Knowledge Withholding in Online Knowledge Spaces: Social Deviance Behavior and Secondary Control Perspective

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Knowledge withholding, which is defined as the likelihood that an individual devotes less than full effort to knowledge contribution, can be regarded as an emerging social deviance behavior for knowledge practice in online knowledge spaces. However, prior studies placed a great emphasis on proactive knowledge behaviors, such as knowledge sharing and contribution, but failed to consider the uniqueness of knowledge withholding. To capture the social-deviant nature of knowledge withholding and to better understand how people deal with counterproductive knowledge behaviors, this study develops a research model based on the secondary control perspective. Empirical analyses were conducted using the data collected from an online knowledge space. The results indicate that both predictive control and vicarious control exert a positive influence on knowledge withholding. This study also incorporates knowledge-withholding acceptability as a moderating variable of secondary control strategies. In particular, knowledge-withholding acceptability enhances the impact of predictive control, whereas it weakens the effect of vicarious control on knowledge withholding. This study concludes with a discussion of the key findings, and the implications for both research and practice.

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Introduction

Continued and rapid technological development has been accelerating the integration of social information and different communication technologies, thus forming a complex sociotechnical system (Meyer, 2014), such as online knowledge spaces, and further opening new and interesting research avenues in the area of social informatics (Fichman & Rosenbaum, 2014). In particular, online knowledge space is often considered as a technology, or Internet-supported social space, where knowledge can be generated, organized, shared, disseminated, and used through interpersonal social interaction to achieve collective and individual goals. Examples of online knowledge space include Wikipedia, social networking sites, the video-sharing community, an electronic word-of-mouth platform, the virtual brand community, and so on. Online knowledge space plays an increasingly important role in the collection and management of social information (Hara & Sanfilippo, 2017; Kling & McKim, 2000; Komito, 2011; Wang, Sun, Shen, & Zhang, 2018). In this sense, online knowledge space also provides a rich technological environment for social informatics research to better understand knowledge practices by considering the embedded social contexts (Hara & Fichman, 2014; Hara & Foon

Hew, 2007; Piscopo, Phethean, & Simperl, 2017; Rosenbaum & Shachaf, 2010; Shachaf, 2010).

Unlike the traditional organizational contexts, online knowledge spaces lack formal contractual relationships and monetary incentives for knowledge contribution, and therefore, people tend to withhold their efforts in online knowledge communities (Cranefield, Yoong, & Huff, 2015; Hung, Lai, & Chou, 2015; Preece, Nonnecke, & Andrews, 2004). In this regard, knowledge withholding represents a very common phenomenon in online knowledge spaces (Fu & Chau, 2013; Jiang & Wagner, 2015), and is defined as "the likelihood that an individual will give less than full efforts to contributing knowledge" (Lin & Huang, 2010, p. 188). A common example of knowledge withholding is contributing without a thorough thinking process and taking advantage of other members' contribution as much as possible. Notably, knowledge-withholding behavior is detrimental to the effective generation and utilization of social knowledge in online knowledge spaces, where users' active and ongoing contribution is highly valued (Chen & Shen, 2015; Cheung, Lee, & Lee, 2013; O'Connor, 2013; Sun et al., 2018). Such a negative impact is mainly reflected in two aspects. First, knowledge withholders are more inclined to consume than to contribute knowledge, and consequently, useful, updated, and valuable social information could not be fully shared in online knowledge spaces (Cranefield et al., 2015; Hung et al., 2015). Second, knowledge-withholding behaviors also produce a result that a small number of contributors generate most existing information in online knowledge spaces. Information monopoly thus is likely to occur, and the information may be distorted, misleading, or even incorrect (Fu & Chau, 2013). In this regard, it is important and necessary to examine knowledge withholding, which is regarded as a social deviance behavior against the prevailing norms for social conduct in online knowledge spaces (Serenko & Bontis, 2016; Sun, Shen, & Wang, 2015a).

However, current social informatics research on knowledge management has placed a great emphasis on knowledge contribution and sharing (for example, Cheung et al., 2013; Cho, Chen, & Chung, 2010; Kankanhalli, Tan, & Wei, 2005; Kowalczyk & Shankar, 2011; O'Connor, 2013; Shen, Lee, & Cheung, 2014). Although a few initial studies have attempted to investigate different counterproductive knowledge behaviors (for example, knowledge hiding or hoarding, partial knowledge sharing, and disengagement from knowledge sharing), most of these studies lie in the realm of formal organizations, provided incomplete analysis of knowledge withholding, and failed to capture the social contexts in which knowledge is withheld (Ford, Myrden, & Jones, 2015; Ford & Staples, 2010; Lin & Huang, 2009, 2010; Tsay, Lin, Yoon, & Huang, 2014; Webster et al., 2008). In this regard, scholars in social informatics also suggested extending the investigation on social information behavior from organizational contexts to online social settings (Hara & Fichman, 2014; Kling, 2007). Some studies also indicated the existence of lurkers and inactive users in online settings (Hung et al., 2015; Metzger, Wilson, & Zhao, 2018; Preece et al., 2004), but these studies mostly focused on users' avoidance of information sharing behavior in online social contexts. This is different from knowledge withholding, which captures the effort-withholding intention involved in knowledge practice (that is, exerting less than full efforts). More important, few current studies have looked at the social-deviant nature of knowledge withholding. Due to the unique features of online knowledge space, where information sharing from multiple heterogeneous sources is a must for achieving its long-term objectives, most of the information is actually contributed by the minority. Knowledge withholding in online knowledge spaces deserves more attention.

To address the above-mentioned research gaps, a secondary control perspective is adopted in this study to explain knowledge withholding embedded within online knowledge spaces. Secondary control refers to the attempt to adjust oneself to accept things as they are, and it represents an adaptive strategy people widely adopt to rationalize their inward behaviors, such as passivity, withdrawal, submissiveness, and other social deviance behaviors (Case, Fitness, Cairns, & Stevenson, 2004; Hall, Perry, Chipperfield, Clifton, & Haynes, 2006; Helzer & Jayawickreme, 2015; Rothbaum, Weisz, & Snyder, 1982). Generally speaking, people are very likely to experience stress and discomfort if their behaviors violate the prevailing social-normative standards, and as a result, they will try to justify their motives and behaviors to reduce such negative feelings (Cooper, 1992). In this regard, secondary control perspective suggests that psychological adjustment and associating themselves with the situations would help individuals engender the perception of control and reduce disappointment (Rothbaum et al., 1982). Therefore, secondary control can be regarded as an appropriate and useful technique used by people in online knowledge spaces to rationalize their social deviant behaviors, that is, knowledge withholding. Drawing on the secondary control perspective, this study attempts to capture the social-deviant nature of knowledge withholding, and to identify the antecedents of knowledge withholding in online knowledge spaces. The first research question of this study is thus:

> RQ1: What is the role of secondary control in explaining knowledge withholding in online knowledge spaces?

Furthermore, it is also necessary to explore the moderators that act as the boundary conditions under which secondary control strategies function. A deep understanding of the moderators and boundary conditions will help explain the detailed underlying mechanisms behind relationships among the research variables (Sun, Shen, & Wang, 2014). In this regard, prior studies have demonstrated that individuals' tendencies and personality traits significantly shaped their reactions and appraisals to social deviance behaviors (Jessor & Jessor, 1977; Rindfleisch & Crockett, 1999). In other words, the extent to which people accept social

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deviance behavior will determine which secondary control strategies they may utilize to justify their behaviors. Following this line of research, this study employs the concept of knowledge-withholding acceptability, which is defined as the extent to which effort-withholding behavior is compatible with one's personal values, needs, and prior experiences (Chen & Hung, 2010), as a moderator of the relationship between secondary control and knowledge withholding. Therefore, the second research question of this study is:

> RQ2: How will knowledge-withholding acceptability moderate the relationship between secondary control and knowledge withholding in online knowledge spaces?

The remainder of the article is structured as follows. Current studies on knowledge withholding and secondary control are systematically reviewed in the next section. This is followed by the research model and the associated research hypotheses. Research methodology and data analysis results are reported in the following sections, respectively. The study concludes with a detailed discussion of the implications for both research and practice.

Literature Review

Knowledge Withholding

In spite of the huge number of studies addressing knowledge sharing and contribution, there is an increasing emphasis on the counterproductive knowledge behaviors, such as knowledge withholding, knowledge hiding, knowledge hoarding, partial knowledge sharing, and disengagement from knowledge sharing (Connelly, Zweig, Webster, & Trougakos, 2012; Ford et al., 2015; Holten, Robert Hancock, Persson, Marie Hansen, & Høgh, 2016; Lin & Huang, 2009, 2010; Serenko & Bontis, 2016; Webster et al., 2008; Zhao, Xia, He, Sheard, & Wan, 2016). According to Webster et al. (2008), knowledge withholding includes two separate types, that is, hiding and hoarding, which are believed to be fundamentally distinguished in terms of request and intention (for example, Anand & Jain, 2014; Connelly et al., 2012; Jha & Varkkey, 2018; Kang, 2016). Specifically, knowledge hiding refers to an intentional attempt to conceal knowledge that is requested by another, whereas knowledge hoarding captures the unintentional accumulation of knowledge that is not requested by others in most current studies (for example, Holten et al., 2016; Jha & Varkkey, 2018; Kang, 2016).

However, as Figure 1 illustrates, knowledge hiding and knowledge hoarding fail to provide a holistic picture of knowledge withholding. For example, people may unintentionally withhold their knowledge when requested by others. Notably, disengagement from knowledge sharing refers to the practice that people neither actively communicate nor protect their knowledge deliberately (Ford & Staples, 2008). People disengage from knowledge sharing perhaps because they do not have the required physical energy or mental focus to contribute (Ford & Staples, 2008), or they have a low level of engagement and are indifferent to the interests of others (Serenko & Bontis, 2016). In this regard, disengagement from knowledge sharing involves an unintentional attempt to withhold knowledge, regardless of whether the knowledge is requested or not. Therefore, disengagement from knowledge sharing could be another possible manifestation of knowledge withholding, apart from knowledge hiding, knowledge hoarding, and partial knowledge sharing.

Knowledge withholding represents an emerging research field in recent years (for example, Lin & Huang, 2010; Lin & Wang, 2012; Tsay et al., 2014; Wang, Lin, Li, & Lin, 2014). To adequately conceptualize the phenomenon of knowledge withholding, this study attempts to define knowledge withholding based on the effort-withholding perspective (Kidwell & Bennett, 1993), as recommended by Lin and Huang (2010). According to Lin and Huang (2010), knowledge withholding indicates that people exert less than maximum effort into knowledge contribution, irrespective of request and intentionality. Specifically, effort-withholding is believed to be the common pattern observed in social deviance behaviors like shirking, job neglect, social loafing, and free riding (Kidwell & Bennett, 1993; Wasko, Teigland, & Faraj, 2009; Lin & Huang, 2010; Shiue, Chiu, & Chang, 2010). In this regard, the effort-withholding perspective can generally conceptualize the fundamental features of knowledge-withholding behaviors. Based on the above arguments, we believe that knowledge withholding, defined from the effort-withholding perspective, can act as an overarching concept that covers different types of the counterproductive knowledge behaviors discussed earlier.

Table 1 summarizes the previous studies on knowledge withholding, among which knowledge withholding in organizations has received extensive attention but very limited research has been conducted in online settings. Notably, Trusson, Hislop, and Doherty (2017) provided some qualitative evidence demonstrating that people in organizations predominantly perceived prosocial knowledge behavior as their routine practices, because of the unavoidable close connections with other colleagues and co-workers. However, unlike the organizational contexts, knowledge withholding is more likely to occur in online settings, where connections between people are loose and disjointed. In this regard, people in online settings do not have the responsibility to contribute their knowledge, and also there is a lack of explicit punishment rules for knowledge withholding in online settings (Jiang, Mirkovski, Wall, Wagner, & Lowry, 2018; Li, 2011; Wasko & Faraj, 2005). Based on the above observations, knowledge withholding in an online setting obviously should receive more attention. It is also necessary to mention that some scholars have investigated various counterproductive knowledge behaviors in the online settings, such as lurking or browsing (Jiang et al., 2018; Metzger et al., 2018; Nonnecke, Andrews, & Preece, 2006; Nonnecke & Preece, 2003). Lurking or browsing indicates that people are pure knowledge consumers, without contributing to the online knowledge space (that is, avoidance performance; Jiang et al., 2018), and

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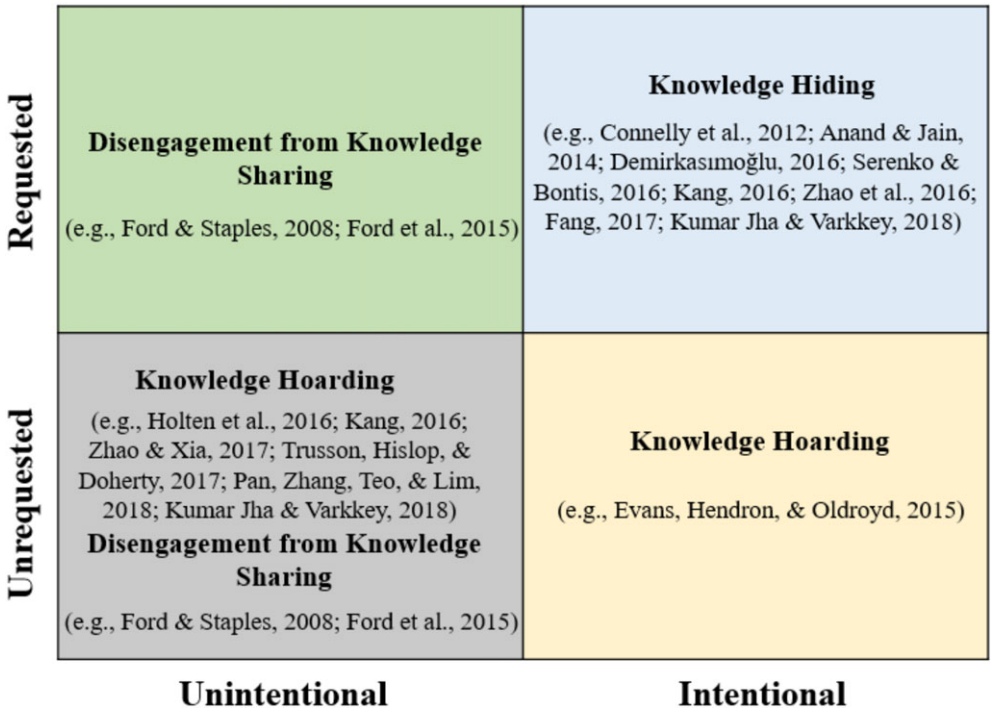

FIG. 1. Comparison of counterproductive knowledge behaviors. [Color figure can be viewed at wileyonlinelibrary.com]

such behaviors are also viewed as nonpublic participation in online settings (Nonnecke et al., 2006). In this regard, lurking or browsing is distinguished from knowledge withholding, which emphasizes that people do not make full efforts to contribute to the online knowledge space (that is, reduction performance). In general, a thorough understanding of why people contribute less is more important than focusing on lurking or browsing behavior, because it will be more difficult to motivate lurkers to engage in knowledge contribution than to motivate knowledge withholders, who have ever contributed to the online knowledge spaces.

Secondary Control Perspective

Perceived control is an important belief in knowledge activities (Cho et al., 2010; Hau & Kang, 2016; Kuo & Young, 2008; Yang & Farn, 2009). The perceptions of control can be obtained through two processes: primary control (that is, attempts to alter the environment to satisfy one's wishes) and secondary control (that is, attempts to psychologically adjust oneself and keep in line with the environment; Rothbaum et al., 1982). In particular, Rothbaum et al. (1982) indicated that inward behaviors (that is, passivity, withdrawal, submissiveness, and other social deviance behaviors) were not a sign of relinquishment of controllability, but a process to gain the perception of secondary control. In this regard, secondary control strategies have been frequently employed in the literature to justify people's inward behaviors (Brandtstädter & Rothermund, 2002; Case et al., 2004; Hall et al., 2006; Helzer & Jayawickreme, 2015).

Because people generally attach great value to controllability, once their attempts to influence the environment produce some disappointing failures, they will suffer from stress and thereby tend to adopt coping strategies to eliminate the negative feelings (Rothbaum et al., 1982). Based on the coping theory, which is a general theory for understanding stressful situations, stress results from the interactions between an individual and the surrounding environment (Fang, 2017; Lazarus, 1993). Some other studies also demonstrated that counterproductive behavior is a product of the interactions between a person and the environment, and hence, attributing to oneself and the external environment is a common approach to understand and explain the causes of human behaviors (Martinko, Gundlach, & Douglas, 2002; Wong & Weiner, 1981). Accordingly, people cope with stress in two ways. First, people can adjust themselves, such as expressing their negative feelings and accepting the failures (Duhachek, 2005; Fang, 2017). Second, people can reconstrue their cognitions about the stressful situations, such as associating themselves with the external situations to diminish the detrimental influences of their negative feelings or experiences (Duhachek, 2005; Fang, 2017). In particular, in a social-deviant context, stress also can be aroused when behavior violates social-normative standards (Cooper, 1992). Based on the coping theory and the associated coping strategies mentioned above, this study further deconstructs secondary control into two factors: predictive control and vicarious control, which provide specific strategies for knowledge withholders to justify their social deviance behaviors.

Predictive control means people try to predict failures of the desired events and lower their self-expectations for success to protect against disappointment (Rothbaum et al., 1982). In this regard, people quit and withdraw because they

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TABLE 1. Literature review on knowledge withholding.

Authors (year)	Theories and predicting variables	Research context	Methodological type	Outcomes
Webster et al. (2008)	Power and Politics in Organizations: expert power; reward power; concerns of power; rational gain; job insecurity. Territoriality: psychological ownership; territorial behaviors. Interpersonal Dynamics: interpersonal distrust; interpersonal fairness. Organizational Culture and Norms: sharing climate; norms of distrust; organizational secrecy. Individual Characteristics: machiavellianism; goal orientation; individual power and status; religion or sexual orientations.	Organization	Qualitative	Knowledge Withholding
Lin and Huang (2010)	Social Exchange Theory: procedural justice; distributive justice; trust. Social Cognitive Theory: group size; task visibility; knowledge contribution self-efficacy; team outcome expectations; personal outcome expectations.	Organization	Quantitative	Knowledge Withholding
Lin & Wang (2012)	Big Five Personality Traits: extraversion; agreeableness; conscientiousness; neuroticism; openness to experience; locus of control. Social Exchange Theory: expected rewards; expected association. Social Identity Theory: perceived social identity.	University	Qualitative	Knowledge Withholding Intention
Tsay et al. (2014)	Justice Theory: procedural justice; interactional justice; distributive justice. Social Exchange Theory: perceived organization support; leader–member exchange; team–member exchange. Social Cognitive Theory: task visibility; task interdependence; knowledge withholding self-efficacy.	Organization	Quantitative	Knowledge Withholding Intentions
Sun, Shen, et al. (2015)	Neutralization: denial of responsibility; denial of injury; denial of victim; appeal to higher loyalty; condemnation of the condemners; defense of necessity; the metaphor of the ledger. Motivations: extrinsic motivation; intrinsic motivation; prosocial motivation.	Online Community	Quantitative	Knowledge Withholding
Kang (2016)	Territorial behavior: control-oriented vs. identity-oriented marking behavior; anticipatory vs. reactionary defense behavior.	Organization	Qualitative	Knowledge Withholding
Stenius, Hankonen, Ravaja, and Haukkala (2016)	Self-Determination Theory: Extrinsic Motivation: identified regulation; introjected regulation; external regulation. Intrinsic Motivation: intrinsic regulation.	Organization	Quantitative	Knowledge Withholding
Anaza and Nowlin (2017)	Environment: isolation from coworkers; isolation from company; internal competition; past opportunistic coworker behaviors. Incentives: lack of KS rewards; lack of feedback for KS from coworkers; lack of feedback for KS from upper management. Individual: conscientiousness; agreeableness; neuroticism.	Salespeople in B2B Markets	Quantitative	Knowledge Withholding

believe no matter how hard they try, they cannot achieve the desired outcomes. In particular, Rothbaum et al. (1982) suggested that attributing one's limited abilities and task difficulties could serve as a reflection that people execute predictive control to make excuses for their social deviance behaviors. With this point of view, we conceptualize predictive control as a formative construct composed of knowledge sharing self-inefficacy and knowledge sharing cost. Knowledge sharing self-inefficacy refers to the extent to which people have no confidence in their knowledge, expertise, and abilities that are valuable and useful to others (Bandura, 1977). Knowledge sharing cost refers to the amount of time, effort, and attention associated with delivering valuable knowledge to others (Tong, Wang, Tan, & Teo, 2013). The definitions above suggest that knowledge sharing self-inefficacy and knowledge sharing cost can appropriately reflect predictive control strategies that knowledge withholders adopt to predict undesired results of knowledge sharing.

Vicarious control indicates that people associate themselves with the situation to avoid the disappointment, so that they can mitigate the stressful feelings and gain a sense of control (Rothbaum et al., 1982). Rothbaum et al. (1982) particularly demonstrated that attributing to others could be a common strategy that people adopt to gain the sense of vicarious control. That is, in the social-deviant context, people can attribute their social deviance behavior to situational factors, wherein social norm is a salient factor that provides a situational (that is, nonpersonal) explanation for the resulting behavior (Webster et al., 2008). This is because social norms are commonly accepted standards by other members of a group, and further guide people to behave in social interactions (Cialdini, Reno, & Kallgren, 1990). As a result, people who exhibit social deviance behavior are very likely to attribute their social deviance behavior to the lack or the wrongness of social norms. Notably, social norms may or may not be stated explicitly, and they generally include explicit policies and the observations of others' behavior

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(Cialdini et al., 1990; Hagger & Chatzisarantis, 2005; Park, Oh, & Kang, 2015). People can quickly learn social norms through explicit policies or simply through observing others' behaviors (Webster et al., 2008). Motivated by these observations, we develop two concepts (that is, explicit social norms attribution and implicit social norms attribution) to act as the manifestations of vicarious control. Explicit social norms attribution refers to attributing to attributing behavior to explicit social norms, such as policies, instructions, documents, and regulations (Burnett & Bonnici, 2003; Cialdini et al., 1990). In other words, people can justify their social deviance behavior by arguing that prosocial policies are not well advertised. Implicit social norms attribution represents attributing to implicit social norms, such as community climates and others' behaviors (Burnett & Bonnici, 2003; Cialdini et al., 1990). That is, people exhibit social deviance behaviors mainly because they observe others' similar behaviors in the same situation, and therefore they believe it is a rational choice.

Research Model and Hypotheses

Drawing upon the secondary control perspective, this study develops a research model as depicted in Figure 1. Both predictive control and vicarious control are conceptualized as second-order formative constructs. Predictive control incorporates two subconstructs, that is, knowledge sharing self-inefficacy and knowledge sharing cost, while vicarious control includes implicit social norms attribution and explicit social norms attribution as its subconstructs. In addition, knowledge-withholding acceptability is used as a moderating variable. Prosocial motivation, community experience, age, and gender are considered as the control variables. Each construct and their relationships are discussed in detail in the following sections.

Secondary Control and Knowledge Withholding

In this study, secondary control strategies are composed of both predictive control and vicarious control, which are hypothesized to exert positive effects on knowledge withholding in online knowledge spaces.

With respect to predictive control, people can gain a perception of control by predicting the negative outcomes and adjusting their self-expectations to avoid disappointment (Rothbaum et al., 1982). To achieve this, people specifically attribute their social deviance behaviors to their limited abilities (that is, knowledge sharing self-inefficacy) and the high demands of the proactive behaviors (that is, knowledge sharing cost). In particular, when people have a high level of knowledge sharing self-inefficacy, they will lower their self-expectations for successfully contributing their knowledge in the online knowledge spaces and predict some disappointing outcomes. As a result, they will withhold their efforts on knowledge sharing (Chen & Hung, 2010; Yang & Farn, 2009). In this regard, social informatics research also shows that people will exert less effort to a task when they feel their abilities are insufficient for the task (Cheung & Lee, 2012; Cho et al., 2010; Hung et al., 2015; Shen, Li, Sun, & Zhou, 2018). In addition, knowledge sharing cost also reduces the expected benefits of knowledge sharing and results in negative behaviors (Kankanhalli et al., 2005; Min & Kim, 2015; Sun, Wang, Shen, & Zhang, 2015; Tong et al., 2013). Based on the discussion above, both knowledge sharing self-inefficacy and knowledge sharing cost will make people predict that knowledge sharing may bring some undesired results and will let them feel disappointed. Therefore, people tend to withhold their efforts on knowledge sharing to avoid such disappointment. In this regard, predictive control can act as an effective strategy for knowledge withholders to justify the knowledge-withholding behaviors in the online knowledge spaces.

As for vicarious control, people can gain a sense of control by attributing their social deviance behavior to external situational reasons, including the lack of prosocial policies (that is, explicit social norms attribution) and others' social deviance behaviors (that is, implicit social norms attribution; Rothbaum et al., 1982). Explicit social norms attribution occurs when knowledge withholders justify their knowledge withholding by arguing that knowledge-sharing policies are not explicitly stated or advertised in the online knowledge spaces. Knowledge withholders thus will believe that they should not be blamed for the social deviance behaviors like knowledge withholding because they are not well-informed about the social-normative standards (Siponen & Vance, 2010; Sun, Shen, et al., 2015). On the other hand, implicit social norms attribution occurs when knowledge withholders attribute their behaviors to the commonly observed phenomenon of knowledge withholding in the online knowledge spaces. People who withhold their efforts in knowledge sharing will associate themselves with other community members, and thus they tend to believe that they should not be blamed because knowledge withholding is a common practice in the online knowledge spaces (Rothbaum et al., 1982; Siponen & Vance, 2010; Sun, Shen, et al., 2015). In brief, both explicit social norms attribution and implicit social norms attribution can help knowledge withholders shirk their responsibilities and justify their social deviance behaviors. Taken together, we believe that both predictive control and vicarious control will help people rationalize the knowledge-withholding behaviors in the online knowledge spaces, and therefore, we have the following hypotheses:

H_{1a}: Predictive control is positively associated with knowledge withholding in online knowledge spaces.

H_{1b}: Vicarious control is positively associated with knowledge withholding in online knowledge spaces.

Moderating Role of Knowledge-Withholding Acceptability

Knowledge-withholding acceptability refers to the compatibility or fit between knowledge-withholding behavior

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and an individual's cognitive system, and it describes the extent to which people accept knowledge withholding (Chen & Hung, 2010). According to the regulatory fit theory, a fit perception will make people more involved in what they are doing and feel right about their behavioral decisions, and this will further increase the value and the meaning of the target behavior (Avnet & Higgins, 2003; Han, 2012; Higgins, 2005).

Following the above discussion, it is likely that people who have a high level of knowledge-withholding acceptability will regard knowledge withholding as a right thing, and worthy to do. That is to say, the knowledge-withholding behavior for people with high knowledge-withholding acceptability is mainly driven by their internal value systems. People tend to attach a high value and personal meaning (for example, loss avoidance) to knowledge-withholding behavior, and they will be more likely to predict negative outcomes or undesired results associated with knowledge sharing to rationalize their knowledge-withholding behaviors. In contrast, when people have a low level of knowledge-withholding acceptability, there is a large misfit between knowledge withholding and their personal value systems (that is, people may think knowledge withholding is wrong). In this sense, people will try to justify their knowledge-withholding behaviors based on external situational reasons instead of internal rational judgment. Therefore, we believe that predictive control will play a more important role for people with a higher level of knowledge-withholding acceptability in justifying their knowledge withholding, than those with a lower level of knowledge-withholding acceptability.

Vicarious control strategy will be a more important process for people who have a lower level of knowledge-withholding acceptability to gain the perception of control. This is because, for people with high knowledge-withholding acceptability, the perception of correctness and importance attached to knowledge withholding will make them more focused on the predictable values of the target behavior (Avnet & Higgins, 2003). In this case, they will be less likely to consider situational factors as the reasons for withholding, especially when they personally believe it is quite right to withhold knowledge. On the contrary, for people with low knowledge-withholding acceptability, knowledge withholding conflicts with their personal value systems. In this case, people will feel uncomfortable due to this type of misfit or cognitive dissonance (Thibodeau & Aronson, 1992) because they perceive little or no predictable values attached to knowledge-withholding behavior (Han, 2012; Higgins, 2005). Therefore, they have to adopt other control strategies to justify their knowledge-withholding behavior. In this sense, people who engage in knowledge-withholding behavior tend to attribute their social-deviant behaviors to others or situational factors. For example, they may feel that they are just imitating others, even if such behavior does not bring any value to themselves. Therefore, we believe that vicarious control will exert a stronger effect on knowledge withholding for people who have a lower level of knowledge-withholding acceptability than those with a higher level of knowledge-withholding acceptability. Drawing on the discussion above, we have the following hypotheses:

H_{2a}: Knowledge-withholding acceptability will positively moderate the relationship between predictive control and knowledge withholding in online knowledge spaces.

H_{2b}: Knowledge-withholding acceptability will negatively moderate the relationship between vicarious control and knowledge withholding in online knowledge spaces.

Control Variables

This study further incorporates some control variables into the research model to rule out the alternative explanations, apart from the secondary control strategies, for knowledge withholding. In particular, knowledge withholding is regarded as a social deviance behavior, which deviates from the mainstream social expectations of an open and sharing environment. Therefore, people with a strong tendency or motivation to conduct prosocial behavior will be less likely to engage in knowledge withholding. In addition, individuals' past experiences with the online community may also play an important role in affecting their future participation behaviors. Demographic variables, such as age and gender, were also controlled in the subsequent analyses. Figure 2 depicts the model of this study.

Research Methodology

Research Setting

An online survey was conducted to collect data and validate the proposed research model and the hypotheses. The target population of this study was users of XiaoMi Community, which is one of the most typical online knowledge spaces in China and has more than 70 million users and 300 million posts as of July 2016. The XiaoMi Community provides a virtual platform for its users to discuss product-relevant issues; however, each user has sent less than five posts on average over the past 5 years, which implies that knowledge withholding should be a serious issue. Knowledge withholding in the XiaoMi Community can be requested (for example, product questions and answers) or unrequested (for example, avoiding contributing product knowledge when not being asked) by other community members. In addition, some information on the community is private, such as F-code (a priority code that allows users to buy XiaoMi products), and thus it is often intentionally protected by its owners. A lack of sharing on the XiaoMi Community may also be caused by an unintentional form of concealment (for example, lack of time and resources). In this regard, we believe that knowledge withholding represents a broad and overarching concept covering different forms of counterproductive knowledge behaviors in the XiaoMi Community.

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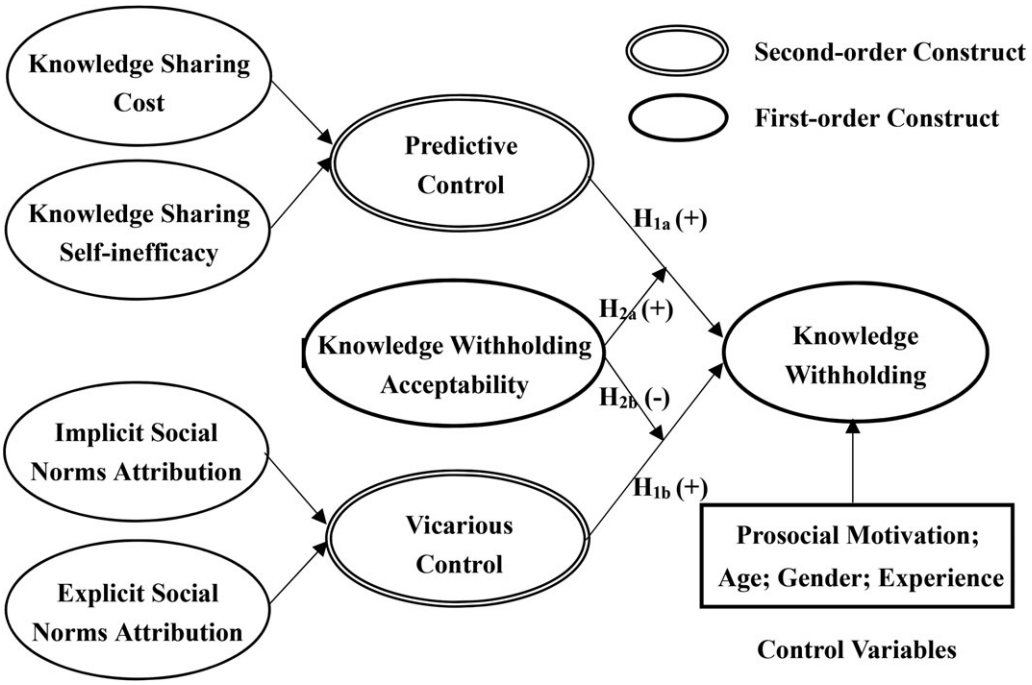

FIG. 2. Research model.

Measures

All constructs in the research model were measured with items adapted from prior studies, with slight modifications to fit the context of this study. Knowledge sharing self-inefficacy and knowledge-withholding acceptability were measured with items adapted from Chen and Hung (2010). Implicit and explicit social norms attribution were measured with items adapted from Siponen and Vance (2010). Items measuring knowledge sharing cost were adapted from Tong et al. (2013). Items for knowledge withholding were adapted from Lin and Huang (2010). Prosocial motivation, which was used as a control variable, was measured with items adapted from Grant and Sumanth (2009). The Appendix shows the constructs and the corresponding items, and all items were rated on a seven-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Data Collection

The online survey was conducted in Mainland China, and the measures of all the constructs were adapted from previous studies. A backward translation method was used to ensure the consistency between the English and Chinese versions of the questionnaire. Before formal data collection, the questionnaire was pretested with information science scholars and community users to improve the design and the quality of the survey instruments. Suggestions on format, layout, logic, wording, and other important details of the items were incorporated in the revised questionnaire. The questionnaire was then distributed to potential respondents by including two screening questions. First, the respondents should know something about XiaoMi products, such as having ever used XiaoMi products. Second, they have registered and used the XiaoMi Community. The two screening questions ensure that knowledge-withholding behavior is likely to happen in the community. Respondents who were filtered out by any one question would not be able to continue with the survey. A public post containing the survey URL was also published in the community to maximize the possible response. In addition, respondents with the same IP and MAC address could only complete the questionnaire once, thus avoiding duplicate survey responses. Finally, 480 valid responses were received, and the demographic characteristics of the respondents are presented in Table 2.

Common Method Bias

Common method bias (CMB) is a frequently mentioned concern in empirical research, particularly when all data are self-reported and collected from the same source at the same time (Lindell & Whitney, 2001; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). To examine CMB, this study followed Tsai and Bagozzi (2014) to conduct Harman's one-factor test and marker variable assessment. Harman's one-factor test with confirmatory factor analysis (CFA) can assess whether a single latent factor accounts for an alternative explanation of the analysis (Podsakoff et al., 2003). The one-factor latent model exhibits extremely unsatisfactory CFA results ($\chi^2[230] = 5075.543$, $\chi^2/df = 22.068$, $p < .001$; GFI = 0.520; CFI = 0.810; NFI = 0.800; RMSEA = 0.210; SRMR = 0.139), which are significantly worse than that of the measurement model in this study ($\chi^2[209] = 318.639$, $\chi^2/df = 1.525$; $p < .001$; GFI = 0.945; CFI = 0.994; NFI = 0.982; RMSEA = 0.033; SRMR = 0.029).

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TABLE 2. Demographic characteristics of respondents (N = 480).

Characteristics	Frequency	Percentage	Characteristics	Frequency	Percentage
Gender			Weekly frequency of visits (times)		
Male	246	51.3	<1	28	5.8
Female	234	48.7	1–3	166	34.6
Education			4–6	108	22.5
≤ Junior college	120	25.0	>6	178	37.1
Undergraduate	336	70.0	Community experience		
≥ Postgraduate	24	5.0	<3 months	66	13.8
Age			3–6 months	95	19.8
< 22	189	39.3	7–12 months	106	22.1
22~30	225	46.9	1-2 years	137	28.5
> 30	66	13.8	>2 years	76	15.8

Therefore, the measurement model of this study is robust to CMB (Tsai & Bagozzi, 2014). In addition, this study further used the marker variable assessment technique proposed by Lindell and Whitney (2001) to evaluate the threat of CMB. Specifically, this study chose the number of owned brand products (NOBP) as the marker variable for data analysis because it is theoretically unrelated to major constructs in the model. According to Lindell and Whitney (2001) and Malhotra, Kim, and Patil (2006), the second-smallest positive correlation between the marker variable and the major constructs was chosen as the estimated shared correlation resulting from CMB (that is, R_m), and R_m is 0.047 in this study. After partialling out R_m and based on the analytic procedure described in Lindell and Whitney (2001), the results revealed that none of the significant correlations became insignificant, thus yielding additional evidence for the nonexistence of CMB.

Data Analysis and Results

SmartPLS 2.0 was used in this study to examine and validate the proposed research model and the associated hypotheses. The partial least squares (PLS) technique is a widely used structural equation modeling (SEM) approach in information behavior research, especially for testing research models with formative constructs (for example, predictive control and vicarious control in this study; Hair, Anderson, Babin, & Black, 2010). In addition, compared to the covariance-based SEM approaches, PLS-SEM can be used to analyze data with a small sample size and abnormal distribution (Hair et al., 2010). In this section, the measurement model was first examined to assess the reliability and the validity of both formative and reflective constructs in the model, and then the structural model was examined to test the hypotheses and evaluate the theoretical explanatory power of the proposed research model.

Measurement Model

The proposed research model incorporated both reflective and formative constructs. Prior studies have demonstrated that the examination of the measurement model for formative and reflective constructs should follow different procedures (for example, Petter, Straub, & Rai, 2007; Shen, Li, Sun, & Wang, 2018). Specifically, reliability, convergent validity, and discriminant validity were first examined in this study to assess the measurement model of reflective constructs. A composite reliability (CR) value greater than 0.7 is often deemed to be acceptable (Fornell & Bookstein, 1982). As shown in Table 3, all CR values satisfy the suggested criteria. Convergent validity can be evaluated by examining the average variance extracted (AVE) value, which should be greater than 0.5 (Fornell & Bookstein, 1982). The results in Table 3 suggest a good convergent validity for all reflective constructs. We can also check the item loadings to evaluate convergent validity and discriminant validity. When item loadings on the theoretically related constructs are higher than 0.7, the convergent validity is considered satisfactory. When items load much more heavily on their theoretically related construct than on other constructs, the discriminant validity will also be achieved. Table 3 demonstrates that all reflective constructs exhibit good convergent validity and discriminant validity.

Furthermore, the discriminant validity of the construct can be evaluated by comparing its correlations with other constructs and the square root of AVE for the construct (Fornell & Bookstein, 1982). Table 3 demonstrates that the square roots of AVE for each construct are higher than the correlation with other constructs. Therefore, all reflective constructs are significantly different from other constructs.

In addition, the heterotrait–monotrait ratio (HTMT), which is a recently proposed method to evaluate discriminant validity (Henseler, Ringle, & Sarstedt, 2015), was further examined in this study. As shown in Table 5, the highest absolute HTMT value for the reflective constructs is 0.676, smaller than the suggested threshold of 0.85 (Henseler et al., 2015). Overall, the discriminant validity of all reflective constructs is satisfactory.

To evaluate the potential multicollinearity problems, this study also calculated the variance inflation factor (VIF) values of all variables. As shown in Table 4, VIF values for all constructs are below the recommended threshold of 10 and the more stringent threshold of 3 (Diamantopoulos, 2011). Therefore, multicollinearity is not a problem in this study.

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TABLE 3. Construct reliability and validity.

	AVE	CR	Items	KSC	KSS	ESNA	ISNA	KWA	PM	KW
KSC	0.814	0.929	KSC1	**0.901**	0.369	0.422	0.502	0.497	−0.059	0.359
			KSC2	**0.900**	0.315	0.431	0.538	0.389	−0.042	0.322
			KSC3	**0.906**	0.343	0.401	0.496	0.440	−0.036	0.304
KSS	0.844	0.942	KSS1	0.366	**0.921**	0.319	0.488	0.497	−0.194	0.527
			KSS2	0.362	**0.932**	0.301	0.512	0.539	−0.231	0.553
			KSS3	0.319	**0.903**	0.270	0.422	0.465	−0.171	0.511
ESNA	0.725	0.840	ESNA1	0.299	0.193	**0.789**	0.372	0.284	−0.068	0.215
			ESNA2	0.467	0.336	**0.910**	0.397	0.412	−0.053	0.318
ISNA	0.825	0.904	ISNA1	0.528	0.523	0.388	**0.937**	0.530	−0.195	0.564
			ISNA2	0.503	0.402	0.441	**0.879**	0.422	−0.148	0.413
KWA	0.856	0.947	KWA1	0.474	0.490	0.394	0.492	**0.921**	−0.137	0.577
			KWA2	0.445	0.510	0.400	0.515	**0.935**	−0.183	0.585
			KWA3	0.446	0.515	0.365	0.463	**0.919**	−0.168	0.523
PM	0.666	0.908	PM1	−0.056	−0.189	−0.051	−0.156	−0.123	**0.790**	−0.210
			PM2	−0.025	−0.187	−0.057	−0.167	−0.166	**0.866**	−0.235
			PM3	−0.069	−0.208	−0.080	−0.211	−0.201	**0.866**	−0.268
			PM4	−0.050	−0.181	−0.076	−0.126	−0.124	**0.814**	−0.208
			PM5	0.003	−0.100	−0.001	−0.104	−0.076	**0.735**	−0.167
KW	0.782	0.947	KW1	0.343	0.521	0.293	0.504	0.517	−0.240	**0.900**
			KW2	0.348	0.518	0.291	0.525	0.632	−0.244	**0.912**
			KW3	0.283	0.443	0.253	0.392	0.428	−0.191	**0.820**
			KW4	0.345	0.544	0.302	0.521	0.563	−0.272	**0.928**
			KW5	0.290	0.520	0.278	0.466	0.527	−0.245	**0.858**

Note. Bold numbers indicate item loadings on the assigned constructs. KSC = knowledge sharing cost; KSS = knowledge sharing self-inefficacy; ESNA = explicit social norms attribution; ISNA = implicit social norms attribution; KWA = knowledge-withholding acceptability; PM = prosocial motivation; KW = knowledge withholding.

TABLE 4. Correlations of constructs.

	Mean	*SD*	VIF	Gen.	Age	Exp.	KSC	KSS	ESNA	ISNA	KWA	PM	KW
Gen.	1.488	0.500	1.373	—									
Age	3.156	1.124	1.434	0.417	—								
Exp.	3.129	1.286	1.257	0.129	0.398	—							
KSC	4.391	1.318	1.694	−0.122	−0.028	−0.079	**0.902**						
KSS	3.899	1.443	1.775	−0.207	−0.154	−0.225	0.378	**0.919**					
ESNA	4.655	1.258	1.403	−0.031	−0.008	−0.077	0.450	0.311	**0.851**				
ISNA	3.913	1.436	2.074	−0.023	−0.013	−0.085	0.566	0.506	0.456	**0.908**			
KWA	3.506	1.454	2.133	−0.320	−0.200	−0.193	0.489	0.545	0.408	0.521	**0.925**		
PM	5.882	0.799	1.111	−0.042	−0.030	0.063	−0.047	−0.212	−0.067	−0.183	−0.169	**0.816**	
KW	3.458	1.442	2.044	−0.228	−0.200	−0.248	0.361	0.576	0.313	0.532	0.603	−0.266	**0.884**

Note. Bold numbers indicate item loadings on the assigned constructs. Gen = gender; Exp = community experience; KSC = knowledge sharing cost; KSS = knowledge sharing self-inefficacy; ESNA = explicit social norms attribution; ISNA = implicit social norms attribution; KWA = knowledge-withholding acceptability; PM = prosocial motivation; KW = knowledge withholding; *SD* = standard deviation.

The measurement model of the second-order formative constructs can be assessed by checking the weights of subconstructs on their respective theoretically related second-order construct (Petter et al., 2007; Wang, Shen, & Sun, 2013). The weight values reflect the relative importance of the subconstructs to the higher-order constructs (Petter et al., 2007). In particular, two second-order formative constructs (for example, predictive control and vicarious control in this study) were measured with the average value of their related subconstructs. As shown in Table 6, all weight values of subconstructs on their theoretically related second-order constructs are significant and positive, suggesting that the validity of second-order formative constructs in this study is acceptable (Petter et al., 2007). In addition, the construct reliability of second-order formative construct was assessed by checking the potential multicollinearity problems among the subconstructs (Petter et al., 2007; Shen, Li, & Sun, 2018). Table 6 shows that VIF values for all subconstructs range from 1.363 to 1.818, smaller than the threshold of 3 (Diamantopoulos, 2011). In this regard, formative constructs in this study exhibit good reliability and validity.

Structural Model

Figure 3 depicts the PLS-SEM results, including explained variances, path coefficients, and their respective *t*-statistics. Specifically, the results suggest that predictive

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TABLE 5. Heterotrait–monotrait ratio.

HTMT	KSC	KSS	ESNA	ISNA	KWA	PM
KSS	0.422					
ESNA	0.597	0.407				
ISNA	0.676	0.598	0.642			
KWA	0.543	0.598	0.533	0.612		
PM	−0.054	−0.237	−0.090	−0.221	−0.189	
KW	0.399	0.626	0.405	0.621	0.653	−0.294

Note. KSS = knowledge sharing self-inefficacy; KSC = knowledge sharing cost; ESNA = explicit social norms attribution; ISNA = implicit social norms attribution; KWA = knowledge-withholding acceptability; PM = prosocial motivation; KW = knowledge withholding.

TABLE 6. Weights of formative constructs.

Second-order constructs	Subconstructs	Weights	*t*-values	VIF values
Predictive Control	KSS	0.859	21.050	1.374
	KSC	0.282	4.414	1.597
Vicarious Control	ESNA	0.162	2.099	1.363
	ISNA	0.916	19.864	1.818

Note. KSS = knowledge sharing self-inefficacy; KSC = knowledge sharing cost; ESNA = explicit social norms attribution; ISNA = implicit social norms attribution.

control and vicarious control are the two key determinants of knowledge withholding, with path coefficients at 0.266 (t = 5.125) and 0.168 (t = 3.327), respectively, supporting H_{1a} and H_{1b}.

When examining the moderating effects, following Kankanhalli et al.'s (2005) suggestions, all the moderating effects are considered simultaneously because this approach can provide a more complete picture of multiple moderating effects and help evaluate these effects in the context of the overall model, that is, assessing the moderating effects "in the presence of other main and interaction effects" (Kankanhalli, 2005, p. 129). Furthermore, entering all the moderating effects simultaneously in a single step can help control the Type I error (Frazier, Tix, & Barron, 2004). In this regard, this approach has been widely employed in recent studies (for example, Ali, Musawir, & Ali, 2018; Arazy, Gellatly, Brainin, & Nov, 2016; Chua & Banerjee, 2015; Hong, Lee, & Suh, 2017; Kobsa, Cho, & Knijnenburg, 2016; Venkatesh, Thong, & Xu, 2012). To evaluate the potential confounding effects induced by simultaneously considering multiple moderating effects, this study further included a three-way interaction effect among independent variables and the moderator in the model. The main results do not show any significant changes, suggesting that confounding effects are not a serious concern in this study. The results obtained indicate that the interaction effect of knowledge-withholding acceptability and predictive control on knowledge withholding is positive and statistically significant (β = 0.189; t = 3.215), and therefore, H_{2a} is supported. In addition, knowledge-withholding acceptability and vicarious control also exert a significantly negative interaction effect on knowledge withholding (β = −0.114, t = −2.052), thus supporting H_{2b}.

As for the control variables, both prosocial motivation and community experience have negative effects on knowledge withholding, with path coefficients of −0.148 (t = 3.897) and −0.097 (t = 2.404), respectively. Demographic variables such as gender (β = −0.058; t = 1.420) and age (β = −0.040; t = 0.991) have no significant effect on knowledge withholding. Overall, all the variables jointly explain 52.1% of the variance in knowledge withholding.

This study further evaluated the predictive capability of the research model by calculating a global fit measure, that is, GoF, for PLS path modeling, as recommended by Tenenhaus, Amato, and Esposito Vinzi (2004) and Henseler and Sarstedt (2013). The results indicate the average communality of all major constructs is 0.786, and the average R^2 of the endogenous latent variables is 0.521. By calculating the geometric mean of the two values (Henseler & Sarstedt, 2013), the GoF value is 0.640, exceeding the cutoff value of 0.36 for large effect sizes of R^2 (Wetzels, Odekerken-Schröder, & Van Oppen, 2009) and thus suggesting an adequate fit of the model.

Furthermore, this study compared the effects of predictive control and vicarious control on knowledge withholding to advance the understanding about secondary control strategies. Based on Chin's (2003) equation, the statistical results in Table 7 indicate that predictive control exerts a stronger effect on knowledge withholding than vicarious control.

Hierarchical Multiple Regression Analysis

To test the robustness of the findings, this study further conducted a hierarchical multiple regression analysis using SPSS 17.0 (IBM, Armonk, NY). The data were first standardized and each latent variable was measured with a single indicator formed by averaging its indicators' values. The interaction term was obtained by multiplying independent variables and the moderator. The results in Table 8 were consistent with those generated from SmartPLS. In particular, both predictive control and vicarious control positively affected knowledge withholding, thus supporting H_{1a} and H_{1b}. Predictive control and knowledge-withholding acceptability had a significantly positive interaction effect on knowledge withholding (β = 0.210; t = 4.202), whereas vicarious control and knowledge-withholding acceptability exerted a significantly negative interaction effect on knowledge

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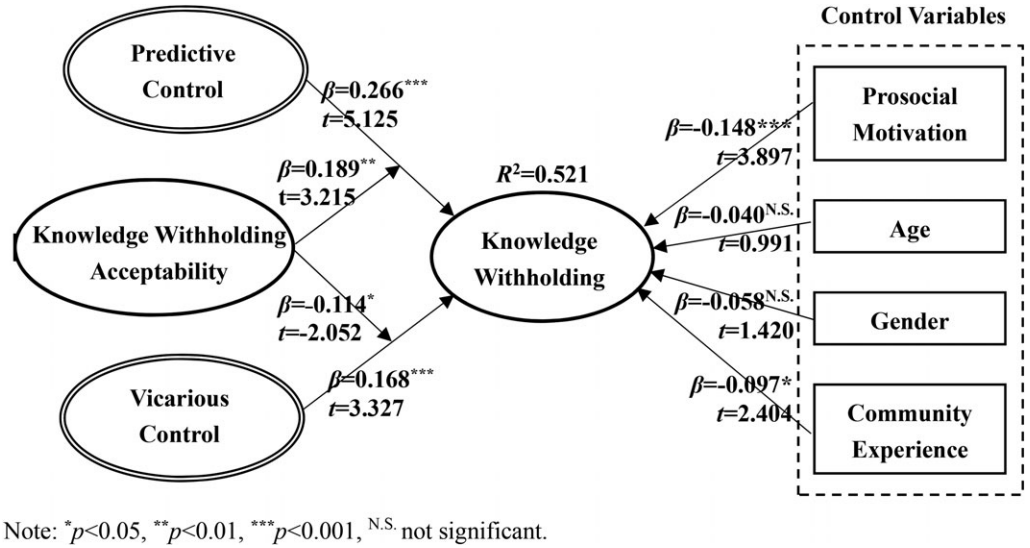

FIG. 3. PLS-SEM results.

TABLE 7. Comparison between the effects of predictive control and vicarious control.

	PC → KW	VC → KW	Δβ	*t*	Conclusion
β	0.266***	0.168***	0.098***	29.746	PC > VC
t	5.125	3.327			
S.E.	0.053	0.049			

Note. PC = predictive control; VC = vicarious control; KW = knowledge withholding. 3. $t = (\beta_1 - \beta_2)/\sqrt{(SE_1^2 + SE_2^2)/N}$, where SE_i is the standard error for path *i*; β_i is the path coefficient for path *i*; *N* is the sample size (Chin, 2003).

*$p < .05$, **$p < .01$, ***$p < .001$.

withholding (β = −0.125; *t* = −2.433), further confirming H_{2a} and H_{2b}.

Discussions and Conclusion

This study aimed to investigate social deviance behavior in online knowledge spaces, that is, knowledge withholding. Drawing on the secondary control perspective, this study proposes a research model to explain why people withhold their knowledge in online knowledge spaces and how knowledge-withholding acceptability affects the withholding processes. The results demonstrate that secondary control plays an important role in knowledge withholding, with an explained variance of 52.1%. Both predictive control and vicarious control, as expected, exert significantly positive effects on knowledge withholding. This further confirms the value and importance of secondary control in justifying human social-deviant behavior. In this regard, people can justify their social deviance behaviors by either lowering their self-expectations of prosocial behaviors, or attributing it to situational factors. Furthermore, knowledge-withholding acceptability enhances the effect of predictive control, whereas it weakens the effect of vicarious control

TABLE 8. Results of hierarchical multiple regression analysis.

Independent variable	Dependent variable: knowledge withholding			
	Model 1		Model 2	
	β	*t*	β	*t*
(Constant)	0.000	0.000	−0.053	−1.553
Gender	−0.052	−1.341	−0.055	−1.437
Age	−0.055	−1.367	−0.037	−0.946
CE	−0.097**	−2.612	−0.111**	−3.031
PM	−0.154***	−4.493	−0.167***	−4.798
PC	0.211***	4.311	0.254***	5.138
VC	0.157***	3.395	0.105*	2.170
KWA	0.313***	6.719	0.297***	6.251
PC*KWA			0.210***	4.202
VC*KWA			−0.125*	−2.433
R^2	0.474		0.494	
ΔR^2			0.020	
ΔF^2			9.194***	

Note. CE = community experience; PM = prosocial motivation; PC = predictive control; VC = vicarious control; KWA = knowledge-withholding acceptability.

*$p < .05$, **$p < .01$, ***$p < .001$.

on knowledge withholding in the online knowledge spaces. This suggests that people with a high knowledge-withholding acceptability tend to use predictive control to rationalize their social deviance behavior, whereas people with low knowledge-withholding acceptability are more likely to use vicarious control to justify their social deviance behaviors.

Implications for Research

The theoretical implications of this study are three-fold. First, different from current social informatics research placing a great emphasis on knowledge sharing and contribution in online knowledge spaces, this study focuses on the counterproductive knowledge behavior, which is less

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investigated but represents a very important facet of knowledge management. In particular, knowledge withholding is conceptualized as an overarching concept that covers different forms of counterproductive knowledge behaviors in this study. Knowledge withholding represents the most common phenomena in online knowledge spaces, where social networks among people are loose and there is no explicit punishment mechanism for the withholding behaviors. In this regard, this study provides another lens to understand how the expected knowledge exchange will be impeded in an online information environment. The research efforts demonstrated in this study will extend current research by highlighting the nature and potential causes of peoples' knowledge-withholding behavior in the online knowledge spaces.

Second, this study delves into the social contexts in which knowledge withholding arises, and interprets it as a social deviance behavior, thus contributing to the current understanding and explanation of knowledge practice in a complex sociotechnical system. Due to the social-deviant nature of knowledge withholding, this study draws on the secondary control perspective by identifying predictive control and vicarious control as the two key explanatory mechanisms for knowledge withholding. In particular, a large proportion of the variance in knowledge withholding was explained by the research model. Therefore, the secondary control perspective offers a new theoretical framework for empirical research on knowledge practice embedded in the sociotechnical environment, and provides a useful angle for future research to examine the underlying causes of online knowledge withholding.

Third, by employing knowledge-withholding acceptability as the moderator, this study further identifies the boundary conditions under which predictive control and vicarious control have an impact on knowledge withholding. Although evidence supporting the main effects appears reasonably strong, the contingent analysis represents an empirical and theoretical step forward because it provides a more robust and thoughtful attempt to understand the effect of secondary control on knowledge-withholding behavior. In this study, knowledge-withholding acceptability enhances the effect of predictive control, whereas it weakens the effect of vicarious control on knowledge withholding. The different moderating mechanisms demonstrate that the influential strengths of predictive control and vicarious control on knowledge withholding significantly depend on the different levels of knowledge-withholding acceptability. Therefore, this study reveals the underlying interaction mechanisms between secondary control factors and knowledge-withholding acceptability, and provides a useful reference for future research to further address the effect of secondary control.

Implications for Practice

This study further provides some clear implications for practice. First, the online knowledge space represents an important venue for practitioners to harness the wisdom of the crowd. In this regard, the success of online knowledge spaces greatly depends on full participation of the community users. However, in most cases, a small number of people exert full effort and contribute most of the content, indicating a silent majority in the online knowledge community. Therefore, the practitioners should pay special attention to the phenomenon of knowledge withholding. More important, it is necessary for the practitioners to keep track of users' contributions, identify those people who have withheld their knowledge in a unit of time period (for example, month or a quarter), and take preventive actions, such as contribution invitation or flexible dynamic incentive mechanisms, before they become completely silent.

Second, this study also provides some diagnostic tools for the practitioners to understand why people withhold their contribution efforts in online knowledge spaces. Generally speaking, people may withhold their knowledge based on either predictive control or a vicarious control process. For the predictive control process, people attribute knowledge withholding to their limited abilities and the high knowledge sharing costs. In this regard, practitioners should try to reduce users' perceptions of failure. Specifically, practitioners can set up some tasks that are easy to complete and will not take a lot of time and effort. Some clear instructions and guidelines on knowledge sharing also should be offered to the potential contributors to help them successfully complete the tasks. For the vicarious control process, people attribute their knowledge withholding to the lack of explicit policies about knowledge sharing and the antisharing community culture. In this regard, practitioners should make the knowledge sharing policies explicit and accessible. In addition, it is also important to build a prosharing community culture by providing more incentives—both material and symbolic—to knowledge contributors and setting knowledge access restrictions on knowledge withholders.

Another important practical implication that emerged from this study is related to knowledge-withholding acceptability. People may adopt different secondary control strategies to justify their knowledge withholding when they have different levels of knowledge-withholding acceptability. In this regard, practitioners should apply different coping strategies to different people. For people with a high level of knowledge-withholding acceptability, practitioners should focus more on preventing them from predictive control by optimizing the knowledge-sharing process and reducing knowledge-sharing task difficulties. For people with a low level of knowledge-withholding acceptability, practitioners should focus more on preventing them from vicarious control by making knowledge-sharing policies explicit and letting them feel that many people are contributing knowledge to the online knowledge spaces.

Limitations and Future Research

Although this study offers some theoretical and practical implications, several limitations also should be acknowledged

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before generalization the findings. First, even though this study explained a large proportion of the variance (52.1%) for knowledge withholding in online knowledge spaces, it is also worthy noting that some other important factors, such as factors listed in Table 1, have not been incorporated. To keep the model at a manageable size, it is also unrealistic to include all of them as control variables. However, we believe these factors may work together with the secondary control perspective, and we will leave this important work for future research. Second, predictive control and vicarious control exhibited substantial explanatory power in a knowledge-withholding context. Nevertheless, it is also unclear how exactly they are formed in online knowledge spaces. In this regard, future research can further explore factors predicting secondary control perceptions. Third, this study examined knowledge withholding in one of the Chinese online knowledge spaces. In this regard, the generalizability of the findings should be made with caution. We highly recommend future cross-cultural and cross-sectional studies to validate the generalizability and reproducibility of this study.

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Appendix: Measures and Constructs

Knowledge Sharing Self-inefficacy (KSS; Chen & Hung, 2010).

KSS1: I have no confidence in my ability to provide knowledge that other members in the virtual community consider valuable.

KSS2: I have no expertise, experience, and insights needed to provide knowledge valuable for other members in the virtual community.

KSS3: I have little confidence in answering the questions posted by other members in the virtual community.

Knowledge Sharing Cost (KSC; Tong et al., 2013).

KSC1: It is costly to organize related knowledge cognitively to answer the questions posted by other members in the virtual community.

KSC2: It takes me too much time to answer the questions posted by other members in the virtual community.

KSC3: It calls for a great effort for me to recall related knowledge to answer the question posted by other members in the virtual community.

Explicit Social Norms Attribution (ESNA; Siponen & Vance, 2010).

ESNA1: It is OK to not contribute knowledge to the virtual community if there is not an explicit policy about knowledge sharing.

ESNA2: It is OK to not contribute knowledge to the virtual community if the knowledge sharing policy is not well advertised.

Implicit Social Norms Attribution (ISNA; Siponen & Vance, 2010).

ISNA1: It is OK to not contribute knowledge to the virtual community as many other members have not contributed their knowledge either.

ISNA2: Many others do not contribute knowledge to the virtual community either, so it is unjust to force me to do so.

Knowledge-withholding acceptability (KWA; Chen & Hung, 2010).

Answering the questions posted by other members in the virtual community:

KWA1: Is incompatible with my values.

KWA2: Misfits my current needs.

KWA3: Is incompatible with my previous experiences.

Knowledge Withholding (KW; Lin & Huang, 2010).

KW1: I contribute less knowledge to the virtual community than I know I can.

KW2: I give less effort on knowledge contribution than other members in the virtual community.

KW3: I often leave contributing knowledge to other members in the virtual community.

KW4: I often take advantage of other community members' knowledge without contribution.

KW5: I avoid contributing knowledge to the virtual community as much as possible.

Prosocial Motivation (PM; Grant & Sumanth, 2009).

PM1. I get energized by working on tasks that have the potential to benefit others.

PM2. I like to work on tasks that have the potential to benefit others.

PM3. I prefer to work on tasks that allow me to have a positive impact on others.

PM4. I do my best when I'm working on a task that contributes to the well-being of others.

PM5. It is important to me to have the opportunity to use my abilities to benefit others.

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