evidence is consistent with a linkage between SC and escalation behavior. We posit that individuals create a mental budget in which SCs are perceived as losses, which can only be recouped if the individual maintains a WCB. Thus, as an individual incurs a higher level of SCs associated with the bidding process, this will encourage a greater WCB.

Drawing on escalation theory, the influence of SC on OB is likely to be mediated by WCB. In other words, when SCs are high, this should increase an individual's WCB, which in turn should lead to an increase in OB. Thus, we state the following hypothesis:

H3: *Sunk cost promotes overbidding behavior because it increases an individual's willingness to continue bidding. Specifically, the relationship between sunk cost and overbidding behavior will be mediated by willingness to continue bidding.*

The moderating role of CI Several researchers believe that excessive bidding is the result of the competitive nature of auctions. Murninghan (2002) reports the long-held folk wisdom on auctions that suggests that people get caught up in auction fever, that is, their adrenaline starts to rush, their emotions block their ability to think clearly, and they end up bidding much more than they ever envisioned. Competitive pressure can increase arousal, resulting in impaired decision-making and risk-seeking behavior (Yeniyurt *et al*, 2011). On the basis of an experiment involving online reverse auctions, Yeniyurt *et al* (2011) found that an individual's propensity to submit a bid increased as the number of competitors participating in the auction increased. Moreover, being in a state of competitive arousal can presumably cause bidders to lose sight of their pre-set limits and bid past these (Ku *et al*, 2005). While this would seem to suggest that CI could have a direct effect on overbidding, we contend that the relationship between CI and overbidding is more nuanced. In particular, we argue that CI actually serves to moderate the relationship between WCB in an online auction context and actually engaging in OB. Our rationale for conceptualizing CI as a moderating variable is based on the herding behavior perspective and the notion of informational cascades. Herding behavior occurs when people tend to imitate the actions of others. Huang & Chen (2006) suggest that online herding behavior occurs when people tend to use the product evaluations of others to indicate product quality on the internet. We believe that such herding behavior may also contribute to overbidding in online auction settings.

According to Asch (1956), people are influenced by others in decision making. Deuthch & Gerard (1955) distinguished between two influence types: normative and informational. Normative influence describes occurrences in which individuals conform to the expectations of others, whereas informational influence is considered to be the tendency to accept information received from others as an indicator of reality. In an online auction context, informational influence should exert a stronger influence on consumers than normative influence, since individuals have no need to conform to the expectations of others when making online purchase.

Generally, consumers make decisions based on existing online information. However, when facing plentiful information, people often imitate others rather than making decisions based on existing conditions (Bonabeau, 2004). Such imitative behavior can lead to the formation of informational cascades (Bikhchandani *et al*, 1992). Informational cascades occur when individuals follow the previous behavior of others and disregard their own information. Such imitative behavior can be derived from rational inferences based on the decision information of others that dominates individual signals (Anderson & Holt, 1997). The mimetic behavior by consumers, once started, leads to an upward cascade (Dholakia *et al*, 2002). In online auctions, buyers tend to bid for listings that others have already bid for, while ignoring similar or more attractive unbid-for listings (Dholakia & Soltysinski, 2001).

Previous studies on informational cascades have highlighted the importance of informational social influence in decision making. On the basis of the results of prior studies, such as those carried out by Gilkeson & Reynolds (2003), Johns & Zaichkowsky (2003), and Ku *et al* (2005), it is reasonable to assume that decision dynamics can be impacted by CI. From an informational cascades

perspective, increasing the level of CI can create a situation in which individuals become unduly influenced by the bidding behavior of others. Thus, when CI increases, of the relationship between WCB and OB should be strengthened. Thus, we state the following hypothesis:

H4: *Competition intensity will moderate the relationship between willingness to continue bidding and overbidding behavior such that the strength of the relationship will be greater when competition intensity is higher.*

Construct operationalization

In this section, we describe how we operationalized each of our constructs. To increase the reliability of the survey measurement, multiple measurement items were developed for each construct. The actual measurement items are shown in Appendix A.

SC, derived from PT, was operationalized by capturing the extent to which the bidder referred to prior investments as a reason for not being willing to quit the bidding process. Reference to prior investment such as time and effort can be taken as evidence of SCs. These form the basis for four of our measurement items (SC_1–SC_4). Similarly, the bidder may sometimes justify continuation by exhibiting an attitude that there is too much invested to quit, which formed the basis for our fifth measurement item (SC_5). When this is the case, it is strongly suggestive that SCs are operative.

Since SJ cannot be accessed directly, we operationalized this construct by tapping into self-reported thought patterns that could serve as reliable indicators of the psychological need to self-justify. Our measurement items were therefore designed to tap into whether the individual saw his/her decisions as justifiable (SJ_1, SJ_2, and SJ_3).

The CE was operationalized by creating four measures (CE_1–CE_4) designed to assess the extent to which goal proximity, and the need for completion, may have influenced the decision to continue bidding. For example, our operationalization of the CE construct is consistent with previous research that has employed content analysis to detect phrases that people use to express the CE as a rationale for continuing a troubled project (Keil *et al*, 2000b). According to Keil *et al* (2000a, p. 378), remarks such as 'once you start something, finish it' are typical of the way in which people express the CE as a rationale for continuation. Thus, we included two measurement items, for example, that were designed to tap into the extent to which an individual felt that s/he was close enough to winning the auction that another bid could lead to successful closure (CE_1 and CE_3).

CI was operationalized using a 3-item scale that was developed for this study. These measures were designed to tap into the number of people competing in the auction and how fierce the competition was perceived to be. WCB was operationalized using the 3-item scale shown in Appendix A. All of the items were designed to tap into an individual's WCB in spite of increasing prices.

The ultimate final dependent variable in this study, OB, was defined as making a bid that exceeded one's reservation price. A single item measure was used: 'I made a bid at a price which was higher than I initially thought to purchase a product'.

Research approach and data collection

Given that our study focused on evaluating why individuals sometimes engage in OB, it was important to be able to probe perceptions of those who had participated in an actual auction. We therefore adopted a survey approach in order to test our research model. The survey was developed and refined as follows. First, we developed an initial version of the questionnaire in which each subject was asked to respond based on his or her most recent online auction experience. Then, we asked four faculty members who had domain expertise in the area of online auctions and who had experience in survey design to review the questionnaire.

On the basis of their feedback, revisions were made to improve the questionnaire items. Next, we recruited 196 undergraduate students to complete the survey. This served as a pilot test of the modified version of the questionnaire and allowed us to check the psychometric properties of the scales (Straub *et al*, 2004). Convergent validity of each scale was assessed using a principal components factor analysis (PCA). A separate PCA was run for each of the constructs. A single eigenvalue above 1 for each construct verified that the construct was unidimensional, hence, showing the convergent validity of each scale. Cronbach's α was used to assess the reliability of our measures in the pretest and all scales were judged to exceed the normal threshold for reliability (Hair *et al*, 1998).

Subsequent to the pilot test, we administered a web-based survey in October 2006 that targeted individuals who had participated in online C2C auctions using one of Korea's three leading online sites. Before pooling our data across the three auction sites (Auction, Onket, and G-market), we checked extensively for any differences across auction sites in terms of WCB and OB. No significant differences were observed.

We focused on the common value auction context, in which the auctioned item has the same value for everyone, but different bidders have different information about the underlying value and one bidder's information would be informative to another bidder's valuation of the item being auctioned. In a common value auction, the auctioned item is of roughly equal value to all bidders, but the bidders do not know the item's market value when they bid. Each bidder independently estimates the value of the item before bidding. The winner of an auction is, of course, the bidder who submits the highest bid. If we assume that the average bid is an accurate estimate of the value of the item, then the highest bidder overestimates the item's value. Thus,

the auction's winner is likely to overpay, resulting in the so-called winner's curse.

A market research firm was hired to administer the survey to a random sample of Auction users. Survey recipients were asked to recall their most recent online auction experience that involved making multiple bids during an auction. There was no attempt to determine whether the survey respondent had actually won the item that they were bidding on, as this was neither practical nor necessary for the purposes of our research. WCB and OB, as defined and operationalized in our study, can occur regardless of whether an individual wins the auction. Five dollars of cyber-money was provided to each survey recipient in order to motivate them to complete the survey. In total, 479 completed surveys were collected by the market research firm. Because we were interested in studying individuals' willingness to engage in continued bidding during an online auction, we restricted our analysis to survey respondents who indicated that they had placed four or more bids. A total of 250 survey respondents met this threshold and these cases were retained for further analysis.

All survey items for the constructs in our model were measured on a 7-point Likert scale, which ranged from 'strongly disagree' (1) to 'strongly agree' (7). On the basis of an exploratory factor analysis, we noted that one of the SJ items (SJ_4), exhibited a cross-loading greater than 0.40 on another factor. Thus, this item was dropped in subsequent analyses.

Results and discussion

Table 2 shows the demographics for our sample. As shown, respondents placed between 4 and 15 bids during an auction, with the modal response being 4–5 bids.

Respondents reported using Auction (http://www.auction.co.kr) (82.2%), G-market (http://www.gmarket.co.kr) (15.7%), and Onket (http://www.onket.com) (2%), which are the most popular online auction sites in Korea.

Measurement model

For the measurement model, each construct was modeled to be reflective. The measurement model was tested by examining convergent and discriminant validity (Hair *et al*, 1998). Two different assessments were made for convergent validity: (1) individual item reliability and (2) construct reliability. Individual item reliability was assessed by examining the item-to-construct loadings for each construct that was measured with multiple indicators. In order for the shared variance between each item and its associated construct to exceed the error variance, the standardized loadings should be greater than 0.70. As can be seen in Appendix B, all of our item-to-construct loadings exceeded the desired threshold.

The next step in establishing measurement reliability was to examine the internal consistency for each block of measures (i.e., construct reliability). This was done by examining the composite reliability, Cronbach's α, and the average variance extracted (AVE) for each block of measures, as shown in Table 3. Composite reliability scores and Cronbach's α scores both measure the internal consistency within a given construct's items. The threshold values for composite reliability and Cronbach's α are not absolute ones, but our measures appear to be more than acceptable by established criteria. Bearden *et al* (1993) claim that a score of 0.7 indicates 'extensive' evidence of reliability, and a score of 0.8 or higher provides 'exemplary' evidence. As shown in Table 3, all of the constructs in our measurement model exhibited composite reliabilities of 0.85 or higher, and they all exhibited Cronbach's α of 0.73 or higher.

Table 2 Sample demographics

Items	*Category*	*Frequency*	*Ratio (%)*
Gender	Male	183	73.2
	Female	67	26.8
Age	10–19	3	1.20
	20–29	71	28.40
	30–39	54	21.60
	Over 40	11	4.40
Number of bids for a product	4–5	173	69.2
	6–8	49	19.6
	9–12	21	8.4
	13–15	7	2.8
Number of visits to online auction site (monthly)	1 ~ 3	90	36.0
	4 ~ 6	84	33.6
	7 ~ 10	30	12.1
	11 ~ 15	21	8.4
	Over 16	25	10.0

The guideline threshold for AVE is 0.5, meaning that 50% or more variance of the indicators is accounted for (Chin, 1998). As Appendix C indicates, all of the constructs in our measurement model exceeded the established criteria for AVE. Thus, all of the constructs in our measurement model exceeded the threshold judged to be acceptable for construct reliability.

Having established convergent validity, we then turned to discriminant validity. We conducted two tests for discriminant validity. First, we calculated each indicator's loading on its own construct and its cross-loading on all other constructs (see Appendix B). In the columns of the Table in Appendix B, the loadings for the indicators for each construct are higher than the cross-loadings for other constructs' indicators. In addition, going across the rows, each indicator has a higher loading with its construct than a cross-loading with any other construct. This provides good evidence of discriminant validity (Fornell & Larcker, 1981). As a second test of discriminant validity, we considered whether the AVEs of the latent constructs were greater than the square of the correlations among the latent constructs (see Appendix C).

Table 3 Descriptive statistics and reliability of constructs

Construct	*Mean (SD)*	*Cronbach's α*	*Composite reliability*	*AVE*
Total sample group (250 respondents)				
CE	4.52 (1.00)	0.876	0.915	0.729
SJ	4.52 (1.21)	0.794	0.886	0.721
SC	4.74 (1.13)	0.938	0.954	0.807
WCB	4.86 (1.09)	0.865	0.919	0.790
CI	4.51 (1.13)	0.905	0.940	0.840
OB	4.32 (1.19)	NA	1.000	1.000
High CI group (127 respondents)				
CE	5.15 (0.89)	0.847	0.897	0.687
SJ	4.72 (0.89)	0.792	0.882	0.714
SC	5.03 (0.96)	0.923	0.942	0.765
WCB	4.99 (1.08)	0.849	0.911	0.773
CI	5.67 (0.83)	0.711	0.839	0.635
OB	4.74 (1.16)	NA	1.000	1.000
Low CI group (123 respondents)				
CE	4.33 (0.93)	0.847	0.897	0.687
SJ	4.07 (0.87)	0.735	0.850	0.654
SC	4.03 (1.04)	0.923	0.942	0.765
WCB	4.09 (0.97)	0.812	0.889	0.727
CI	4.05 (0.68)	0.704	0.833	0.624
OB	3.89 (1.05)	NA	1.000	1.000

NA: not applicable.

When this is true, more variance is shared between the latent construct and its block of indicators than with another construct. As can be seen by reading across the rows of the Tables in Appendix C, our measures passed this test, thus providing additional evidence of discriminant validity.

Having established the validity of our measurement model, we next explored the role of CI to determine what type of moderator it might be, as this information was necessary in order to determine the appropriate analysis approach (Sharma *et al*, 1981). Following the moderated regression analysis (MRA) procedure outlined by Sharma *et al* (1981) and explained in more detail in Appendix D, we determined that CI was not a pure moderator or a quasi-moderator, but that it acts as a homologizer. The appropriate procedure to probe this particular type of moderation is to conduct a subgroup analysis (Sharma *et al*, 1981), which we describe in detail later. With this information, we proceeded to test our mediation hypotheses first using the full data set. Our objective was to determine whether WCB acted as a mediator as specified in our research model.

We conducted the mediation analysis using two different approaches. We began by examining the structural model using partial least squares (PLS) analysis. To obtain a more detailed understanding of the mediation (i.e., the extent to which the influence of each independent variable on the dependent variable is transmitted through the mediator), we followed up with a traditional regression analysis-based approach.

PLS analysis

One advantage of PLS is that it allowed us to examine all of the paths in the proposed model simultaneously. Using PLS-Graph Version 3.0 (Chin *et al*, 2003), a bootstrap analysis was performed with 200 subsamples, with sample size set equal to the number of respondents in our sample ($n = 250$). In general, resamples of 200 tend to provide reasonable standard error estimates (Chin, 1998; 2004). While our research model is one that suggests full mediation, we included the direct paths from the independent variables to the dependent variable in our PLS analysis to determine if any of them were significant, which would imply partial mediation. Results are shown in Figure 2.

Given the large sample used in this study, statistical tests can be very sensitive and may detect spurious effects (Hair *et al*, 1998). Therefore, a strict significance level of 0.01 was used for all statistical tests. The explanatory power of a structural model can be evaluated by looking at the R^2 value (variance accounted for) of the final dependent construct. It is also instructive to examine the R^2 values for the intermediate variables in the structural model. The final dependent construct in this study (OB) has an R^2 value of 0.276, indicating that the model accounts for 27.6% of the variance in the dependent variable. The R^2 value for the intermediate variable (WCB) was 0.453. In our judgment, these R^2 values are sufficiently high to make interpretation of path coefficients meaningful.

As shown in Figure 2, the path between CE and WCB ($\beta = 0.351$, $t = 7.811$); the path between SJ and WCB ($\beta = 0.158$, $t = 3.132$); the path between SC and WCB ($\beta = 0.260$, $t = 4.729$); and the path between WCB and OB ($\beta = 0.378$, $t = 6.386$) were all significant at $P < 0.01$ suggesting that WCB mediates the relationship between the escalation factors and OB. In the case of SC, the direct path to OB was found to be significant ($\beta = 0.238$, $t = 3.696$), suggesting partial mediation. To control for observed heterogeneity, we also evaluated a similar model in which we included three control variables (respondents' gender, age, and average number of visit to online auction sites per 1 month). None of the control variables had a significant influence on either WCB or OB, and thus we did not retain them in the analysis presented here.

Regression analysis

In order to drill down deeper on the mediation implied by the PLS analysis, we conducted a regression analysis following the Baron & Kenny (1986) approach, which has been widely used to test for mediation (Bontis *et al*, 2007). According to Baron & Kenny (1986), the nature of a mediator is to affect the direction or strength of the relationship between the predictors (independent variables) and criterion (outcome or dependent variable). Following the Baron & Kenny (1986) approach, we conducted the mediation analysis using a three-step process. First, the mediator was regressed on the

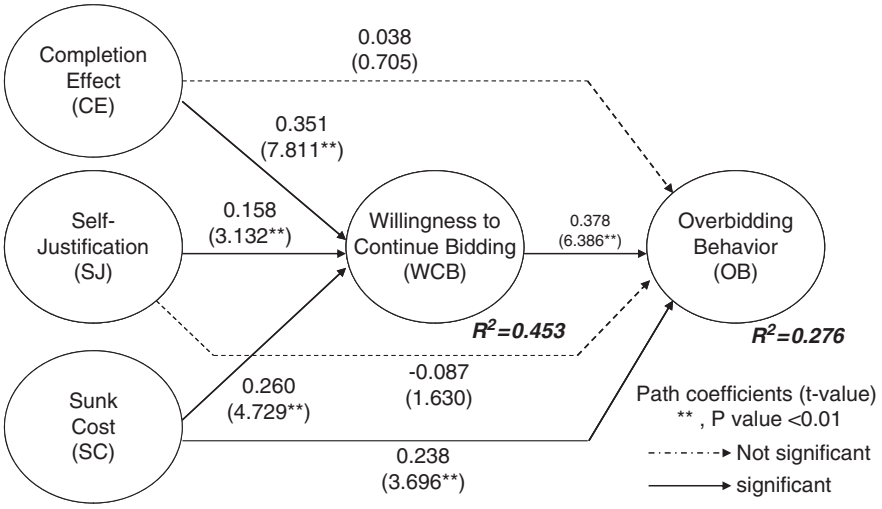

Figure 2 Analysis of mediation effect using PLS analysis ($n = 250$).

independent variable(s). Second, the dependent variable was regressed on the independent variables. Third, the dependent variable was regressed on the independent variables and the mediator. In order to establish mediation, 'the independent variable must affect the mediator in the first equation; second, the independent variable must be shown to affect the dependent variable in the second equation; and third, the mediator must affect the dependent variable in the third equation. If these conditions all hold in the predicted direction, then the effect of the independent variable on dependent variable must be less in the third equation than in the second. Perfect mediation holds if the independent variable has no effect when the mediator is controlled' (Baron & Kenny, 1986, p. 1177).

Before testing the mediating role of WCB, we conducted an analysis to check for differences across auction sites in terms of WCB and OB, and found no significant differences across auction sites. Using the Baron & Kenny (1986) approach, we then ran three regressions: (1) the independent variables (CE, SJ, and SC) predicting the mediator (WCB), (2) the independent variables (CE, SJ, and SC) predicting the dependent variable (OB), and (3) both the independent variables and the mediator predicting the dependent variable.

As shown in Table 4, Step 1 revealed that all of the escalation factors (CE, SJ, and SC) were significant predictors in the first regression (explaining a significant amount of variance in the mediator, WCB). Step 2 revealed that two of the escalation factors (CE and SC) were significant predictors in the second regression (explaining a significant amount of variance in the dependent variable, OB). The third step of the analysis revealed that even when we controlled for the mediator, SC had a significant effect on OB. As expected, the effect of the independent variable on the dependent variable was less in the third regression equation than in the second (i.e., $\beta 2 < \beta 3$), indicating that the effect of SC on OB is partially mediated by WCB. The effect of completion on OB was fully mediated by WCB. Sobel's test provides a means of testing whether the influence of the independent variable on the dependent variable that is expressed through the mediator is statistically significant. As shown in Table 4, the Sobel test statistics are significant for both the CE and SC, indicating that these two factors do indeed have a significant indirect effect on OB that is mediated by WCB.

Returning to our mediation hypotheses, these results show strong support for H1 and H3, respectively, in that the effect of completion on OB is fully mediated by WCB and the effect of SC on overbidding is partially mediated by WCB. H2 was not supported, however, because while SJ affects WCB, the effect is not passed through to OB.

The moderating effect of CI

In order to test our final hypothesis (H4), we performed a subgroup analysis (using PLS) in order to test the moderating effect of CI on the relationship between WCB and OB. We followed the subgroup analysis approach because this is the prescribed approach for determining the impact of a variable that acts as a homologizer (Sharma *et al*, 1981). According to Allison *et al* (1992), homologizer effects occur whenever the strength, or magnitude, of association between variables X and Y depends on the level of Z, where Z is the suspected homologizer/moderator variable.

The key difference between this approach and that of evaluating significant multiplicative interaction terms is that multiplicative interactions only provide data bearing on the extent to which the slope of the regression line of Y on X changes as a function of Z. In contrast, significant homologizer effects indicate that the magnitude of the correlation between X and Y varies across levels of Z. It is possible to examine potential homologizer effects by categorizing the sample into two (or more) subgroups on the basis of Z.

Table 4 Mediation analysis following the Baron & Kenny (1986) approach

	Coefficients	*Comments*	R^2
Step1 IV→Mediator (CE, SJ, SC→WCB)	CE = 0.372*** (t = 5.572) SJ = 0.174** (t = 2.283) SC = 0.244*** (t = 3.773)	The IVs must affect the mediator. This condition is satisfied for CE, SJ, and SC	0.452
Step2 IV→DV (CE, SJ, SC→OB)	CE = 0.205** (t = 2.127) SJ = −0.031 (t = −0.286) SC = 0.375***(t = 4.018)	The IVs must be shown to affect DV. This condition is satisfied for CE and SC, but not for SJ	0.195
Step3 IV and mediator→OB	CE = 0.037 (t = 0.382) SJ = −0.110 (t = −1.038) SC = 0.265***(t = 2.900) WCB = 0.451***(t = 5.147)	If there were perfect mediation, we would not expect to see a significant relationship controlling for the mediator. This condition is satisfied for CE. Thus, CE is fully mediated by WCB, while SC is partially mediated by WCB	0.274
Sobel test	Z = 5.38** (CE→WCB→OB) Z = 3.97** (SC→WCB→OB)	Z-value = a*b/SQRT(b^2*S_a^2+a^2*S_b^2), where a is the unstandardized regression coefficient for the association between IV and mediator, S_a is the standard error of a, B is the unstandardized regression coefficient for the association between mediator and DV, S_b is the standard error of b. Since the Sobel test statistics are significant for both CE and SC, this indicates that these two factors have a significant indirect effect on OB that is mediated by WCB	

*P < 0.05; **P < 0.01; ***P < 0.001.

To perform the analysis, we therefore split the sample into two subgroups. The high CI and the low CI subgroups were created by splitting the sample at the mean value of CI (4.87), after which we also tested both validity and reliability by subgroup. Referring back to Appendixs B and C, we can see that all items in the high CI subgroup (n = 127) demonstrate an acceptable range having acceptable loadings (0.746–0.931), as do all items in the low intensity subgroup (n = 123) (0.747–0.928). In addition, the reliability indicators are all well above accepted thresholds, and the AVEs are greater than 0.5.

Following Carte & Russell's (2003) suggestion, we assessed whether the latent constructs were perceived in a similar fashion between the high CI and low CI subgroups. An examination of Appendix B suggests that the loading patterns are the same and factor loadings are very similar, thus permitting between-group path comparison. In addition, a measurement invariance analysis was performed to further validate the similarity of measurement models between the two subgroups. The results in Appendix E provide additional support for measurement invariance and provide further support for conducting a meaningful path coefficient comparison across subgroups.

With the measurement model appearing to be stable and adequate across the subgroups, we proceeded to analyze the structural model for each subgroup. Consistent with the Sharma *et al* (1981) approach for analyzing a homologizer, we tested the moderating effect of CI by estimating two separate models in PLS, namely, the high CI subgroup and the low CI subgroup. This approach is similar to a test of the moderation effect of CI on the path strength across groups (Hsieh *et al*, 2008). We tested the differences across these two models using the approach suggested by Chin *et al* (2003) and used by Keil *et al* (2000b), by computing a t-statistic as follows:

$$S_{pooled} = \sqrt{\left\{\left[\frac{(N-1)}{(N_1+N_2-2)}\right]\times\left[\frac{(N_2-1)}{N_1+N_2-2}\right]\times SE_2^2\right\}}$$

$$t = \frac{(PC_1 - PC_2)}{\left[S_{pooled}\times\sqrt{(1/N_1+1/N_2)}\right]},$$

where S_{pooled} is the pooled estimator of the variance; PC_i is the path coefficient in structural model of CI group i; N_j is the sample size of data set for CI i; SE_i is the standard error of path in structural model of CI i; and t_{ij} is the t-statistic with N_1+N_2-2 degrees of freedom.

As shown in Figures 3 and 4, the path coefficient from WCB to OB is larger for the high CI subgroup than for the low CI subgroup.

As shown in Table 5, comparison of the path coefficients for WCB→OB across the two subgroups reveals that the strength of the relationship between WCB and OB is significantly greater in the high competition subgroup (β = 0.426, t = 8.737) is greater than it is in the low competition subgroup (β = 0.226, t = 3.842).

In other words, an individual's WCB has a greater impact on OB when the level of CI is high, thus supporting H4. This finding indicates that the level of CI moderates the relationship between WCB and OB. As a homologizer, CI is a variable that does not interact with the predictor, yet is conceptually distinct from both the criterion (OB) and predictor (WCB). A homologizer affects the strength of the relationship through the error term. On the basis of our finding from the subgroup analysis, OB in the high CI subgroup is a function of WCB so that the predictive validity of the model is very high,

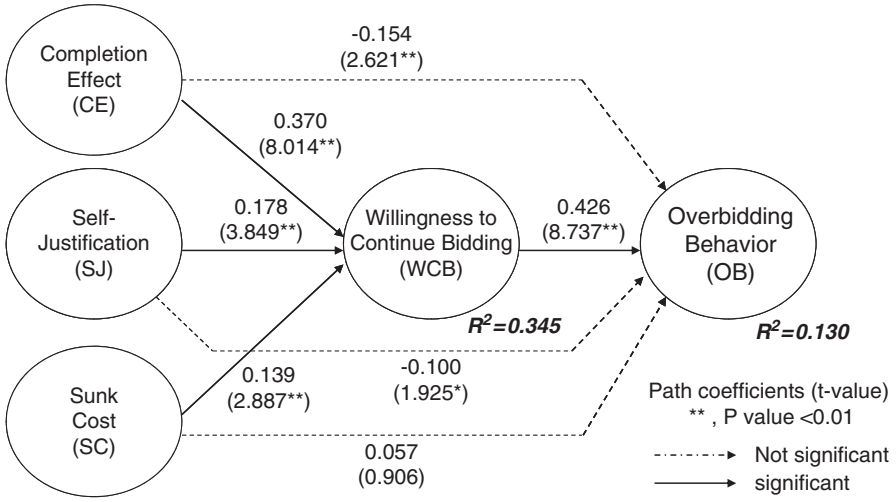

Figure 3 High CI group ($n = 127$).

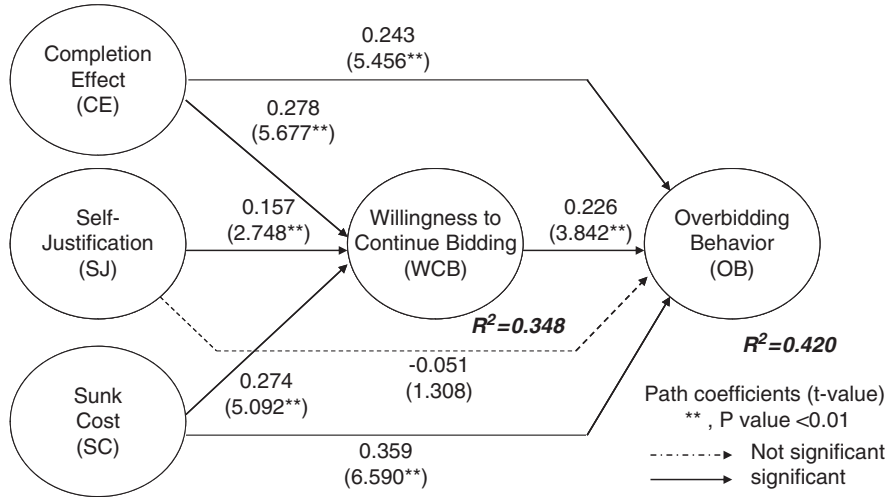

Figure 4 Low CI group ($n = 123$).

Table 5 Comparisons of paths in each group

From → To	*High CI (127 respondents)*			*Low CI (123 respondents)*			*Comparison of path coefficients*
	Path	*Standard error*	*t-value*	*Path*	*Standard error*	*t-value*	
WCB → OB	0.426	0.0755	8.737	0.226	0.0923	3.842	18.780***

***$P < 0.001$.

but in the low CI group WCB is a function of OB as well as other predictor variables such as CE and SC. Therefore, the strength of relationship in the low CI group is weaker than that in the high CI group.

Table 6 provides a summary of the results for all of the hypotheses that were tested.

As indicated in Table 6, all of our hypotheses were supported, with the exception of H2. The lack of support for H2 appears to indicate that while SJ can affect WCB, its influence ends there (i.e., it does not affect OB). One explanation for this is that the need to self-justify is all about maintaining consistency with respect to bidding, and has nothing to do with winning the auction.

In addition to the above hypothesis testing, one additional observation that emerges from our analysis is that CI not only moderates the relationship between WCB and OB, but also appears to moderate the relationship between SC and OB and the relationship between CE and OB. When CI is low, the effects of SC and CE on OB are fully mediated by WCB. However, when CI is high, SC and

Table 6 Summary of hypotheses testing results

Hypothesis #	*Hypothesis*	*Results*
1	The completion effect promotes overbidding behavior because it increases an individual's willingness to continue bidding. Specifically, the relationship between completion effect and overbidding behavior will be mediated by willingness to continue bidding	Supported
2	Self-justification promotes overbidding behavior because it increases an individual's willingness to continue bidding. Specifically, the relationship between self-justification and overbidding behavior will be mediated by willingness to continue bidding	Not supported
3	Sunk cost promotes overbidding behavior because it increases an individual's willingness to continue bidding. Specifically, the relationship between sunk cost and overbidding behavior will be mediated by willingness to continue bidding	Supported
4	Competition intensity will moderate the relationship between willingness to continue bidding and overbidding behavior such that the strength of the relationship will be greater when competition intensity is higher	Supported

CE are only partially mediated by WCB. This finding indicates that CI strengthens the direct relationship between these escalation factors and OB, and suggests the need for further research on the moderating effects of CI.

Implications and conclusions

One of the major drawbacks of online C2C auctions is that participants can easily get caught up in auction fever, causing them to engage in overbidding, a phenomenon that can result in the so-called 'winner's curse'. Escalation of commitment has been suggested as one theoretical lens through which we can gain a better understanding of OB. To date, however, there has been little or no empirical work demonstrating that OB can be predicted by the key drivers of escalation. Further, there has been no prior research on the moderating role that CI plays in this context. In this study, we therefore sought to address the following research question: 'How does escalation of commitment influence a consumer's overbidding behavior in online auctions and what role does competition intensity play in this process?' In order to address this research question, we developed and tested an integrative escalation-based model of OB by drawing on three different theories of escalation.

Our results provide empirical evidence that key escalation drivers associated with all three theories (i.e., SC, CE, and SJ) affect an individual's WCB, which in turn, predicted OB. Two of the escalation drivers (SC and CE) were found to directly or indirectly influence OB. Using two different analytical approaches, we obtained a consistent pattern of results providing strong empirical support that: (1) the influence of the CE on OB is fully mediated by WCB, (2) the effect of SC on OB is partially mediated by WCB. Consistent with information cascade theory, we found that CI moderates the relationship between an individual's WCB and OB, such that the relationship becomes stronger as competition becomes more intense.

The chief contribution of this study is that it develops and tests a theoretically grounded model of OB by adopting an escalation perspective on the phenomenon. While such a perspective has been suggested in the literature (Ariely & Simonson, 2003), and there is already evidence that SC is predictive of the likelihood of continuing to bid (Ku *et al*, 2005), this is the first study that provides empirical evidence that escalation drivers have both direct and indirect effects on OB. The study also demonstrates, consistent with information cascade theory, that CI plays an important moderating role by strengthening the relationship between WCB and OB. The theoretical perspectives explored here represent promising new avenues for research into online auction behavior, and we invite others to test and extend the model of OB so as to further improve our understanding of this important phenomenon.

This study shows that an escalation-based model is capable of explaining a substantial amount of the variance in OB and holds important implications for both research and practice.

Implications for research

The escalation-related constructs collectively explain more than 27% of the variance in OB. This suggests that the escalation perspective provides a powerful means of understanding and predicting the OB that occurs in online auctions. On the basis of our results, it appears that individuals exhibit a WCB of: (1) the SC associated with any prior investment of effort or time (Ku *et al*, 2005), (2) SJ of their previous behaviors, and (3) the CE, which encourages persistence as the auction heats up and the element of time pressure comes into play as the auction nears its end (Gilkeson & Reynolds, 2003; Johns & Zaichkowsky, 2003). While our results clearly show that all three factors derived from the three escalation theories can help to explain escalation of commitment, as they were all significant predictors of an individual' WCB, the results also reveal that the CE and SC effects also indirectly influence OB and that their effects are partially or fully mediated by WCB. In particular, the relationship between the CE and OB is fully mediated by WCB, and the effect of SC on OB is partially mediated by WCB.

Prior empirical research on individual behavior in online C2C auctions has largely focused on the winner's curse (Ku *et al*, 2005), rather than exploring possible mechanisms that lead to OB. Since the extant research on overbidding lacks empirical work linking escalation related constructs to OB, this study adds to our theoretical understanding of what drives OB, while also contributing to the literature on escalation of commitment by showing that multiple constructs from multiple theories can together help to explain the complexity of escalation behavior.

Finally, only a few previous studies have provided any empirical evidence that a bidder's motivation is stimulated by competition with others (Gilkeson & Reynolds, 2003; Johns & Zaichkowsky, 2003). On the basis of the empirical support we found for the moderating effect of CI in this study, we can speculate that the impact of CI may arise from a kind of signaling effect. In particular, the informational cascade perspective may explain why CI can affect the relationship between WCB and OB.

Implications for practice

This study also has some practical implications for both the individual bidder and the auction sites that they frequent. In particular, our empirical findings provide a simple and powerful means that can help to limit overbidding.

First, it is important for individual bidders to understand the factors that promote escalation of commitment. SC and CE appear to be particularly important determinants of the WCB. According to Ku (2008), individuals can learn to de-escalate after escalating in one situation because post-escalation regret can promote learning and lead to new behavioral patterns. Actions with pleasurable or satisfying behavioral outcomes become related with the circumstances in which they are experienced and are more likely to be repeated when those circumstances are encountered again. However, if the actions are accompanied by painful outcomes, the associations become weaker and the actions are decreased over time (Dand, 1946). Thus, overbidding and the negative outcomes that can result, such as the winner's curse may have a self-correcting property in that the individual who overbids and experiences regret for doing so may become less likely to overbid in the future. Individuals may be able to avoid the pain associated with this learning process if they can imagine or visualize how they will feel emotionally if they win the auction but know that they have engaged in OB in order to do so. This may have the effect of inducing anticipatory regret sufficient to impede the escalation that leads to OB.

While we have focused on how decision dynamics can lead to overbidding, it should be noted that overbidding could also result from a flawed value assessment. In particular, individuals have been shown to place bids for products that exceed by 15% the lowest retail price at which the product could be purchased (Ariely & Simonson, 2003). In some cases, such overbidding could be the result of inadequate search on the part of the consumer to establish an accurate value assessment for the product before entering the auction. Consumers would do well to thoroughly research a product before trying to obtain it through a C2C auction.

From the standpoint of auction sites, it should be noted that OB could be detrimental in that it may ultimately result in a reduction of the number of bidders willing to participate in online auctions. Such a scenario would not be beneficial for either the sellers or the auction sites in the long run. Therefore, auction sites need to find a way to mitigate the escalation of commitment by controlling the CE and CI. For instance, auction sites could provide bidders access to posted information on reference prices, thus reducing the uncertainty of price information on the listed product. If this were done, bidders would become better informed and they would presumably be less likely to experience the winner's curse. Eventually, this could prove advantageous to auction sellers. According to Bajari & Hortaçsu's (2003) empirical results, a decrease in the uncertainty on auction merchandise value can lead to an increase in the overall profit of the seller. Providing access to posted reference price information can not only help guide consumers in formulating an appropriate bid, but can also promote the development of trust in the auction site, thereby removing a major barrier to conducting online transactions.

Limitations

This study shows that an escalation-based model is capable of explaining a substantial amount of the variance in OB and holds important implications for both research and practice. However, as is the case with all studies this one is subject to limitations and it is important to point these out.

Recall bias and common method bias (CMB) are two potential limitations of our study. Due to the nature of our survey approach, we asked subjects to recall their most recent online auction experience. Recall bias can be a threat in these circumstances, as respondents may not have accurate recall of their motivations to continue bidding. CMB can also be a threat given the design of our study. In order to guard against any errors that could have arisen due to the self-report survey methodology used to collect data, we conducted several tests for the effect of CMB. We performed Harmon's one factor test recommended by Podsakoff & Organ (1986) after collecting data. A factor analysis including all variables revealed no sign of a single factor accounting for the majority of covariance. Next, following the recommendation of Podsakoff *et al* (2003) and the analytical procedure used by Liang *et al* (2007), we added a common method factor to the PLS model. The indicators of all constructs were associated reflectively with the method factor. Then each indicator variance explained by the principle constructs and by the method factor was computed. The results in Appendix F show that (1) only 1 out of the 16 method

loadings are significant, and (2) while the average substantive explained variance for an indicator is 0.882, the common method-based variance is only 0.008. The ratio of substantive variance to method variance is about 95:1. Furthermore, most method factor loadings are not significant and results of the structural models demonstrated different levels of significance for path coefficients. On the basis of all of the above evidence, it appears that CMB is not a significant threat in this study. In some respects, our study design would be stronger if we had been able to capture real-time bidding behavior (which we unfortunately were unable to do) or if we had undertaken the study in a controlled laboratory setting. Researchers wishing to pursue this line of work further may want to consider alternative approaches for data collection. Another limitation of our study is that we did not attempt to distinguish between rational and irrational motivations to engage in overbidding. Finally, we did not collect data on whether respondents had won the auction in which they exhibited OB, and therefore we cannot say anything about the frequency at which the winner's curse was experienced or the degree to which the escalation factors we studied influence the winner's curse. It is reasonable to assume, however, that overbidding sometimes results in the winner's curse and that if overbidding can be reduced, this will, by definition, reduce the incidence of the winner's curse. Thus, in spite of the aforementioned limitations, we believe that our work has important implications for both research and practice.

About the Authors

Sang Cheol Park is currently a Postdoctoral Researcher of the Department of Computer Information Systems in the J. Mack Robinson College of Business at Georgia State University. He received his Ph.D. in MIS from Sungkyunkwan University in Korea. His research focuses on the areas of escalation of commitment, IT adoption and diffusion, IOS, cloud computing, knowledge transfer in IT project and so on. His papers have been published in the *Computers in Human Behavior*, *Journal of Computer Information Systems*, and *Asia Pacific Journal of Information Systems* among others.

Mark Keil is the Board of Advisors Professor of Computer Information Systems in the J. Mack Robinson College of Business at Georgia State University. His research focuses on IT project management and includes work on preventing IT project escalation, identifying and managing IT project risks, and improving IT project status reporting. His interests also include IT implementation and use. He has published more than 100 refereed publications including papers that have appeared in *MIS Quarterly*, *Journal of Management Information Systems*, *Decision Sciences*, *Strategic Management Journal*, and many other journals. He currently serves on the editorial boards of *Information Systems Research*, *Journal of Management Information Systems*, and the *Information Systems Journal*. He has also served on the editorial boards of *MIS Quarterly*, *Decision Sciences*, *IEEE Transactions on Engineering Management*, and *The DATA BASE for Advances in Information Systems*.

Jong Uk Kim is currently a Professor at the Business School of Sungkyunkwan University (SKKU) in Korea. He received his Ph.D. in Computer Information Systems from Georgia State University. His research focuses on the areas of Knowledge transfer in IT project, online consumer behavior, IT outsourcing and decision support systems. His papers have been published in *Computers in Human Behavior*, *International Journal of Human–Computer Studies*, *and Asia Pacific Journal of Information Systems among others*.

Gee-Woo Bock received his Ph.D. in management engineering from Korea Advanced Institute of Science and Technology (KAIST), Seoul, Korea, in 2001 after 7 years of working at Department of Strategy Planning in Samsung Economic Research Institute. After acquiring his Ph.D., he joined the School of Computing at the National University of Singapore as an Assistant Professor in 2002. He is currently an Associate Professor at the Business School of Sungkyunkwan University (SKKU) in Korea. He has been serving Information and Management as a member of the Board of Editors since 2008, and Asia Pacific Journal of Information Systems as a member of Associate Editor since 2009. His current research interests include knowledge and creativity management, virtual community, online rumors, trust in EC, cloud computing, and augment reality. His papers have been either accepted or published in *MIS Quarterly*, *IEEE Transactions on Engineering Management*, *Communications of ACM*, *I&M*, *International Journal of Electronic Commerce*, *European Journal of Information Systems*, *The Data Base*: *Advances in Information Systems*, *Journal of Information Science*, among others.

References

ALLISON DB, HESHKA S, PIERSON RN Jr., WANG J and HEYMSFIELD SB (1992) The analysis and identification of homologizer/moderator variables when the moderator is continuous: an illustration with anthropometric data. *American Journal of Human Biology* **4(6),** 775–782.

AMYX DA and LUEHLFING MS (2006) Winner's curse and parallel sales channels-online auctions linked within e-tail websites. *Information & Management* **43(8),** 919–927.

ANDERSON LR and HOLT CA (1997) Information cascades in the laboratory. *American Economic Review* **87(5),** 847–862.

ARIELY D and SIMONSON I (2003) Buying, bidding, playing, or competing? Value assessment and decision dynamics in online auctions. *Journal of Consumer Psychology (Lawrence Erlbaum Associates)* **13(1/2),** 113–123.

ARKES HR and BLUMER C (1985) The psychology of sunk cost. *Organizational Behavior & Human Decision Processes* **35(1),** 124–140.

ASCH SE (1956) Studies of independence and conformity: a minority of one against a unanimous majority. *Psychological Monographs* **70(9),** 70–79.

BAJARI P and HORTAÇSU A (2003) The winner's curse, reserve prices, and endogenous entry: empirical insights from ebay auctions. *RAND Journal of Economics* **34(2),** 329–355.

BAPNA R, GOES P, GUPTA A and JIN Y (2004) User heterogeneity and its impact on electronic auction market design: an empirical exploration. *MIS Quarterly* **28(1),** 21–43.

BARON RM and KENNY DA (1986) The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* **51(6),** 1173–1182.

BEARDEN WO, NETEMEYER RG and MOBLEY MF (1993) *Handbook of Marketing Scales: Multi item Measures for Marketing and Consumer Behavior Research*. Sage Publications, Newbury Park, Calif.

BIKHCHANDANI S, HIRSHLEIFER D and WELCH I (1992) A theory of fads, fashion, custom, and cultural change as informational cascades. *Journal of Political Economy* **100(5),** 992–1026.

BONABEAU E (2004) The perils of the imitation age. *Harvard Business Review* **82(6),** 45–54.

BONTIS N, BOOKER LD and SERENKO A (2007) The mediating effect of organizational reputation on customer loyalty and service recommendation in the banking industry. *Management Decision* **45(9),** 1426–1445.

BROCKNER J (1992) The escalation of commitment to a failing course of action: toward theoretical progress. *Academy of Management Review* **17(1),** 39–61.

BROCKNER J and RUBIN JZ (1985) *Entrapment in Escalating Conflicts: A Social Psychology Analysis*. Springer-Verlag, New York.

CARMON Z and ARIELY D (2000) Focusing on the forgone: how value can appear so differentr to buyers and sellers. *Journal of Consumer Research* **27(3),** 360–370.

CARTE TA and RUSSELL CJ (2003) In pursuit of moderation: nine common errors and their solutions. *MIS Quarterly* **27(3),** 479–501.

CHEUNG GW and RENSVOLD RB (2002) Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling* **9(2),** 233–255.

CHIA-HUI Y and HSI-PENG L (2008) Factors influencing online auction repurchase intention. *Internet Research* **18(1),** 7–25.

CHIN WW (1998) The partial least square approach to structural equation modeling. In *Modern Method for Business Research* (MARCOULIDES GA, Ed.), pp 150–170, Lawrence Erlbaum, Mahwah, NJ.

CHIN WW (2004) Frequently asked questions partial least squares & PLS-graph. [WWW document] http://disc-nt.cba.uh.edu/chin/plsfaq.htm, (accessed 25 October 2006).

CHIN WW, MARCOLIN BL and NEWSTED PR (2003) A partial least squares latent variable modeling approach for measuring interaction effects: results from a monte carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research* **14(2),** 189–217.

CONLON DE and GARLAND H (1993) The role of project completion information in resource allocation decisions. *Academy of Management Journal* **36(2),** 402–413.

DAND A (1946) Reward and punishment in learning. *British Journal of Psychology* **39(2),** 83–87.

DEUTHCH M and GERARD H (1955) A study of normative and informational social influences upon individual judgment. *Journal of Abnormal and Social Psychology* **51(3),** 629–636.

DHOLAKIA UM, BASUROY S and SOLTYSINSKI K (2002) Auction or agent (or both)? A study of moderators of the herding bias in digital auctions. *International Journal of Research in Marketing* **19(2),** 115–130.

DHOLAKIA UM and SOLTYSINSKI K (2001) Coveted or overlooked? The psychology of bidding for comparable listings in digital auctions. *Marketing Letter* **12(3),** 225–237.

DOLL WJ, HENDRICKSON A and XIAODONG D (1998) Using Davis's perceived usefulness and ease-of-use instruments for decision making: a confirmatory and multigroup invariance analysis. *Decision Sciences* **29(4),** 839–869.

EASLEY RF and TENORIO R (2004) Jump bidding strategies in internet auctions. *Management Science* **50(10),** 1407–1419.

FESTINGER L (1957) *A Theory of Cognitive Dissonance*. Row, Peterson and Company, Evanston, IL.

FORNELL C and LARCKER DF (1981) Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* **18(1),** 39–50.

FOX S and HOFFMAN M (2002) Escalation behavior as a specific case of goal-directed activity: a persistence paradigm. *Basic & Applied Social Psychology* **24(4),** 273–285.

GARLAND H and CONLON DE (1998) Too close to quit: the role of project completion in maintaining commitment. *Journal of Applied Social Psychology* **28(22),** 2025–2048.

GEFEN D and STRAUB D (2005) A practical guide to factorial validity using PLS-graph: tutorial and annotated example. *Communications of AIS* **16(25),** 91–109.

GILKESON JH and REYNOLDS K (2003) Determinants of internet auction success and closing price: an exploratory study. *Psychology & Marketing* **20(6),** 537–566.

HAIR JF Jr., ANDERSON RE, TATHAM RL and BLACK WC (1998) *Multivariate Data Analysis*, 5th edn., Prentice-Hall, Upper Saddle River, NJ.

HSIEH JJP-A, RAI A and KEIL M (2008) Understanding digital inequality: comparing continued use behavioral models of the socio-economically advantaged and disadvantaged. *MIS Quarterly* **32(1),** 97–126.

HUANG J-H and CHEN Y-F (2006) Herding in online product choice. *Psychology & Marketing* **23(5),** 413–428.

JOHNS CL and ZAICHKOWSKY JL (2003) Bidding behavior at the auction. *Psychology & Marketing* **20(4),** 303–322.

KAHNEMAN D and TVERSKY A (1979) Prospect theory: an analysis of decision under risk. *Econometrica* **47(2),** 263–291.

KEIL M, MANN J and RAI A (2000a) Why software projects escalate: an empirical analysis and test of four theoretical models. *MIS Quarterly* **24(4),** 631–664.

KEIL M, TAN BCY, WEI K-K, SAARINEN T, TUUNAINEN V and WASSENAAR A (2000b) A cross-cultural study on escalation of commitment behavior in software projects. *MIS Quarterly* **24(2),** 299–325.

KEIL M, TRUEX DP and MIXON R (1995) The effects of sunk cost and project completion on information technology project escalation. *IEEE Transactions on Engineering Management* **42(4),** 372–381.

KU G (2008) Learning to de-escalate: the effects of regret in escalation of commitment. *Organizational Behavior & Human Decision Processes* **105(2),** 221–232.

KU G, MALHOTRA D and MURNIGHAN JK (2005) Towards a competitive arousal model of decision-making: a study of auction fever in live and internet auctions. *Organizational Behavior & Human Decision Processes* **96(2),** 89–103.

LIANG H, SARAF N, QING H and YAJIONG X (2007) Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS Quarterly* **31(1),** 59–87.

LUCKING-REILEY D (1999) Using field experiments to test equivalence between auction formats: magic on the internet. *American Economic Review* **89(5),** 1063–1080.

MCAFEE RP and MCMILLIAN J (1987) Auctions and bidding. *Journal of Economic Literature* **25(2),** 699–738.

MILGROM PR and WEBER RJ (1982) A theory of auctions and competitive bidding. *Econometrica* **50(5),** 1089–1122.

MOON H (2001) Looking forward and looking back: integrating completion and sunk sost effect within an escalation of commitment progress decision. *Journal of Applied Psychology* **86(1),** 104–113.

MURNINGHAN JK (2002) A very extreme case of the dollar auction. *Journal of Management Education* **26(1),** 56–69.

OH W (2002) C2C versus B2C: a comparison of the winner's curse in two types of electronic auctions. *International Journal of Electronic Commerce* **6(4),** 115–138.

PETERS C and BODKIN CD (2007) An exploratory investigation of problematic online auction behaviors: experiences of ebay users. *Journal of Retailing & Consumer Services* **14(1),** 1–16.

PODSAKOFF PM, MACKENZIE SB, JEONG-YEON L and PODSAKOFF NP (2003) Common method biases in behavioral research: a critical review of the

literature and recommended remedies. *Journal of Applied Psychology* **88(5),** 879–903.
PODSAKOFF PM and ORGAN DW (1986) Self-reports in organizational research: problems and prospects. *Journal of Management* **12(4),** 531–554.
SHARMA S, DURAND RM and GUR-ARIE O (1981) Identification and analysis of moderator variables. *Journal of Marketing Research* **18(3),** 291–300.
SINHA AR and GREENLEAF EA (2000) The impact of discrete bidding and bidder aggressiveness on sellers' strategies in open english auctions: reserves and covert shilling. *Marketing Science* **19(3),** 244–265.
STAFFORD MR and STERN B (2002) Consumer bidding behavior on internet auction sites. *International Journal of Electronic Commerce* **7(1),** 135–150.
STAW BM (1976) Knee-deep in the big muddy: a study of escalating commitment to a chosen course of action. *Organizational Behavior & Human Performance* **16(1),** 27–44.
STAW BM (1981) The escalation of commitment to a course of action. *Academy of Management Review* **6(4),** 577–587.
STAW BM and FOX FV (1977) Escalation: the determinants of commitment to a chosen course of action. *Human Relations* **30(5),** 431–450.
STAW BM and ROSS J (1987) Behavior in escalation situations: antecedents, prototypes, and solutions. In *Research in Organizational Behavior* (STAW BM and CUMMINGS LL, Eds), pp 39–78, JAI Press Inc, Greenwich, CT.
STEENKAMP J-BEM and BAUMGARTNER H (1998) Assessing measurement invariance in cross-national consumer research. *Journal of Consumer Research* **25(1),** 78–90.
STRAUB D, BOUDREAU M-C and GEFEN D (2004) Validation guidelines for IS positivist research. *Communications of AIS* **14(13),** 380–427.
TVERSKY A and KAHNEMAN D (1981) The framing of decisions and the psychology of choice. *Science* **211(4481),** 453–458.
WALLEY MJC and FORTIN DR (2005) Behavioral outcomes from online auctions: reserve price, reserve disclosure, and initial bidding influences in the decision process. *Journal of Business Research* **58(10),** 1409–1418.
WHYTE G (1986) Escalating commitment to a course of action: a reinterpretation. *Academy of Management Review* **11(2),** 311–321.
YENIYURT S, WASTON S, CARTER CR and STEVENS CK (2011) To bid or not to bid: drivers of bidding behavior in electronic reverse auctions. *Journal of Supply Chain Management* **47(1),** 60–72.

Appendix A

Table A1 Measurement items for key constructs

Construct	*Items*	*Sources*
CE	1. I believed that I would be successful if I made more bids 2. I had come too far to stop bidding 3. I believed I would win the auction if I made more bids 4. I could not abandon the auction because the auction was about to end	Arkes & Blumer (1985); Moon (2001)
SJ	1. To stop bidding in the middle of the auction process would not have been the right choice for me 2. I thought it was the right choice to continue further bidding 3. I felt bidding should not be stopped once it is initiated	Keil *et al* (2000a); Moon (2001)
SC	1. It would have been regrettable for me to stop bidding due to the effort I had already spent 2. It would have been regrettable for me to stop bidding because of the time I had already spent 3. I could not stop bidding because I had already spent too much effort in the process 4. I could not stop bidding because I had already spent too much time in the process 5. Overall, it would have been a waste of time and effort if I stopped bidding	Keil *et al* (2000a); Moon (2001)
CI	1. The bidding competition was fierce 2. There were many people who participated in the bidding process 3. Compared with other auctions, there were many bidders who competed in that auction	Developed for this study
WCB	1. I kept bidding even though the bidding price had increased 2. I had a WCB despite increasing bidding prices 3. I had a willingness to bid higher than the current price given	Keil *et al* (2000b)
OB	I made a bid at a price that was higher than I was initially willing to make in order to purchase a product	Developed for this study

Strongly disagree/agree (1–7 scale).

Appendix B

Table B1 Item-factor loadings and cross-loadings for full sample and item-factor loadings for subgroups

	Full sample (n = 250)						*High CI subgroup (n = 127)*	*Low CI subgroup (n = 123)*
	CE	*SJ*	*SC*	*CI*	*OB*	*WCB*		
ce1	0.822	0.506	0.454	0.391	0.198	0.520	0.819	0.747
ce2	0.822	0.488	0.599	0.391	0.324	0.504	0.774	0.808
ce3	0.898	0.538	0.552	0.374	0.382	0.550	0.856	0.901
ce4	0.870	0.504	0.553	0.314	0.333	0.512	0.862	0.852
sj1	0.457	0.791	0.606	0.250	0.259	0.407	0.780	0.791
sj2	0.544	0.854	0.475	0.324	0.252	0.475	0.816	0.853
sj3	0.516	0.899	0.615	0.356	0.249	0.491	0.931	0.781
sc1	0.562	0.569	0.847	0.494	0.292	0.526	0.843	0.767
sc2	0.575	0.617	0.899	0.475	0.401	0.564	0.885	0.866
sc3	0.596	0.585	0.922	0.460	0.428	0.537	0.879	0.928
sc4	0.579	0.605	0.918	0.405	0.385	0.519	0.906	0.904
sc5	0.523	0.597	0.904	0.412	0.397	0.492	0.861	0.900
ci1	0.400	0.335	0.469	0.915	0.260	0.380	0.819	0.769
ci2	0.367	0.306	0.425	0.924	0.249	0.375	0.823	0.827
ci3	0.418	0.373	0.481	0.912	0.303	0.395	0.746	0.773
ob	0.363	0.297	0.426	0.295	1.000	0.493	1.000	1.000
wcb1	0.567	0.458	0.492	0.364	0.374	0.876	0.860	0.850
wcb2	0.584	0.505	0.535	0.428	0.429	0.905	0.898	0.867
wcb3	0.482	0.477	0.538	0.323	0.508	0.886	0.881	0.841

PLS item cross-loadings were calculated according to the procedure suggested by Gefen & Straub (2005). While the cross-loadings for CE, SJ, and SC are relatively high, the differences between loadings on principal factors and on other constructs are higher than the threshold suggested Gefen & Straub. All 114 cross-loading differences are higher than 0.2.

Appendix C

Table C1 Squared pairwise correlations and assessment of discriminant validity

	CE	*SJ*	*SC*	*WCB*	*OB*	*CI*
C-1. Total sample group (250 respondents)						
CE	(0.854)					
SJ	0.597	(0.849)				
SC	0.632	0.662	(0.898)			
WCB	0.611	0.541	0.589	(0.889)		
OB	0.363	0.297	0.424	0.493	(0.917)	
CI	0.431	0.368	0.501	0.418	0.295	(1.000)
C-2. High CI group (127 respondents)						
CE	(0.854)					
SJ	0.523	(0.845)				
SC	0.580	0.587	(0.875)			
WCB	0.543	0.453	0.458	(0.879)		
OB	0.057	0.045	0.104	0.323	(1.000)	
CI	0.149	0.095	0.296	0.158	0.092	
	(0.797)					
C-3. Low CI group (123 respondents)						
CE	(0.854)					
SJ	0.505	(0.809)				
SC	0.488	0.595	(0.875)			
WCB	0.495	0.463	0.506	(0.853)		
OB	0.489	0.388	0.564	0.504	(1.000)	
CI	0.141	0.103	0.123	0.012	0.102	(0.790)

Notes: AVE of every multi-item construct is shown on the main diagonal. (OB is a single-item construct.) Squared correlations are off the diagonal.

APPENDIX D

MRA analysis to determine type of moderation

To investigate the moderating role of CI on the relationship between WCB and OB, we followed the MRA procedure recommended by Sharma *et al* (1981). Using MRA, one can determine the type of moderator based on a few simple rules. If there is an interaction effect and no direct effect with criterion or predictor variables, we can conclude that the variable is a pure moderator. If there is an interaction effect and a direct relationship with the predictor, the criterion variable, or both, we can conclude that the variable is a quasi-moderator. If there is neither a direct effect nor a moderation effect but the detected interaction derives from unequal measurement errors across subsamples, we can conclude that the variable is a homologizer. The MRA procedure recommended by Sharma *et al* (1981) and shown in Table D1 can be applied to make this assessment.

Type of CI moderation in the relationship between WCB and OB OB is the criterion variable. WCB is the predictor. On the basis of the MRA procedure, and applying a strict $P<0.05$ significance threshold, we find that

(1) for direct effect of the predictor (WCB) on the criterion (OB), WCB is highly significant. ($\beta_{WCB}=0.493$, $P<0.001$);
(2) for direct effects of the predictor (WCB) and the moderator (CI) on the criterion (OB), WCB was found to be highly significant while CI was not found to be statistically significant at the 0.05 threshold. ($\beta_{WCB}=0.448$, $P<0.001$; $\beta_{CI}=0.108$, $P<0.09$);
(3) for the effects of the predictor (WCB), the moderator (CI), and the interaction of the moderator and the predictor (WCB $\times$ CI), WCB was found to be highly significant while neither CI nor the interaction term (WCB $\times$ CI) were found to be statistically significant at the $P<0.05$ threshold, though the interaction term was close to the significance threshold. ($\beta_{WCB}=0.467$, $P<0.001$; $\beta_{CI}=0.105$, $P<0.08$; $\beta_{WCB*CI}=0.115$, $P<0.06$).

On the basis of the above results, we concluded that CI is a moderator, but that it is neither a pure moderator, nor a quasi-moderator. Instead, CI acts as a homologizer.

Table D1 Moderated regression analysis to determine the type of moderation

Type of effect	*Equations*	*Decision rules*
Direct effect of predictor	$Y=a+b_1\times X$	• Z is not a moderator if $b_3=0$ and $b_2\neq 0$. (i.e., Eq. 2 and Eq. 3 are not different)
Direct effect of predictor and moderator	$Y=a+b_1\times X+b_2\times Z$	• Z is a pure moderator, if $b_2=0$ but $b_3\neq 0$. (i.e., Eq. 1 and Eq. 2 are not different from each other but are different from Eq. 3)
Interaction	$Y=a+b_1\times X+b_2\times Z+b_3\times X\times Z$	• Z is a quasi-moderator, if $b_2\neq b_3\neq 0$. (i.e., all three equations are different from each other)

Source: Hsieh *et al* (2008).

APPENDIX E

Measurement invariance analysis for group comparison

We conducted a supplementary measurement invariance analysis to determine the appropriateness of comparing path coefficients between the two groups. The measurement invariance analysis was done using AMOS 6.0. We performed configural and metric variance analyses to examine whether the measurement models are invariant across the high and low CI groups. Configural invariance means that the patterns of item loadings are congeneric across groups (Doll *et al*, 1998; Steenkamp & Baumgartner, 1998). When modeling configural invariance, no restrictions are imposed on metrics across groups (Doll *et al*, 1998). A metric invariance analysis is then used to determine whether items have equal loadings between groups. When modeling metric invariance, item loadings are constrained to be equivalent across groups. If the change in CFI between these two nested (configural and metric) models is smaller than the suggested threshold 0.01 (Cheung & Rensvold, 2002), then metric invariance is supported, permitting path coefficient comparison between groups.

Following the above procedure, we configural invariance analysis revealed the pattern of item loadings to be congeneric across the two groups. In terms of metric invariance, the changes in CFI ranged from 0.000 to 0.004. Since these values were all less than the 0.01 level (Cheung & Rensvold, 2002), metric invariance was established, providing additional support for meaningful path coefficient comparison across groups.

Table E1 Measurement invariance analysis for group comparison

Model test	χ^2	*DF*	χ^2/DF	*CFI*	*NFI*	*RMSEA*	*CFI*	*NFI*	*RMSEA*
Baseline model	315.715	111	2.844	0.935	0.904	0.086	—	—	—
Constrained model between									
CE and WCB	315.715	111	2.844	0.935	0.904	0.086	0.000	0.000	0.000
SJ and WCB	315.715	111	2.844	0.935	0.904	0.086	0.000	0.000	0.000
SC and WCB	315.715	111	2.844	0.935	0.904	0.086	0.000	0.000	0.000
SC and OB	315.715	111	2.844	0.935	0.904	0.086	0.000	0.000	0.000
WCB and OB	315.715	111	2.844	0.935	0.904	0.086	0.000	0.000	0.000
CE, SJ and WCB	317.086	112	2.831	0.935	0.903	0.086	0.000	0.001	0.000
CE, SC and WCB	318.302	112	2.842	0.934	0.903	0.086	0.001	0.001	0.000
SC SJ and WCB	315.745	112	2.819	0.935	0.904	0.085	0.000	0.000	0.001
CE, SJ, SC and WCB	318.632	113	2.820	0.934	0.903	0.085	0.001	0.001	0.001
Totally constrained	330.063	115	2.870	0.931	0.899	0.087	0.004	0.005	0.001

Appendix F

Table F1 Common method bias analysis

Constructs	*Items*	*Substantive factor loading (R1)*	$R1^2$	*Common method factor loading (R2)*	$R2^2$
CE	ce1	0.822	0.675	0.073	0.005
CE	ce2	0.822	0.676	0.077	0.006
CE	ce3	0.898	0.806	0.082	0.007
CE	ce4	0.870	0.758	0.078	0.006
SJ	sj1	0.791	0.626	0.095	0.009
SJ	sj2	0.855	0.730	0.101	0.010
SJ	sj3	0.899	0.808	0.107	0.011
SC	sc1	0.847	0.717	0.057	0.003
SC	sc2	0.899	0.808	0.064	0.004
SC	sc3	0.922	0.851	0.064	0.004
SC	sc4	0.918	0.843	0.061	0.004
SC	sc5	0.904	0.817	0.060	0.004
WCB	wcb1	0.876	0.767	*0.199*	0.040
WCB	wcb2	0.905	0.820	0.093	0.009
WCB	wcb3	0.886	0.784	0.100	0.010
OB	ob	1.000	1.000	0.000	0.000
Average		0.882	0.780	0.082	0.008