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Asset specificity asymmetry and supplier opportunism in buyer–supplier exchanges☆

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ABSTRACT

Despite the prominent role of asset specificity in buyer–supplier exchanges, its influence on opportunism remains controversial. While transaction cost economics (TCE) addresses its potential to encourage opportunism, relational exchange theory (RET) highlights its role in discouraging opportunism. We extend this debate by considering (1) the effects of asset specificity asymmetry, (2) changes in supplier opportunism over time, and (3) the moderating roles of supply market uncertainty and prior exchange history. We argue that the logics of TCE and RET are not fundamentally irreconcilable; instead, we suggest a perspective combining the calculative logic of TCE within the relationship logic of RET such that they jointly affect opportunism changes. Our propositions are supported by the results of a matched sample of 193 buyer–supplier relationships at two time points.

1. Introduction

Given that asset specificity (AS) facilitates the efficiency of an exchange relationship, it is a central concept in the study of interorganizational relationships and strategic alliances (Wang, Jiang, Li, Motohashi, & Zheng, 2019; see De Vita, Tekaya, & Wang, 2011; Delbufalo, 2021 for recent reviews). However, theoretical and empirical debates exist over how AS influences opportunism. Relational exchange theory (RET) argues that by signaling the desire to invest in an enduring relationship, AS discourages partner opportunism (Macneil, 1980). For example, Bensaou and Anderson (1999) found that credible commitments signaled by the buyer's AS discourage supplier opportunism. This counterpoint is reflected in the case of Japanese keiretsu. As observed by Dyer (1996), human asset cospecialization in Japanese automotive value chains results in superior information sharing and signals a credible commitment.

In contrast, transaction cost economics (TCE) scholars have highlighted the potential liabilities associated with AS. Because a specific asset cannot be easily redeployed to other relationships, it creates a lock-in effect for investors and enables receivers to exploit investments, thus increasing receivers' opportunism (Penney & Combs, 2020; Rokkan, Heide, & Wathne, 2003; Williamson, 1985). An example is a chassis supplier holding up Ford in the U.K. The chassis was specific to Ford's Land Rover Discovery model. The supplier had gone bankrupt and had been taken over by a court-appointed receiver who insisted on a price for the chassis that was multiple times the original contracted price.

Empirically, prior studies tend to use *either* RET *or* TCE to explain the effect of AS on opportunism, leading to inconsistent findings (e.g., Handley & Benton, 2012; Liu, Luo, & Liu, 2009; Rokkan et al., 2003; Wang, Li, Ross, & Craighead, 2013). As a result, it is not clear how AS affects partner opportunism in interorganizational relationships. This is an issue of great importance because opportunism is widely noted as a central risk in these relationships (Lumineau & Oliveira, 2020; Luo, Liu, Yang, Maksimov, & Hou, 2015; Zhou & Xu, 2012). We suggest instead that we are likely to gain a better understanding of the impact of AS on partner opportunism in interorganizational relationships by combining these two approaches.

We aim to tackle this theoretical puzzle by overcoming important limitations in the extant literature. First, previous researchers have largely examined AS unilaterally (i.e., by focusing only on one firm; e.g., Luo, Liu, & Xue, 2009; Wang et al., 2019; Zhou & Poppo, 2010), overlooking the dyadic nature of AS (Cuypers, Hennart, Silverman, & Ertug,

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2021; Huo, Ye, Zhao, Wei, & Hua, 2018; Liu, Deligonul, Cavusgil, & Chiou, 2018). In contrast, we capture AS from both sides of the relationship to examine the effects of AS asymmetry between buyers and suppliers and analyze the directionality of the asymmetry, i.e., we distinguish cases where supplier AS > buyer AS from cases where buyer AS > supplier AS. Therefore, we extend prior studies of the effect of AS on opportunism (e.g., Bensaou & Anderson, 1999) by examining whether it is the asymmetry between buyer and supplier AS that actually drives what prior literature has found between AS and exchange partner opportunism. Second, prior studies are largely cross-sectional and assume the existence of an immediate effect of AS on opportunism (e.g., Handley & Benton, 2012; Luo et al., 2009), although more recent studies have begun to examine buyer–supplier relationships with a longitudinal approach (e.g., Heide, Wathne, & Rokkan, 2007; Wathne, Heide, Mooi, & Kumar, 2018). Extending these longitudinal studies of buyer–supplier relationships, we explain *changes* in supplier opportunism over time. Third, building on the literature that notes the critical roles of uncertainty and frequency (Williamson, 1985), we study the moderating effects of supply market uncertainty and prior exchange history to investigate the contextual factors impacting the influence of AS asymmetry on supplier opportunism. Consistent with prior research, we focus on perceptions of supplier opportunism (see Handley & Benton, 2012 or Skowronski, Benton, & Hill, 2020 for a similar approach).

Since RET and TCE are complementary in explaining interorganizational relationships, we develop a combinative view to address their tensions and investigate the following research questions: (1) How does AS asymmetry between buyers and suppliers influence changes in supplier opportunism over time? (2) How is this relationship moderated by supply market uncertainty and prior exchange history? We tested our theoretical model using a sample of 193 matched long-term buyer–supplier dyads with data collected at two time points. The temporal dynamics involved in these buyer–supplier dyads can help reconcile the theoretical tensions between RET and TCE. Our study advances a dyadic approach to analyze both the degree and directionality of AS asymmetry and offers a nuanced understanding of the influence of AS asymmetry on changes in opportunism over time.

2. Theoretical background

2.1. Asset specificity: Relational exchange theory and transaction cost economics

As a prominent inter-organizational theory, RET suggests that the dyadic relationship is the critical factor for understanding competitive advantages (Dyer & Singh, 1998). Interorganizational relationships can provide firms with important access to idiosyncratic resources and capabilities, which constitutes a unique way for value creation (Dyer & Singh, 1998; Pellicano, Perano, & Casali, 2016). AS is defined as the degree to which an asset cannot be redeployed to alternative uses or by alternative users without sacrificing productive value (Williamson, 1985), and it plays a critical role in realizing relational rents for both exchange partners (Dyer & Singh, 1998; Wathne et al., 2018). The arm's-length market transaction is characterized by non-specific asset investment, which cannot generate relational rents. To move beyond market transactions, a firm must dedicate specific investments toward improving its relationships with its exchange partners (Zhou, Zhang, Sheng, Xie, & Bao, 2014). AS is a durable investment undertaken in support of particular transactions, indicating sunk costs if an original transaction is prematurely terminated (Klein, Crawford, & Alchian, 1978; Williamson, 1985). In turn, a large body of literature has addressed the influence of AS in interorganizational relationships including strategic alliances (e.g., Artz & Brush, 2000; Dyer, 1996) and buyer–supplier relationships (e.g., Bensaou & Anderson, 1999).

AS creates the potential for opportunism, which is defined as a lack of candor or honesty in transactions including "self-interest seeking with guile" (Williamson, 1985, p. 47). RET and TCE are the two dominant approaches to explain the relationship between AS and opportunism. However, they rely on distinct assumptions. RET focuses on how transactions occur within a historical and social context (Dyer & Singh, 1998; Dyer, Singh, & Hesterly, 2018; Pellicano et al., 2016). It considers the entire relationship between the partners, rather than each transaction, as a unit of analysis (Macneil, 1980). Exchange parties depend on relational norms broadly defined as the mutual expectation that partners will act in collectively beneficial ways that constrain opportunistic behavior through self-regulation rather than through threats or incentives. Accordingly, RET focuses on how AS enables firms to develop confidence in the stability of a relationship by signaling loyalty commitment and long-term bonding (Kaufmann & Dant, 1992; Rokkan et al., 2003). As a firm that makes idiosyncratic investments would lose substantial value if the relationship were to dissolve, AS credibly demonstrates the firm's willingness to live up to its promises, reflects good faith toward the other party, and reassures the other party regarding its intentions and integrity (Anderson & Weitz, 1992; Wu, Chen, Chen, & Tung, 2016). As such, RET argues that AS fosters the development of positive expectations between partners and thus reduces the likelihood of opportunism (Lui, Wong, & Liu, 2009).

In contrast, with the transaction as the unit of analysis, TCE assumes that exchange partners are potentially opportunistic and are intentionally rational but constrained by a limited capacity to gather and process information (Coase, 1937; Williamson, 1985). Using calculative logic, TCE's main relevant proposition is that AS increases the risk of opportunism (Poppo, Zhou, & Zenger, 2008b). Because of their specialized nature, specific assets are costly to redeploy for alternative uses or relationships; their limited usage outside of a focal relationship increases the investing partner's vulnerability to opportunistic exploitation (Williamson, 1985). Thus, a firm's investment in AS can lead its partner to exploit that vulnerability by behaving opportunistically. Exchange partners have "hold-up" incentives to expropriate returns from AS using ex post bargaining or threats of termination, which gives rise to a safeguarding problem and creates the potential for opportunism (Penney & Combs, 2020). Many empirical studies support this core proposition that AS fosters opportunism (e.g., Handley & Benton, 2012; Rindfleisch & Heide, 1997).

2.2. The combinative view of relational exchange theory and transaction cost economics

RET and TCE converge in their interest in the effects of AS but diverge in their respective assumptions and explanatory mechanisms. Our study addresses the theoretical debate over how AS influences opportunism by bringing together RET and TCE. Dyer and Singh (1998) point out that the relational view should not be detached from closely related viewpoints. Conventional TCE research often overlooks the critical role of social embeddedness in business transactions (Zaheer & Venkatraman, 1995). With long-term social bonding, exchange partners are likely to behave in a trustworthy fashion (Lui et al., 2009). Therefore, we develop a combinative view – relying on the notions of forward-looking calculation and social bonding – that combines the key TCE component of calculation and the RET focus on relational norms.

The conventional TCE logic uses the transaction as the unit of analysis to mainly consider the costs of each transaction but overlooks the fact that partners may calculate the value of the exchange relationship as a whole. In contrast, RET treats the relationship as the unit of analysis (Dyer & Singh, 1998) but downplays the calculative nature of business exchanges. However, in practice, if business partners make rational choices by maximizing their expected gains and minimizing their expected losses, they also pay attention to the value of the whole relationship (Dyer & Singh, 1998). Business partners are indeed guided by both calculative considerations of the incentive structure and relational considerations of loyalty commitment and long-term bonding (Pellicano et al., 2016; Rokkan et al., 2003). The consideration of both economic and social reasoning leads us to combine TCE and RET to evaluate the

impact of AS in exchange relationships. Furthermore, Dyer et al. (2018, p. 3141) note that a dynamic lens is important for understanding "both what drives cooperation for value creation and what leads to competition for value capture" in the inter-organizational relationship. We thus consider the temporal dynamics involved in buyer–supplier relationships to examine the relationship between AS and opportunism.

2.3. Revisiting the relationship between asset specificity and opportunism

A large body of literature has focused on the influence of AS on opportunism (e.g., Crosno & Dahlstrom, 2016; Handley & Benton, 2012; Huo et al., 2018; Luo et al., 2009; Wang, Zhang, Li, Huo, & Fan, 2020). However, a close review of prior literature has revealed three major limitations. First, most prior studies have assumed mutual AS and employed a unilateral approach, focusing on AS on the part of either buyers or suppliers (e.g., Lui et al., 2009; Wang et al., 2013; see McEvily, Zaheer, & Kamal, 2017; Rokkan et al., 2003 for exceptions). This represents an important theoretical and empirical limitation because buyer–supplier relationships often involve asymmetric investments by buyers and suppliers (e.g., Crosno & Dahlstrom, 2016; Wagner & Bode, 2014). Indeed, "presuming that one party mirrors the other is potentially erroneous" (Roh, Whipple, & Boyer, 2013, p. 713), as noted in recent research (Graebner, Lumineau, & Fudge Kamal, 2020; Wang et al., 2020). A dyadic analysis is therefore necessary to uncover the exact role of AS on opportunism, which motivates us to focus on AS asymmetry in our theoretical development.

Second, despite the time that opportunism often takes to materialize (Seggie, Griffith, & Jap, 2013), prior studies have been largely cross-sectional (e.g., Crosno & Dahlstrom, 2016; Handley & Benton, 2012; Luo et al., 2009). A handful of studies have recently taken a longitudinal approach. For instance, Lado, Dant, and Tekleab (2008) and Samaha, Palmatier, and Dant (2011), both with a three-year survey, investigate how opportunism influences performance (see also Seggie et al., 2013). In addition to the studies that focus on the consequences of opportunism, Jap and Anderson (2003) and Wathne et al. (2018) consider how specific investments impact exchange outcomes over time. Another noteworthy longitudinal study is Heide et al. (2007) who examine the effects of monitoring on partner opportunism. However, this body of research has ignored how AS asymmetry between buyers and suppliers influences *changes* in supplier opportunism over time. A better understanding of "changes" is important because "the consequences of the partner's withholding information, distorting performance results, nurturing hidden agendas, etc., may not become evident quickly to the focal firm" (Das, 2004, p. 754). It takes time for a buyer to gather clues signaling the potential for opportunistic behavior, recognize the relevant patterns, make an evaluation, and then take appropriate actions (Schilke & Cook, 2013). A supplier must interpret the decisions made by the buyer and, in turn, assess the various options and consider whether to behave opportunistically. Moreover, *changes* in opportunism (i.e., between Time 1 and Time 2 in our study) represent a better indicator than simply focusing on opportunism at Time 2 because an analysis of the changes in opportunism over time also considers the initial level of perceived opportunism. Thus, rather than studying opportunism as an immediate reaction, we examine changes in supplier opportunism.

Third, recent studies note the importance of accounting for the contexts in which specific assets are deployed (Cao, Li, Jayaram, Liu, & Lumineau, 2018; Delbufalo, 2021). Accordingly, we analyze two moderators, specifically, supply market uncertainty and prior exchange history, as they are highlighted as important contextual factors in TCE and RET (Poppo, Zhou, & Ryu, 2008a; Rindfleisch & Heide, 1997). We focus on how, given an initial level of supplier opportunism, AS asymmetry between buyers and suppliers influences changes in supplier opportunism over time and how such impacts are moderated by supply market uncertainty and prior exchange history.

3. Hypothesis development

3.1. The curvilinear effect of asset specificity asymmetry on changes in supplier opportunism

To analyze how AS asymmetry influences changes in supplier opportunism, we discuss three possible scenarios in succession that correspond to AS in buyers and suppliers: (1) supplier AS > buyer AS, (2) supplier AS = buyer AS, and (3) supplier AS < buyer AS. By distinguishing whether it is the buyer or the supplier that has the higher level of AS in a relationship, our study is, to the best of our knowledge, the first to address these distinct types of AS asymmetries. As noted by Molina and Dyer (1999), the use of the relational view is not meant to "turn our backs" on the existing conceptual frameworks. Rather, "a productive way of thinking about this is to determine which framework is most useful in a particular setting" (Molina & Dyer, 1999, p. 185). We directly draw on this viewpoint to justify our focus on the tensions between TCE and RET and our analysis of boundary conditions in explaining the impact of AS asymmetry on supplier opportunism. We present the key logic of our hypotheses in Appendix 1.

Scenario where supplier AS > buyer AS. In the case where a supplier invests more in AS than a buyer, the supplier faces greater risks of hold-up and misappropriation. Following the TCE rationale, the supplier is in a vulnerable position (Williamson, 1985). The supplier has no interest in jeopardizing the relationship, while the buyer has little to lose if the relationship goes sour. If the supplier is opportunistic, the buyer can easily retaliate and inflict more harm on the supplier (Crosno & Dahlstrom, 2016; Provan & Skinner, 1989). The fear of retaliation from the buyer, therefore, represents a bond against the supplier's possible opportunistic behavior (Achrol & Gundlach, 1999). Motivated by a rational concern for instrumental gain, the supplier will focus its efforts on suppressing any opportunism it might have had at Time 1 to reach a minimal level of opportunism at Time 2. As a result, the supplier is likely to reduce its opportunism over time.

Meanwhile, RET argues that the supplier's vulnerability signals an increased commitment to the relationship. The buyer feels more reassured by this continued commitment to the relationship and becomes progressively less tempted to exploit its advantage. While "opportunism begets opportunism" (Gundlach, Achrol, & Mentzer, 1995, p. 82), this type of AS asymmetry supports a progressively stronger loyalty commitment between the partners, which reduces their opportunism over time. In summary, in this situation, although the two theoretical approaches rely on distinct logics, they converge to suggest a reduction in supplier opportunism over time.

Scenario where supplier AS = buyer AS. When a buyer and supplier have invested in specific assets to the same degree, both partners face the same risk. This balanced condition corresponds to a "balance of terror" wherein both firms can hurt each other by taking advantage of the other party's AS. Such joint symmetric commitments have been analyzed in prior research (De Vita et al., 2011; Gundlach et al., 1995; Joshi & Stump, 1999), which suggests that reciprocal investment in AS by buyers and suppliers creates a mutual reliance relation (Williamson, 1985). Such mutual dependence represents a guarantee against defection and deters opportunism, which leads the supplier to avoid the risk of retaliation by its buyer (Provan & Skinner, 1989). Thus, it is likely that supplier opportunism will not change over time.

Scenario where supplier AS < buyer AS. In the situation in which a buyer makes a greater specific investment, conventional TCE studies suggest that because the buyer has little choice but to tolerate the supplier's misbehavior, the supplier now has a greater propensity to opportunistically exploit the buyer's AS (Achrol & Gundlach, 1999; Handley & Benton, 2012; Heide & John, 1990). In contrast, according to RET, higher buyer AS signals the buyer's commitment because it would have much to lose if the relationship were to dissolve; such commitment reassures the supplier and reduces its opportunistic behavior (Anderson & Weitz, 1992; Kaufmann & Dant, 1992; Wathne et al., 2018). For

instance, Bensaou and Anderson (1999) found that credible commitments by the buyer discourage supplier opportunism. As such, TCE and RET generate opposite predictions.

The apparent inconsistency between the two theoretical approaches arises from their distinct units of analysis. Because each transaction is a subset of the whole relationship between the buyer and the supplier (Scuotto et al., 2017), partners would evaluate the value of both the focal transaction and the whole relationship. According to the combinative view, the calculative logic of TCE on each transaction is embedded within the entire set of relationships over time. As such, since higher buyer AS signals the buyer's loyalty commitment, the supplier perceives a long-term cooperative horizon with the buyer. The expectation of long-term cooperation, in turn, shapes the supplier's calculative motivation toward a forward-looking calculus that evaluates the benefits and the costs over the long term (Heide & Miner, 1992; Pellicano et al., 2016; Poppo et al., 2008a; Rokkan et al., 2003). With a forward-looking calculation, the supplier rationally decreases its opportunism over time to gain more benefits in the long run. More buyer AS thus serves as a credible signal for the supplier to constrain opportunistic behaviors for the sake of long-term benefits based on relationship continuity. In summary, with the support of the RET logic that AS signals loyalty commitment and long-term bonding, the TCE transactional logic becomes relationship-based and forward-looking, leading to the reduction of supplier opportunism over time.

Taken together, we expect to observe a reduction in supplier opportunism over time in both asymmetry situations, while supplier opportunism tends to remain stable when AS is symmetric. In other words, if AS between a buyer and supplier is asymmetric rather than symmetric, supplier opportunism reduces more over time.

Hypothesis 1. *AS asymmetry between a buyer and a supplier has an inverted U-shaped relationship with changes in supplier opportunism.*

3.2. The moderating effect of supply market uncertainty

TCE highlights market uncertainty as an important exchange hazard and, as such, is a central part of TCE (Williamson, 1985). Given the unpredictability it creates, market uncertainty leads to an adaptation problem and makes planning and coordination difficult in an exchange (Martin, Gözübüyük, & Becerra, 2015). In our study, we focus on *supply market uncertainty*, which refers to unpredictable changes in the supply environment such as changes in pricing, product features and specifications, and product supply (Cannon & Perreault, 1999; Poppo, Zhou, & Li, 2016).

Scenario where supplier AS > buyer AS. When a supplier invests more in AS than its buyer, the supplier faces greater risks of hold-up and expropriation. When market uncertainty is low, the supplier can find necessary information to make a deliberative cost–benefit analysis, which is the basis for calculative decision making (Fiske & Taylor, 2008). Thus, the supplier can make a more accurate assessment of the risks and payoffs of supplier AS asymmetry, which further discourages supplier opportunism. In addition, low market uncertainty makes it easier for the buyer to find new partners if it wants to replace the current supplier as a means of retaliation against supplier opportunism (Beckman, Haunschild, & Phillips, 2004; Podolny, 1994). Because, in this scenario, the supplier is the more vulnerable partner, it rationally reduces its opportunistic behavior further over time based on pragmatic reasoning and calculative motivation. In so doing, the supplier can ensure the stability of the relationship with the buyer and enhance the return on its AS.

Scenario where supplier AS < buyer AS. When supplier AS is lower than buyer AS, the buyer faces greater risks. As our combinative view suggests, the supplier employs a forward-looking calculus only when it perceives loyalty commitment from the buyer. Prior literature on credible commitments (Sears, McLeod, Evert, & Payne, 2020; Williamson, 1983) suggests that only credible commitments can mitigate the threat of resource misappropriation. Under low levels of supply market uncertainty, product features and market supply are relatively stable and predictable (Zhou & Poppo, 2010). In this situation, the buyer does not take many risks in investing in AS because the expected return on its investment is relatively secure. As such, the buyer's higher AS is more likely to be perceived as a rational decision reflecting its best economic interests rather than as a signal of loyalty commitment to the supplier (Anderson & Weitz, 1992; Fein & Anderson, 1997). Without the support of the loyalty commitment from the buyer AS, the supplier is unlikely to adopt a long-term orientation and initiate a forward-looking calculus. Rather, the supplier may focus on a short-term calculation by taking advantage of the buyer's AS. Thus, in the case of greater buyer AS, supplier opportunism may increase between Time 1 and Time 2 when supply market uncertainty is low.

Hypothesis 2a. *When supply market uncertainty is low, supplier AS asymmetry (i.e., when supplier AS > buyer AS) will further discourage supplier opportunism, and buyer AS asymmetry (i.e., when buyer AS > supplier AS) will encourage supplier opportunism over time.*

When supply market uncertainty is high, important factors such as product specifications, pricing, and component supply frequently change (McMullen & Shepherd, 2006). The relationship is then subject to rapid and unpredictable changes (Krishnan, Martin, & Noorderhaven, 2006), and decisions must be made on the basis of ambiguous information (Miller, 2007).

Scenario where supplier AS > buyer AS. If supplier AS is higher than buyer AS and a supplier's operating environment is highly uncertain, the supplier may face even more substantial risks. The instability and unpredictability of the supply market weakens the supplier's reliance on calculation because informational requirements are higher for the supplier to evaluate the benefits and costs in times of uncertainty. Meanwhile, high supply market uncertainty strengthens the value of a stable relationship because the supplier must secure resources and support from its existing partners to address the uncertainty (Beckman et al., 2004). Moreover, uncertainty makes it difficult to assess the quality of new partners because a firm cannot easily discern the value of unfamiliar partners (Podolny, 1994). Thus, market uncertainty will cause the supplier to reinforce its existing relationship with the buyer (Beckman et al., 2004), which helps safeguard its AS and further discourages supplier opportunism over time.

Scenario where supplier AS < buyer AS. As articulated in H1, our combinative view suggests that when higher buyer AS signals loyalty commitment, a supplier's transactional calculation becomes relationship-based and forward-looking to decrease its opportunism over time. Transaction-specific investments have important value-creation properties (Scuotto, Caputo, Villasalero, & Del Giudice, 2017; Wathne et al., 2018) but little value for alternative uses (Anderson & Weitz, 1992). When market uncertainty is high, frequent changes in product features and market conditions require the buyer's adaptation to the external environment (Rindfleisch & Heide, 1997; Williamson, 1985). Such adaptation challenges may jeopardize the buyer's capability to realize the value that resides in its greater AS. The buyer's higher AS thus represents a stronger signal of its loyalty commitment to the relationship (Rokkan et al., 2003). Such a stronger commitment provides the supplier with credible assurance of a long-term orientation. In turn, the supplier is more likely to embrace a forward-looking calculation in evaluating the relationship, which then constrains the supplier's propensity to engage in opportunism.

Overall, for both types of AS asymmetry under high market uncertainty, a supplier will reduce its opportunism to an even greater extent over time, making the inverted U-shaped relationship in H1 steeper.

Hypothesis 2b. *When supply market uncertainty is high, the inverted U-shaped relationship between AS asymmetry and reduced supplier opportunism over time will be steeper.*

3.3. The moderating effect of prior exchange history

RET emphasizes the importance of prior exchange history as it is often a precondition of cooperative exchanges (Poppo et al., 2008a). The key argument is that, through ongoing exchanges, relational norms develop between partners that safeguard AS and decrease opportunistic tendencies (e.g., Liu et al., 2018; Rokkan et al., 2003; Wagner & Bode, 2014). We extend this line of research by assessing the moderating role of prior history on AS asymmetry. It is also noteworthy that the literature does not suggest a clear effect of exchange history on trust (Poppo et al., 2008a). We suggest that when prior exchange history is brief, the proposed inverted U-shaped relationship posited in H1 is steeper.

Scenario where supplier AS > buyer AS. As indicated in H1, with higher AS, the supplier has a strong incentive to reduce opportunism. When prior exchange history is brief, the transaction relationship is fairly new, and there are weak relational norms (Poppo et al., 2008b). This weak relational context exacerbates the risk surrounding the transaction. Without relational norms to safeguard a supplier's AS (Elfenbein & Zenger, 2017), the supplier will then have a stronger motivation to constrain its opportunism to protect its own AS.

Scenario where supplier AS < buyer AS. When a buyer makes a greater investment in AS, the buyer faces greater risks. A brief prior history, however, heightens the signaling effect of higher buyer AS. When the prior exchange history is brief, a buyer's experience with a supplier is limited (Wagner & Bode, 2014). A new relationship with a brief history will then operate with weaker relational norms, which are typically developed and reinforced through repeated long-term transactions (Rokkan et al., 2003). Because the buyer's higher AS increases its vulnerability to partner opportunism, its higher level of AS accompanied by weak relational norms signals a particularly credible commitment to the relationship. In this scenario, AS works as a convincing signal inducing a shift in the supplier's calculation from a short-term focus to forward-looking orientation, leading to a further decrease in opportunism.

Hypothesis 3a. *When prior exchange history is brief, the inverted U-shaped relationship between AS asymmetry and reduced supplier opportunism over time will be steeper.*

When prior exchange history is long, supplier AS asymmetry and buyer AS asymmetry may affect the changes in supplier opportunism in opposite ways.

Scenario where supplier AS > buyer AS. When prior exchange history is long, repeated transactions between the buyer and the supplier enable the supplier to capitalize over time on the value-creation properties of its higher AS (Rokkan et al., 2003). A long prior history thus increases the severity of the buyer's potential retaliation against supplier opportunism because a prematurely terminated relationship not only deprives the value of the supplier AS but also inhibits its opportunity to capitalize on the AS in the future. In this situation, the supplier has no interest in jeopardizing the relationship and will reduce its opportunism even more to maintain a stable relationship that enables it to reap long-term benefits from its higher AS.

Scenario where supplier AS < buyer AS. In contrast, we contend that when the prior exchange history is long, buyer AS asymmetry may encourage supplier opportunism. Long exchange histories cultivate relationship norms (Paulssen, Leischnig, Ivens, & Birk, 2016) and support the accumulation of transaction-specific assets (Wathne et al., 2018). In such conditions, higher buyer AS is perceived as internalized and institutionalized in the relationships and thus does not operate as a convincing effort from the buyer. Rather, the supplier may view the higher buyer AS as a perfunctory accumulation of transaction-specific assets through repetitive long-term transactions (Lioukas & Reuer, 2015). When higher buyer AS is no longer perceived as a signal of strong loyalty commitment, the supplier is unlikely to hold a forward-looking calculation. Instead, it tends to take a short-term view and misappropriate buyer AS, leading to increased opportunism over time.

Hypothesis 3b. *When prior exchange history is long, supplier AS asymmetry (i.e., when supplier AS > buyer AS) will discourage supplier opportunism, and buyer AS asymmetry (i.e., when buyer AS > supplier AS) will encourage supplier opportunism over time.*

4. Method

4.1. Data collection

To test our hypotheses, we collected data from both buyer and supplier firms at two separate time points. For the first survey in 2008, we randomly selected an initial list of 1,000 manufacturing firms from the directory provided by a business research company. The company has a close collaborative relationship with the China National Bureau of Statistics (NBS) and has access to the complete list of firms in the Annual Census of Industrial Enterprises conducted by the NBS, which covers all Chinese firms with annual sales of>5 million RMB (i.e., approximately US$800,000). These firms are located in both developed and less developed regions. Our sample firms covered various manufacturing industries and fell within three-digit Chinese Industrial Classification codes (C13-C42). We developed an English version of the survey instrument and used translation/back-translation procedures to ensure the validity and appropriateness of the measures (Bao, Chen, & Zhou, 2012). We pretested the survey with 20 senior purchasing managers and supply managers to assess the content and face validity of the measures and then incorporated their feedback to finalize the questionnaire.

Following best practices (Homburg, Klarmann, Reimann, & Schilke, 2012), we focused on the boundary spanners who we considered the most knowledgeable for providing information about our focal variables. Thus, in our study, the key informants were senior purchasing managers and supplier managers. We worked with a business research company to develop a step-by-step protocol with clear guidelines and learning objectives. The company trained its professional interviewers to conduct the on-site interviews and collect the data. The on-site interviews enabled us to assess the suitability of the respondents and offered the opportunity to clarify questions during the interviews (Zhou & Xu, 2012). The interviewers first contacted the senior purchasing managers by telephone to solicit their cooperation. In the first round, 25 interviewers visited the purchasing managers in person, presented the survey, and collected the completed questionnaire. All informants were assured that the survey was being conducted only for academic research and that their responses would be completely confidential. To mitigate social desirability bias, we asked the purchasing managers to specifically identify their fourth-largest major suppliers and answer specific questions about their exchanges with those suppliers (see Zaheer, McEvily, and Perrone (1998) for a similar approach). At the end of each interview, we asked the manager to recommend a senior counterpart in the supplier firm. The interviewers contacted the supplier managers. Our efforts generated 438 completed surveys from both buyers and suppliers, for an effective response rate of 43.8 percent. After the fieldwork, one of the authors randomly called 40 respondents from buyer firms to confirm whether the interviews had been conducted, and no cheating was found.

Approximately three years later, 20 interviewers contacted the responding buyer firms again to obtain information on their perceptions of supplier opportunism[1]. We chose a 3-year time lag for three reasons: (1) a time lag can reduce the threat of common method bias and reverse causality (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003); (2) the influence of AS asymmetry on changes in supplier opportunism takes time to materialize, and a 3-year lag is an appropriate trade-off between

[1] The data in our study were collected in 2008 and 2011. Given that the institutional environments in China have evolved continuously over the past ten years, we encourage future studies to validate our findings with the most recent data.

constructing a causal inference but not missing the effect (Rindfleisch, Malter, Ganesan, & Moorman, 2008; Schilke, 2014); and (3) a similar time lag has been adopted in previous studies with a similar research design (e.g., Heide et al., 2007; Tekleab, Takeuchi, & Taylor, 2005).

Ultimately, we collected data on 193 matched buyer–supplier dyads at two time points, resulting in a response rate of 44.1 percent (193 out of 438). Our study's sample size and response rate compare quite favorably to those of prior dyadic studies (cf. McEvily et al., 2017, p. 82; Villena & Craighead, 2017, p. 106). On average, the respondents from the buyer firms had worked for 11.39 years in their industries and 7.5 years with their companies. The respondents from the supplier firms had an average industry experience of 9.67 years and a company tenure of 6.24 years, suggesting that our respondents were experienced informants.

We checked for nonresponse bias in two steps. At Time 1, we compared key attributes of the responding and nonresponding buyer firms and found no significant differences in terms of firm age, size, ownership, and annual sales revenues (Wilks's $\Lambda = 0.99$; $F = 1.33$; $p = 0.26$). At Time 2, we examined whether the respondents to the Time 2 survey were representative of the Time 1 respondents and again found no significant differences (Wilks's $\Lambda = 0.98$; $F = 0.96$; $p = 0.47$). These results indicate that nonresponse bias is unlikely to be a major concern.

4.2. Measurements

We adapted our measures from previous studies (please see Appendix 2). Consistent with prior research (Crosno & Dahlstrom, 2008), we asked the buyers to assess supplier opportunism. We adapted the measure of supplier opportunism from Rokkan et al. (2003), using four items to evaluate the extent to which a supplier behaves opportunistically such as taking advantage of holes in contracts, breaking promises to maximize their own benefits, and lying to protect their interests. *Changes in supplier opportunism* were measured as supplier opportunism at Time 2 (T2) minus supplier opportunism at Time 1 (T1). Understanding change or persistence in opportunism is crucial in exploring the dynamic nature of buyer–supplier exchange and providing insights into how to successfully manage interorganizational relationships in the long term (Pellicano et al., 2016). Empirically, while cross-sectional studies analyze the association between AS and opportunism at a given point in time, we examine the impact of AS asymmetry considering the initial level of opportunism. To ensure the same reference point, we also used the standardized scores of supplier opportunism at two time points to measure changes in supplier opportunism and obtained consistent results. Given that the raw scores may come from different respondents, the standardization process can make some adjustments to those scores and help correct for the potential biases in the informant responses and methodological artifacts (Chang, Van Witteloostuijn, Eden, & L., 2010).

We adapted our measurement scales for *buyer AS* and *supplier AS* from Cannon and Perreault (1999) and Zhou and Poppo (2010), who assessed buyers' (suppliers') specific investments in personnel, inventory and distribution, marketing, and capital equipment and tools to accommodate supplier (buyer) demand. Similarly, to ensure the same reference point, we used the standardized scores of buyer AS and supplier AS and obtained consistent results. We adapted the measure of *supply market uncertainty* from Cannon and Perreault (1999) to evaluate environmental changes in the supply market in terms of pricing, product features, and product supply. We measured *prior exchange history* by the number of years that a buyer and supplier had been engaging in economic exchanges (Malhotra & Lumineau, 2011; Poppo et al., 2008a). To prevent skewness, we used the natural logarithm of the number of years.

Control variables. A firm's age likely affects its accumulation of abilities and experience, which influences its ability to detect or engage in opportunistic behaviors (Wang et al., 2013). We therefore controlled for *buyer (supplier) age* as the logarithm of the number of years a buyer (supplier) had been in operation. Since larger firms often possess greater bargaining power (Zhou & Xu, 2012), we controlled for *buyer (supplier) size* as the logarithm of the number of employees in buyer (supplier) firms. As different types of firms differ in their exchange patterns (Handley & Angst, 2015), we controlled for *buyer (supplier) foreign ownership*, with international joint ventures or foreign subsidiaries = 1 and 0 otherwise, and *buyer (supplier) state ownership*, with *state-owned* enterprise = 1 and 0 otherwise.

Buyers and suppliers both operated in 11 industries, so we created 10 dummy variables representing the buyer and supplier industries. We also included *buyer concentration* (i.e., the ratio of a buyer's annual demand for products obtained from the supplier) and *supplier concentration* (i.e., the ratio of the supplier's annual sales of products sold to the buyer) to control for partner importance in an exchange (Rokkan et al., 2003). We controlled for exchange characteristics with *exchange frequency* and governance mechanisms with *explicit contracts*. We measured *exchange frequency* on an 8-point scale by asking how often the buyer placed orders with the supplier (1 = "more than once a day", 8 = "once a year"). We adapted the measure of *explicit contracts* from Lusch and Brown (1996) and Zhou and Poppo (2010) to evaluate the degree to which the contracts specified relevant terms and clauses.

4.3. Reliability and validity

We followed the approach of Anderson and Gerbing (1988) to assess the reliability and validity of our multi-item constructs. We conducted confirmatory factor analyses (CFAs) to estimate two separate measurement models with the information collected from the buyers and suppliers. In the measurement model, we set each item to load on its corresponding underlying constructs and allowed the constructs to correlate. As shown in Appendix 2, the CFA models exhibited satisfactory fit indexes. All standardized factor loadings were highly significant, providing initial support for convergent validity. The values of composite reliability were greater than the recommended 0.70 cutoff value, demonstrating a high level of reliability. The average variance extracted (AVE) for each construct was much higher than the 0.50 cutoff, suggesting that all the constructs share greater variance with their respective indicators than with the error variance. These results indicate sufficient reliability and convergent validity.

We followed the procedure suggested by Fornell and Larcker (1981) to assess the discriminant validity of all the constructs. We verified that the square root of the AVE of each multi-item construct exceeded the correlations with all other constructs. The results show that, for each construct, the variance shared between the construct and its indicators is much higher than the highest shared variance with the other constructs, providing support for discriminant validity. Table 1 presents the correlations and descriptive statistics.

4.4. Analytical approach

To test our hypotheses, we used polynomial regression, which allows for unconstrained specification of focal variables and uses the original component measures to directly examine the relationships (Edwards & Parry, 1993).[2] As shown in Fig. 1, the line running from Point A (supplier AS asymmetry: supplier AS > buyer AS) to Point B (AS symmetry: supplier AS = buyer AS) to Point C (buyer AS asymmetry: supplier AS < buyer AS) reflects *AS asymmetry*. Polynomial regression can help explicate the relationship among buyer AS, supplier AS, and changes in supplier opportunism so that we can obtain the response surface along the AS asymmetry line. In our study, nearly half of the sample (47.66%) has values of buyer AS and supplier AS that differ from each other,

[2] Interested readers may refer to the works of Edwards (Edwards & Cable, 2009; Edwards & Parry, 1993) and other studies (e.g., Jin & Zhou, 2021; Menguc et al., 2016; Villena & Craighead, 2017) to understand the difference between polynomial regression and traditional approaches (e.g., difference score method, spline regression).

Table 1
Descriptive statistics.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Changes in supplier opportunism																			
2. Supplier opportunism at T2	0.71																		
3. Supplier opportunism at T1	−0.61	0.13																	
4. Buyer AS	0.08	0.13	0.04																
5. Supplier AS	0.01	−0.02	−0.04	0.54															
6. Supply market uncertainty	0.14	0.18	0.00	0.27	0.22														
7. Prior exchange history	0.18	0.11	−0.13	0.13	0.32	0.13													
8. Buyer age	0.03	−0.03	−0.08	0.04	0.05	0.09	0.16												
9. Supplier age	0.02	0.05	0.03	0.01	0.09	−0.09	0.39	0.14											
10. Buyer size	0.12	0.03	−0.14	−0.04	0.06	−0.01	0.12	0.21	−0.07										
11. Supplier size	0.01	−0.05	−0.07	−0.05	0.03	−0.04	0.12	0.06	0.31	0.29									
12. Buyer foreign ownership	0.07	0.07	−0.02	0.01	0.15	−0.03	0.14	0.09	0.30	−0.00	0.03								
13. Supplier foreign ownership	0.02	−0.03	−0.06	0.01	0.04	−0.08	−0.19	−0.07	−0.04	−0.02	0.07	0.27							
14. Buyer state ownership	0.20	0.10	−0.17	−0.01	−0.03	0.02	0.12	0.09	−0.07	0.14	0.20	−0.26	−0.07						
15. Supplier state ownership	0.11	0.05	−0.10	−0.11	−0.11	0.04	0.20	0.03	0.20	0.19	0.33	−0.11	0.22	0.37					
16. Buyer concentration	0.14	0.15	−0.04	0.12	0.15	0.11	0.18	0.06	0.13	−0.09	0.01	0.06	−0.09	0.06	−0.04				
17. Supplier concentration	0.17	0.04	−0.20	0.11	0.11	0.07	0.17	−0.03	−0.02	0.16	0.11	−0.01	−0.25	−0.02	0.14	0.11			
18. Exchange frequency	−0.11	−0.18	−0.04	0.00	−0.05	−0.20	−0.32	0.04	−0.07	0.05	0.07	0.01	0.13	−0.01	−0.16	−0.07	−0.05		
19. Explicit contracts	0.18	−0.05	−0.31	0.25	0.22	0.16	0.10	−0.01	−0.10	0.10	0.15	−0.13	0.03	0.14	0.10	−0.17	0.05	0.07	
Min.	−4.50	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	2.30	2.08	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
Max.	4.50	6.50	6.00	6.50	7.00	6.67	22.0	3.95	4.25	9.90	10.3	1.00	1.00	1.00	1.00	1.00	1.00	8.00	7.00
Mean	0.23	2.39	2.16	2.87	3.06	3.94	5.01	2.23	2.05	5.86	5.21	0.30	0.34	0.14	0.08	0.40	0.16	3.84	5.78
SD	1.66	1.33	1.17	1.13	1.12	1.06	3.08	0.55	0.69	1.40	1.26	0.46	0.48	0.35	0.28	0.37	0.19	0.98	1.09
Unit	/	/	/	/	/	/	year	year	year	person	person	/	/	/	/	/	/	/	/

$N = 193$. $|r| > 0.11$ at the 0.10 level; $|r| > 0.13$ at the 0.05 level, $|r| > 0.18$ at the 0.01 level.

which is above the recommended threshold of 10% (Shanock, Baran, Gentry, Pattison, & Heggestad, 2010), justifying the examination of the impact of AS asymmetry.

We regressed the dependent variable (changes in supplier opportunism) against five polynomial terms (buyer AS, supplier AS, their interaction, and squared terms; see Equation (1)). Before creating the higher-order terms, we mean-centered the focal variables to facilitate the interpretation of the results (Edwards & Cable, 2009).

$$\text{Changes in supplier opportunism} = \beta_{a0} + \beta_{a1}\,B + \beta_{a2}\,S + \beta_{a3}\,B^2 + \beta_{a4}\,S^2 + \beta_{a5}\,B * S + \text{Control variables} + \varepsilon_{a1} \text{ (‘B’ denotes buyer AS; ‘S’ denotes supplier AS)} \quad (1)$$

We used the estimated coefficients of the polynomial regression to calculate the slope and curvature of the response surface along the asymmetry line and examined their significance according to the procedures for testing linear combinations of regression coefficients (Aiken & West, 1991), which provided the test for the specified hypotheses. The surface along the asymmetry line can be expressed by substituting the formula for this line ($S = -B$) into Equation (1) (Lado et al., 2008). Therefore, the asymmetry line is characterized by a slope of (β_{a1} - β_{a2}) and a curvature of ($\beta_{a3} + \beta_{a4}$ - β_{a5}). We calculated the standard errors of the coefficients and examined the significance level of the slope and curvature according to established procedures for testing linear combinations of regression coefficients (Aiken & West, 1991). If the curvature does not differ significantly from 0 but the slope does, the asymmetry line is linear. If the curvature is significantly positive ($\beta_{a3} + \beta_{a4}$ - $\beta_{a5} > 0$), the asymmetry line follows a U-shaped function. Conversely, if the curvature is significantly negative ($\beta_{a3} + \beta_{a4}$ - $\beta_{a5} < 0$), the asymmetry line is an inverted U-shape.

We further examined the moderating effects of supply market uncertainty and prior exchange history by inserting the moderators and their interactions with each polynomial term into the model (see Equation (2); Jin & Zhou, 2021). Based on the estimated moderating effects, we calculated two equations for two levels of the moderators: one for the high level of the moderator (mean + one standard deviation (SD)) and the other for the low level of the moderator (mean – one standard deviation). Using the estimated coefficients, we calculated the slope and curvature along the asymmetry lines, as we did for the main effect. The slope and curvature along the asymmetry line can be obtained by substituting the formula ($S = -B$) into a polynomial regression equation (Equation (2)).

$$\text{Changes in supplier opportunism} = \beta_{b0} + \beta_{b1}\,B + \beta_{b2}\,S + \beta_{b3}\,B^2 + \beta_{b4}\,S^2 + \beta_{b5}\,B * S + \beta_{b6}\,M * B + \beta_{b7}\,M{*}S + \beta_{b8}\,M * B^2 + \beta_{b9}\,M * S^2 + \beta_{b10}\,M{*}\,B * S + \beta_{b11} * M + \text{Control variables} + \varepsilon_{b2} \text{ (M denotes the moderator)} \quad (2)$$

5. Results

In Table 2, we present the results of the polynomial regression analyses.[3] To rule out multicollinearity issues, we assessed variance inflation factors (VIFs). As the highest VIF was 6.52—well below the critical level of 10—we do not expect multicollinearity to confound our results. We included the control variables in Model 1. The five polynomial terms (i.e., buyer AS, supplier AS, their interaction, and quadratic terms) and the moderators were added to Model 2 to test the main effect. Following prior studies (Jin & Zhou, 2021; Menguc, Auh, Katsikeas, & Jung, 2016), we performed separate regressions for each moderating effect and added the interactions between the moderator and each polynomial term to Model 3 and Model 4. We considered these polynomial terms to be a block variable such that the results of a polynomial regression are

[3] We conducted a series of endogeneity tests and robustness tests. We report the results of these analyses in Appendix 3.

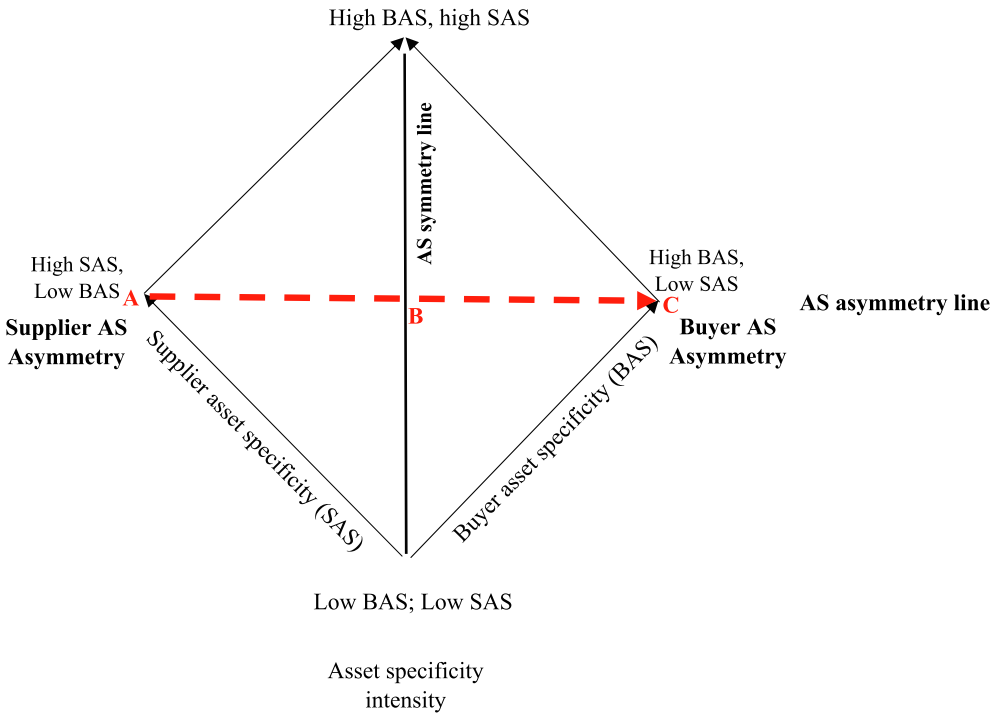

Fig. 1. Asymmetric asset specificity.

significant when these polynomial terms jointly increase model fit (Edwards & Parry, 1993). We used the estimated coefficients to compute the slope and curvature along the asymmetry line in various circumstances (see Table 3). Fig. 2 displays the surface along the AS asymmetry line for ease of interpretation, along which buyer AS and supplier AS differ. We limited the range of the graphs to two standard deviations around the mean scores for buyer AS and supplier AS.

Hypothesis 1 predicts that AS asymmetry has an inverted U-shaped effect on changes in supplier opportunism. As shown in Table 3 (second column), the slope of the surface along the asymmetry line is positive and significant ($\beta = 0.463$; $p = 0.046$), while the curvature is negative ($\beta = -0.331$; $p = 0.015$). Guided by Haans, Pieters, and He (2016), we found that the turning point (buyer AS = 3.569, supplier AS = 2.361) is located well within the data range, indicating the existence of an inverted U-shaped curve. Panel A of Fig. 2 also displays an inverted U-shaped relationship between AS asymmetry and changes in supplier opportunism, in support of H1. Specifically, either supplier AS asymmetry or buyer AS asymmetry reduces the extent of supplier opportunism over time, whereas AS symmetry tends to be associated with a level of supplier opportunism that changes little between T1 and T2.

Hypothesis 2 pertains to the moderating effect of supply market uncertainty. As shown in Table 3 (third column), when supply market uncertainty is low, the slope along the asymmetry line is positive ($\beta = 0.778$; $p = 0.022$), and the curvature is nonsignificant ($\beta = 0.001$; $p = 0.997$). Thus, when supply market uncertainty is low, changes in supplier opportunism increase as one moves along the asymmetry line from supplier AS asymmetry to AS symmetry to high buyer AS asymmetry, in support of H2a. As shown by the dashed line in Fig. 2, Panel B, when buyer AS is lower than supplier AS, supplier opportunism decreases, but supplier opportunism increases when buyer AS is greater than supplier AS.

In contrast, when supply market uncertainty is high (see the fourth column of Table 3), the slope along the asymmetry line is not significant ($\beta = 0.648$; $p = 0.142$), and the curvature is negative ($\beta = -0.621$; $p = 0.008$). The turning point (buyer AS = 3.392, supplier AS = 2.538) falls well within the data range, indicating the existence of an inverted U-shaped relationship. When supply market uncertainty is high, supplier opportunism decreases when buyer AS and supplier AS differ from each other in either direction (solid line, Fig. 2B). Furthermore, we used Haans et al. (2016, p. 1187) to guide our explanation of the moderating effects in the inverted U-shaped relationships. First, as Table 3 shows (see the third and fourth columns), when supplier market uncertainty shifts from low to high, the coefficient of the curvature along the AS asymmetry line becomes more negative, indicating a steepening effect. Second, we calculated the turning points of the inverted U-shaped relationships for the main effect and moderating effect, computed the slopes at a given distance (e.g., ± 1 SD; ± 2 SD), and found that the series of slopes becomes steeper, providing support for H2b. Fig. 2 also shows that the inverted U-shaped curve is steeper (please refer to Panels A and B in Fig. 2).

Hypothesis 3 predicts the moderating effect of prior exchange history. As shown in Table 3 (fifth column), when prior exchange history is brief, the slope along the asymmetry line is nonsignificant ($\beta = 0.155$; $p = 0.626$.) and the curvature is negative ($\beta = -0.579$; $p = 0.009$). We calculated that the turning point and the corresponding levels of buyer AS and supplier AS are 3.004 and 2.926, respectively, again located well within the data range, indicating the existence of the inverted U-shaped relationship. Similarly, as Table 3 shows (see the fifth and sixth columns), when prior exchange history shifts from long to brief, the coefficient of the curvature along the AS asymmetry line becomes more negative, which indicates a steepening effect. We calculated the turning points of the inverted U-shaped relationships for the main effect and the moderating effect, computed the slopes at a given distance (e.g., ± 1 SD; ± 2 SD), and we found that the series of slopes becomes steeper, providing support for H3a. Fig. 2 also shows that the inverted U-shaped curve between AS asymmetry and changes in supplier opportunism is steeper (please refer to Panels A and C in Fig. 2), in support of H3a.

In contrast, when prior exchange history is long (see the sixth column of Table 3), the slope along the asymmetry line is positive ($\beta = 1.389$; $p = 0.000$), and the curvature is nonsignificant ($\beta = -0.269$; $p = 0.345$). Thus, there is a positive relationship between AS asymmetry and changes in supplier opportunism, providing support for H3b. As shown in Fig. 2, Panel C, when buyer AS is lower than supplier AS, the two curves follow the same trend for varying lengths of prior exchange

Table 2
Results of polynomial regression analyses.

	DV = Changes in supplier opportunism							
	Model 1		Model 2		Model 3		Model 4	
Variables	b[a]	se[b]	b	se	b	se	b	se
Buyer age	−0.001	0.222	0.074	0.209	0.047	0.207	0.038	0.205
Supplier age	0.163	0.215	0.227	0.207	0.089	0.207	0.165	0.205
Buyer size	0.110	0.096	0.108	0.090	0.137	0.091	0.074	0.090
Supplier size	−0.273*	0.109	−0.233*	0.104	−0.194†	0.105	−0.244*	0.102
Buyer foreign ownership	0.471	0.291	0.466†	0.276	0.399	0.272	0.443	0.277
Supplier foreign ownership	0.291	0.274	0.528*	0.260	0.567*	0.259	0.595*	0.261
Buyer state ownership	1.087**	0.394	1.016**	0.370	1.027**	0.363	0.935*	0.364
Supplier state ownership	0.333	0.515	0.109	0.490	0.224	0.477	0.301	0.485
Buyer concentration	0.381	0.336	0.216	0.320	0.026	0.321	0.218	0.315
Supplier concentration	1.450*	0.656	1.753**	0.621	1.741**	0.607	2.104**	0.624
Exchange frequency	−0.107	0.133	−0.158	0.125	−0.147	0.122	−0.134	0.123
Explicit contracts	0.250*	0.119	0.333**	0.120	0.265*	0.119	0.274*	0.123
Buyer industry dummies	Included							
Supplier industry dummies	Included							
Supply market uncertainty (SMU)	0.196	0.120	0.117	0.124	0.565**	0.182	0.111	0.123
Prior exchange history (PEH)	0.079	0.258	0.210	0.252	0.229	0.246	0.265	0.355
Buyer AS (BAS)			0.233†	0.131	0.438**	0.148	0.401**	0.148
Supplier AS (SAS)			−0.230	0.143	−0.275†	0.155	−0.371*	0.151
Buyer AS squared (BASS)			−0.245**	0.086	−0.275**	0.093	−0.091	0.116
Supplier AS squared (SASS)			0.217**	0.080	0.267**	0.086	0.142	0.089
Buyer AS * Supplier AS (BASSAS)			0.303**	0.090	0.302**	0.094	0.206†	0.108
SMU * BAS					−0.217	0.153		
SMU * SAS					−0.156	0.159		
SMU * BASS					−0.351**	0.128		
SMU * SASS					−0.018	0.102		
SMU * BASSAS					−0.076	0.102		
PEH * BAS							0.622**	0.230
PEH * SAS							−0.479†	0.248
PEH * BASS							0.075	0.175
PEH * SASS							0.242	0.161
PEH * BASSAS							−0.440**	0.157
R^2[b]	0.298		0.407		0.463		0.452	
$\triangle R^2$[b]			0.109**		0.056*		0.045*	
F	1.970**		2.692**		2.903**		2.779**	

$N = 193$. Significance levels.
† $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$. All tests are two-tailed.
[a] b = unstandardized coefficient.
[b] se = standard error.

Table 3
Slope and curvature of the asset specificity asymmetry Line (DV = Changes in supplier opportunism).

	Main effect	Moderating effect		Moderating effect	
		Supply market uncertainty (Low)	Supply market uncertainty (High)	Prior exchange history (Brief)	Prior exchange history (Long)
Asset specificity asymmetry					
Slope of surface	0.463*(0.232)	0.778*(0.339)	0.648(0.441)	0.155(0.318)	1.389**(0.383)
95% confidence interval	[0.009, 0.917]	[0.114, 1.441]	[−0.217, 1.513]	[−0.468, 0.779]	[0.638, 2.139]
Curvature of surface	−0.331*(0.136)	0.001(0.254)	−0.621**(0.234)	−0.579**(0.222)	0.269(0.286)
95% confidence interval	[−0.597, −0.065]	[−0.498, 0.499]	[-1.079, −0.162]	[-1.014, −0.144]	[−0.292, 0.830]

†$p < 0.10$.
Unstandardized coefficients are reported; standard errors are in parentheses.
* $p < 0.05$.
** $p < 0.01$. All tests are two-tailed.

history. When buyer AS is higher than supplier AS, for low lengths of prior exchange history, supplier opportunism decreases over time (dashed line, Fig. 2C), and the curve becomes steeper; for high lengths of prior exchange, supplier opportunism increases over time (solid line, Fig. 2C), which is consistent with H3a and H3b.

6. Discussion

6.1. Conclusions

Buyer–supplier relationships often involve uneven commitments to AS investment from each partner. However, researchers have seldom examined the implications of such asymmetry, which represents an

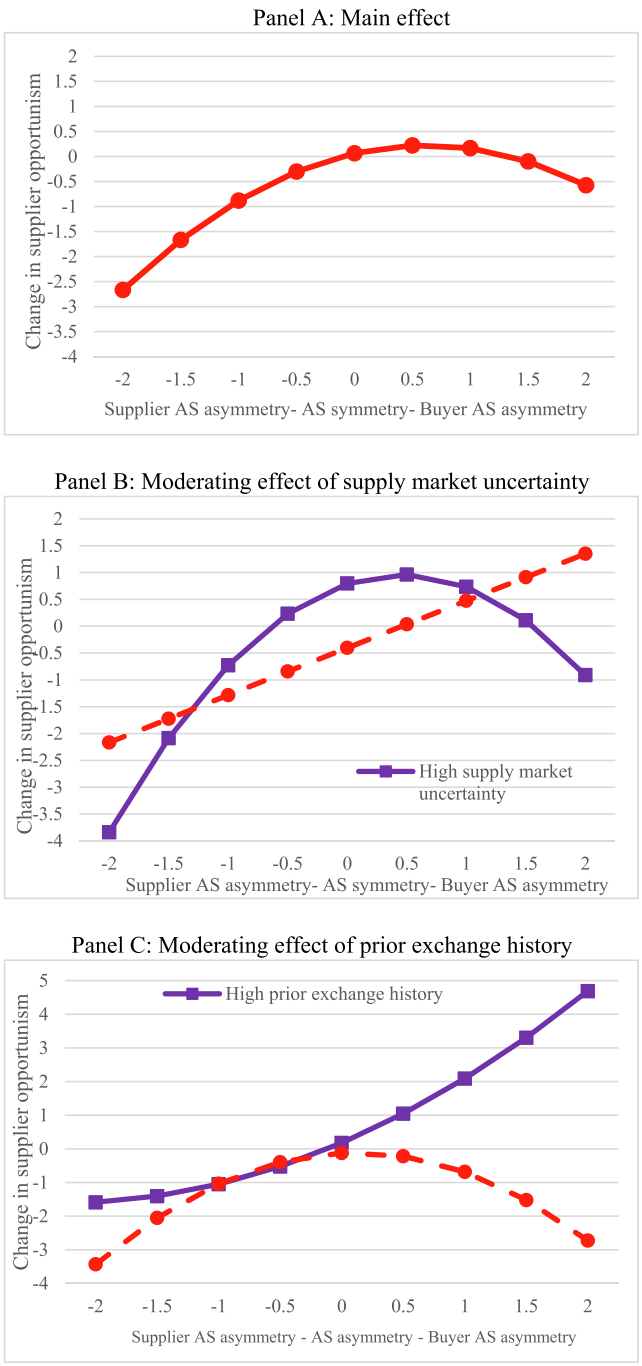

Fig. 2. Response surface along the asset specificity asymmetry line.

important research gap given the longstanding debate between TCE and RET regarding the influence of AS on opportunism. Drawing on the combinative view of TCE and RET, we investigated how AS asymmetry between the buyer and supplier influence changes in supplier opportunism over time. Based on a longitudinal survey of 193 matched buyer–supplier dyads, our empirical analysis shows a curvilinear (inverted U-shaped) relationship between AS asymmetry and changes in supplier opportunism, such that the higher the AS asymmetry between a buyer and a supplier, the more likely the supplier will reduce its opportunism over time. Our results reveal the significant moderating effects of supply market uncertainty and prior exchange history. When supply market uncertainty is high or prior exchange history is brief, the relationship between AS asymmetry and changes in supplier opportunism will become stronger. In contrast, when supply market uncertainty is low or prior exchange history is long, supplier AS asymmetry (i.e., when supplier AS > buyer AS) decreases changes in supplier opportunism, whereas buyer AS asymmetry (i.e., when buyer AS > supplier AS) increases it. This study contributes to the extant literature on the impact of AS in interorganizational relationships. Our findings reveal the ambivalent nature of AS and provide a nuanced understanding of the effect of AS asymmetry on changes in opportunism over time.

6.2. *Theoretical implications*

Our study makes several contributions to the extant literature. First, our study extends the research on AS by developing a dyadic approach to examine AS asymmetry. Assuming mutual AS, most prior researchers have examined AS on the part of either buyers (e.g., Joshi & Stump, 1999) or suppliers (e.g., Walker & Poppo, 1991; Wang et al., 2019) or both (e.g., Jap & Ganesan, 2000; Luo et al., 2009; Rokkan et al., 2003). However, they have largely overlooked its asymmetric nature, leading to recent calls for distinguishing the buyer perspective from the supplier perspective (e.g., Lumineau & Oliveira, 2018). In particular, by differentiating supplier AS asymmetry from buyer AS asymmetry, we are able to show how and which type of asymmetry matters in explaining changes in supplier opportunism. This conceptual and empirical distinction extends the traditional one-sided analysis of buyer–supplier relationships. More broadly, we emphasize the importance for future research of not extrapolating only from the observations of a single party, assuming symmetries between partners, or ignoring potential differences between buyers and suppliers. As such, our study contributes to the nascent but growing body of research on asymmetries in interorganizational relationships (e.g., McEvily et al., 2017; Villena & Craighead, 2017; Wathne et al., 2018).

Second, we address tensions between TCE and RET by developing a combinative view of these two theories to examine the influence of AS asymmetry on changes in supplier opportunism over time with a longitudinal analysis. A few recent studies adopt a longitudinal design to either examine the antecedents and consequences of opportunism (Heide et al., 2007; Lado et al., 2008; Samaha et al., 2011; Seggie et al., 2013) or investigate the consequences of AS (Jap & Anderson, 2003; Wathne et al., 2018). Our study extends this stream of research by studying the effect of AS asymmetry on changes in opportunism over time. As our results show, both buyer AS asymmetry and supplier AS asymmetry lead to a decrease in supplier opportunism over time. With such longitudinal analysis, we avoid comparing the TCE and RET logics directly, as has traditionally been done in prior studies (e.g., Rokkan et al., 2003). Dyer and Singh (1998) emphasize the importance of combining TCE and RET to study interorganizational relationships. According to the combinative view, with the support of the RET logic highlighting that AS signals loyalty commitment, exchange partners extend the TCE transactional calculation to a relationship-based and forward-looking calculus. Specifically, when AS asymmetry is perceived as a credible signal of commitment, it supports a shift toward the calculative reasoning in which it pays to downplay opportunism and to engage in a long-term relationship. Indeed, it encourages the supplier to move from a transactional focus to a long-term orientation in a relationship. As such, our study represents a novel theoretical way to reconcile TCE and RET in examining the impact of AS, opening exciting avenues for future studies. While these two influential theories are traditionally treated as conflicting, we suggest that the theoretical tension between TCE and RET can be reconciled by accounting for the temporal dynamics involved in buyer–supplier relationships.

Third, we contribute to the research on buyer–supplier relationships by highlighting boundary conditions that pertain to the influence of AS asymmetry. We focus on supply market uncertainty and prior exchange history because prior literature on AS highlights the role of these factors in shaping the interactions within an interorganizational relationship (Trada & Goyal, 2020; Xue, Yuan, & Shi, 2016). Our analysis suggests

that supply market uncertainty and prior exchange history are important moderators. Specifically, when supply market uncertainty is high or prior exchange history is brief, the relationship between AS asymmetry and reduced supplier opportunism will become stronger. In contrast, when supply market uncertainty is low or prior exchange history is long, supplier AS asymmetry discourages supplier opportunism over time, whereas buyer AS asymmetry encourages it over time. Our findings provide nuanced insights beyond the traditional examination of unilateral AS (Lumineau & Oliveira, 2018) by identifying the differential moderating mechanisms set in motion by supply market uncertainty and prior exchange history. The novelty of our study lies in analyzing the effect of these moderators on the relationship between AS asymmetry and supplier opportunism. This investigation also extends prior studies that have primarily focused on their individual and direct effects on opportunism (Huo et al., 2018; Xue et al., 2016).

6.3. Managerial implications

Specific investments not only bring substantial benefits to buyer–supplier relationships but also involve considerable risks. Managers should therefore be aware of the existing tension between the potential advantages and disadvantages of AS. Our study provides important insights to management teams regarding this critical dilemma. Managers should consider their own firms' levels of AS relative to those of their partners' firms. Understanding both the level and directionality of AS asymmetry is a first step toward limiting exposure to opportunism.

Moreover, managers should consider the contexts of their relationships. Our results indicate that supplier opportunism is likely to decrease to the greatest extent over time when a supplier has made much more AS than its buyer, and this effect is influenced by the level of supply market uncertainty or the length of prior exchange history. In contrast, purchasing managers should be aware that supplier opportunism is likely to increase over time when buyers invest in AS to a greater extent than their suppliers' firms when supply market uncertainty is low. This risk will also become much higher when there is a long prior exchange history between partners. Such findings highlight the ambivalence of AS and the potential "dark side" of a long exchange history. We warn managers specifically that repeated exchanges with a supplier may backfire and become a liability that encourages suppliers to take advantage of buyer AS.

6.4. Limitations

In this study, we took a first step toward developing a longitudinal analysis of the influence of AS asymmetry on opportunism. However, we acknowledge that our choice of a 3-year lag between the first and second surveys may have resulted in survivor bias toward buyer–supplier relationships that have survived at least three years. We encourage researchers to examine our insights by testing both at more than two time points and with a range of time lags between each time point.

We also acknowledge that with a 3-year lag, the person in charge of purchasing might have changed between the first and second surveys because of employee turnover or job rotation. On the one hand, this is a classical challenge for studies with similar designs (e.g., Bakker & Knoben, 2015; Kumar, Jones, Venkatesan, & Leone, 2011; Palmatier, Houston, Dant, & Grewal, 2013). On the other hand, a large body of literature (e.g., Anand, Manz, & Glick, 1998; Walsh & Ungson, 1991) suggests that there is continuing organizational memory at the department level because of organizational structures, routines, embedded systems, internal databases, records and archives.

6.5. Future research streams

Addressing our research question involved overcoming several issues, which are traditionally associated with a relatively low response rate: (1) collecting data from a matched sample of buyers and suppliers, (2) collecting data at two time points, and (3) collecting data related to sensitive issues (i.e., opportunism). Addressing this combination of practical challenges required some trade-offs in our data collection. In particular, consistent with a large number of prior empirical studies (e.g., Handley & Benton, 2012; Heide et al., 2007; Rokkan et al., 2003; Wang et al., 2013; Wang, Zhang, Wang, & Sheng, 2016), we focused on supplier opportunism because in today's market, it is often buyers that initiate exchanges, making the suppression of supplier opportunism particularly salient (Handley, de Jong, & Benton, 2019). However, given the specific incentives and motivations that drive each party involved in a buyer–supplier relationship (McEvily et al., 2017), we encourage future research to collect information on opportunism from both sides and to analyze how buyer opportunism is influenced by AS asymmetry.

In line with most previous studies of opportunism (see Lumineau & Oliveira, 2020 for a recent review), we used survey research to measure perceptions of opportunism. We see many opportunities for the community of scholars interested in opportunism to employ alternative methodologies and objective indicators to capture opportunistic behaviors and, more broadly, to further analyze the micro-foundations of interorganizational exchanges.

Furthermore, we simply conceptualized a broad, overall level of AS and did not distinguish different types of AS. In contrast to physical assets, knowledge/intangible assets are difficult to observe and evaluate (De Vita et al., 2011). We encourage future research to adopt a holistic approach to consider the differences among various dimensions of AS, such as specific knowledge asset or intangible resources, and to examine their differential influences on partner opportunism over time. Finally, we conducted our study in China. As the Chinese setting tends to emphasize trust in managing business relationships (Child & Möllering, 2003), future research in other institutional settings and regions would be valuable for confirming or modifying our findings.

CRediT authorship contribution statement

Fabrice Lumineau: Conceptualization, Writing – original draft, Writing – review & editing, Writing – review & editing, Writing – original draft, Methodology, Conceptualization, Formal analysis. **Jason Lu Jin:** . **Shibin Sheng:** Conceptualization, Writing – original draft, Writing – review & editing. **Kevin Zheng Zhou:** .

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. Summary of the Logic Underlying the Hypotheses

	Supplier AS > Buyer AS Increased supplier vulnerability	**Supplier AS < Buyer AS** Increased buyer vulnerability
Main effect		
	Fear of retaliation;	Buyer has little choice; supplier has a higher propensity for

(*continued on next page*)

(*continued*)

		Supplier AS > Buyer AS Increased supplier vulnerability	**Supplier AS < Buyer AS** Increased buyer vulnerability
	TCE logic Rational calculation for instrumental gains	Calculative motivation to preserve the stability of the relationship.	opportunism.
	RET logic Loyalty commitment and development of relational norms	AS asymmetry signals strong commitment to the relationship, which reduces its own opportunism and reassures exchange partners.	AS asymmetry signals strong commitment to the relationship, which reduces its own opportunism and reassures exchange partners.
	Hypothesis 1	Both TCE and RET suggest reduced supplier opportunism.	**Traditional view**: TCE's prediction is contradictory to RET's. **Our combinative view**: Given the loyalty commitment signaled by higher buyer AS, the supplier expects continued interactions; such long-term and forward-looking calculation reduces its opportunism. As such, TCE is integrated with RET, which suggests a reduction of supplier opportunism.
Moderating effect of supply market uncertainty	**Low uncertainty**	Allows the supplier to make a more accurate assessment of the risks and payoffs. Easier for the buyer to retaliate against supplier opportunism by choosing new partners in a stable market.	Given the stable environment, the buyer likely secures a return on its AS, so its higher AS does not work as a strong signal of loyalty commitment. Without the loyalty-commitment signal, the long-term calculation effect no longer holds.
	Hypothesis 2a	Discourages supplier opportunism	Encourages supplier opportunism
	High uncertainty	The unpredictability undermines the calculative side of decision making.An enduring relationship is more beneficial for the supplier with regard to dealing with uncertainty.	Because high uncertainty makes it difficult for the buyer to profit from its greater AS, its higher AS represents a salient signal of its commitment to the relationship, which supports the supplier's long-term calculation. The supplier will then restrain its appropriation of the buyer AS.
	Hypothesis 2b	Further discourages supplier opportunism	Further discourages supplier opportunism
Moderating effect of prior exchange history	**Brief history**	Weak relational norms. Instrumental reasoning dominates the relationship.	Given the short history, higher buyer AS represents a particularly strong signal of loyalty commitment, which supports the long-term calculation.
	Hypothesis 3a	Further discourages supplier opportunism	Further discourages supplier opportunism
	Long history	A long history intensifies the severity of the buyer's potential retaliation against the supplier's opportunism.	Higher buyer AS is perceived as perfunctory rather than as a strong signal of loyalty commitment, which decreases the long-term calculation.
	Hypothesis 3b	Discourages supplier opportunism	Encourages supplier opportunism

Appendix 2. Construct Measurement and Validity Assessment

Information source: buyer

Construct	Item	SFL	CR	AVE
Supplier opportunism (Time 1)	On occasion, this supplier lies about certain things in order to protect its interests. (1 = strongly disagree; 7 = strongly agree).	0.72	0.92	0.86
	This supplier sometimes promises to do things without actually doing them later.	0.85		
	This supplier will try to take advantage of "holes" in our contract to further its own interests.	0.94		
	This supplier sometimes uses unexpected events to extract concessions from our firm.	0.95		
Supplier opportunism (Time 2)	On occasion, this supplier lies about certain things in order to protect its interests. (1 = strongly disagree; 7 = strongly agree).	0.90	0.96	0.87
	This supplier sometimes promises to do things without actually doing them later.	0.93		
	This supplier will try to take advantage of "holes" in our contract to further its own interests.	0.95		
	This supplier sometimes uses unexpected events to extract concessions from our firm.	0.95		
Buyer asset specificity (Time 1)	You may have made investments in time, energy, and/or money specifically to accommodate this supplier and its products. These investments would be lost if your firm switched to another supplier. Please indicate the extent to which your firm has made investments or changes *specifically to accommodate* this supplier (1 = none, 7 = a great deal):		0.89	0.68
	Personnel	0.65		
	Inventory and distribution.	0.87		
	Marketing activity.	0.95		
	Capital equipment and tools.	0.80		

Model fit: χ^2///df = 5.62, $p = 0.00$, confirmatory fit index (CFI) = 0.90, incremental fit index (IFI) = 0.90, standardized root mean square residual (SRMR) = 0.08.

Information source: supplier.

Construct	Item	SFL	CR	AVE
Supplier asset specificity (Time 1)	You may have made investments in time, energy, and/or money specifically to accommodate this buyer and its products. These investments would be lost if your firm switched to another buyer. Please indicate the extent to which your firm has made investments or changes *specifically to accommodate* this buyer (1 = none, 7 = a great deal):		0.91	0.71
	Personnel.	0.82		

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(*continued*)

Construct	Item	SFL	CR	AVE
	Inventory and distribution.	0.88		
	Marketing activity.	0.88		
	Capital equipment and tools.	0.79		
Supply market uncertainty (Time 1)	In this supply market, the following factors are changing (1 = very infrequently, 7 = very frequently)		0.85	0.65
	Pricing	0.75		
	Product feature and specifications	0.83		
	Product supply	0.84		
Explicit contracts(Time 1)	We have formal agreements that precisely specify (1 = strongly disagree; 7 = strongly agree)The responsibility of each party	0.94	0.95	0.83
	How each party is to perform	0.96		
	What will happen in the case unplanned events occur	0.91		
	How disagreements will be resolved	0.83		

Model fit: χ^2//df = 4.76, $p = 0.00$, CFI = 0.91, IFI = 0.91, SRMR = 0.07.

SFL = standardized factor loading; CR = composite reliability; AVE = average variance extracted.

Appendix 3. Endogeneity and robustness tests

Endogeneity issue and control function approach. AS might be endogenous. Therefore, we conducted an endogeneity analysis using the two-step control function approach (Petrin & Train, 2010; Wooldridge, 2010), which is widely used in survey-based and buyer–supplier relationship studies (e.g., Sharma, Kumar, Yan, Borah, & Adhikary, 2019; Wang, Lee, Fang, & Ma, 2017). This approach uses exogenous variables meeting both the relevance requirements (i.e., correlated with buyer and supplier AS in our case) and the exclusion restriction (i.e., uncorrelated with the error term or does not have direct effects on the dependent variable; Petrin & Train, 2010; Wooldridge, 2010).

Researchers have rarely examined the drivers of buyer or supplier AS (see Bensaou & Anderson, 1999 for an exception and De Vita et al., 2011 for a review). In our context, we suggest that government support may help firms obtain scarce resources and increase a focal firm's motivation to make more specific investments in the relationship (Sheng, Zhou, & Li, 2011), yet it is unlikely to directly influence changes in supplier opportunism. We adapted a two-item scale from Bai, Sheng, and Li (2016) to measure buyer (supplier) government support: (1) To what degree can you rely on the government to support your company's interests? and (2) To what degree can you rely on the government to protect your company's interests? (Cronbach's α = 0.96/0.98 for the buyer/supplier firms). Empirically, buyer government support correlates with buyer AS ($r = 0.502$, $p = 0.000$), and supplier government support is associated with supplier AS ($r = 0.374$, $p = 0.000$). However, they are not correlated with changes in supplier opportunism ($r = 0.093$, $p = 0.197$; $r = 0.103$, $p = 0.154$). The Anderson-Rubin test indicates that the error term in changes in supplier opportunism is not significantly associated with the instrumental variables ($F = 0.808$, $p = 0.447$), thus confirming the requirement of exclusion restriction. Specifically, the correlation between buyer government support and the error term is −0.083 ($p = 0.251$); the correlation between supplier government support and the error term is −0.090 ($p = 0.211$). Thus, buyer government support and supplier government support could serve as valid exclusion variables. In the first stage of the control function approach, we regressed buyer and supplier AS against the respective exclusion variables and relevant control variables in the model. In the second stage, we estimated the regressions with the residuals from the first stage as the predictors to control for endogeneity bias. In this regard, buyer AS and supplier AS as explanatory variables no longer correlate with the error term in the regression equation. Including the residuals in the model enabled us to establish an independence assumption between buyer/supplier AS and the error term and thus enabled us to address the endogeneity concerns. The results of the second-stage model were consistent with previous results, except that when market uncertainty is low, the slope along the AS asymmetry line is positive but not significant. Moreover, the results indicate that the Durbin-Wu-Hausman test is not significant (β Buyer AS $_{\text{residual}} = 0.158$, $p = 0.661$; β Supplier AS $_{\text{residual}} = 0.682$, $p = 0.252$), suggesting that endogeneity is not a major issue.

Sample selection bias and the Heckman two-stage model. Because we collected the data at two separate time points, some observations in T1 may not enter the final sample in T2, leading to nonrandomness issues and potential sample selection bias. To address this concern, we used the Heckman two-stage method suggested by Wolfolds and Siegel (2019). In the first stage, we constructed a probit model and used the instrumental variable and relevant controls to estimate the presence of an observation at T2. Specifically, we considered the *averaged government support* for a buyer–supplier dyad as the instrumental variable. With more government support, buyers and suppliers are more likely to acquire valuable resources from the government and make more investments to maintain their relationships for a longer time (Sheng et al., 2011), but government support is unlikely to directly influence changes in opportunistic behavior over time. The Anderson-Rubin test indicates that the error term in changes in supplier opportunism is not significantly associated with the instrumental variable ($F = 1.602$, $p = 0.207$), indicating that averaged government support could serve as a valid instrumental variable.

Based on the first-stage regression model, we obtained a selection parameter—the inverse Mills ratio—which accounts for the potential sample selection bias. We included the inverse Mills ratio in the second stage and used polynomial regression to test the hypotheses, obtaining consistent results.

Robustness analysis. First, we used industry-adjusted buyer and supplier AS in the model and retested the hypotheses. The industry-adjusted buyer (supplier) AS is obtained by subtracting the average industry buyer (supplier) AS from the original buyer (supplier) AS. We calculated the slope and curvature of the asymmetry line under varying circumstances based on the coefficient of each polynomial term. The results remained highly consistent. Furthermore, since buyer and supplier AS may change over time, we conducted a robustness check to include buyer AS and supplier AS at T2 in the model and retested the hypotheses. The results were highly consistent.

Second, we followed previous studies to employ the spline method (e.g., Roh et al., 2013; Villena & Craighead, 2017). We created a new variable, *buyer AS asymmetry*, and recoded it to equal buyer AS – supplier AS if buyer AS > supplier AS and 0 otherwise. Similarly, we created another variable, *supplier AS asymmetry*, and recoded it to equal supplier AS – buyer AS if supplier AS > buyer AS and 0 otherwise. We assessed the effects of buyer AS asymmetry and supplier AS asymmetry on changes in supplier opportunism. The results indicate that supplier AS asymmetry ($\beta = -0.428$; $p = 0.004$) and buyer AS asymmetry ($\beta = -0.433$; $p = 0.041$) are both negatively related to changes in supplier opportunism. When supplier AS asymmetry changes from high (high supplier AS and low buyer AS) to low (supplier AS <= buyer AS), changes in supplier opportunism will increase. When buyer AS asymmetry changes from low (supplier AS >= buyer AS) to high (high buyer AS and low supplier AS), changes in supplier opportunism will decrease. Thus, when shifting from (a) high supplier AS and low buyer AS to (b) supplier AS = buyer AS to (c) low supplier AS and high buyer AS,

changes in supplier opportunism first increase and then decrease, demonstrating an inverted U-shaped effect of AS asymmetry. The results are highly consistent with our main analysis. All the results are available upon request.

References

Achrol, R. S., & Gundlach, G. T. (1999). Legal and social safeguards against opportunism in exchange. *Journal of Retailing, 75*, 107–124.

Aiken, L. S., & West, S. G. (1991). *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, CA: Sage Publications.

Anand, V., Manz, C. C., & Glick, W. H. (1998). An organizational memory approach to information management. *Academy of Management Review, 23*, 796–809.

Anderson, E., & Weitz, B. (1992). The use of pledges to build and sustain commitment in distribution channels. *Journal of Marketing Research, 29*, 18–34.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*, 411–423.

Artz, K. W., & Brush, T. H. (2000). Asset specificity, uncertainty and relational norms: An examination of coordination costs in collaborative strategic alliances. *Journal of Management Studies, 41*, 337–362.

Bai, X., Sheng, S., & Li, J. J. (2016). Contract governance and buyer–supplier conflict: The moderating role of institutions. *Journal of Operations Management, 41*, 12–24.

Bakker, R. M., & Knoben, J. (2015). Built to last or meant to end: Intertemporal choice in strategic alliance portfolios. *Organization Science, 26*, 256–276.

Bao, Y., Chen, X., & Zhou, K. Z. (2012). 'External learning, market dynamics, and radical innovation: Evidence from China's high-tech firms. *Journal of Business Research, 65*, 1226–1233.

Beckman, C. M., Haunschild, P. R., & Phillips, D. J. (2004). Friends or strangers? Firm-specific uncertainty, market uncertainty, and network partner selection. *Organization science, 15*, 259–275.

Bensaou, M., & Anderson, E. (1999). Buyer-supplier relations in industrial markets: When do buyers risk making idiosyncratic investments? *Organization Science, 10*, 460–481.

Cannon, J. P., & Perreault, W. D., Jr (1999). Buyer-seller relationships in business markets. *Journal of Marketing Research, 36*, 439–460.

Cao, Z., Li, Y., Jayaram, J., Liu, Y., & Lumineau, F. (2018). A meta-analysis of the exchange hazards–interfirm governance relationship: An informal institutions perspective. *Journal of International Business Studies, 49*, 303–323.

Chang, S. J., Van Witteloostuijn, A., & Eden, L. (2010). From the editors: Common method variance in international business research. *Journal of International Business Studies, 41*, 178–184.

Child, J., & Möllering, G. (2003). Contextual confidence and active trust development in the Chinese business environment. *Organization Science, 14*, 69–80.

Coase, R. H. (1937). The nature of the firm. *Economica, 4*, 386–405.

Crosno, J. L., & Dahlstrom, R. (2008). A meta-analytic review of opportunism in exchange relationships. *Journal of the Academy of Marketing Science, 36*, 191–201.

Crosno, J. L., & Dahlstrom, R. F. (2016). An empirical investigation of bilateral investments and opportunism in buyer-supplier relationships. *Journal of Marketing Channels, 23*, 146–156.

Cuypers, I. R., Hennart, J. F., Silverman, B. S., & Ertug, G. (2021). Transaction cost theory: Past progress, current challenges, and suggestions for the future. *Academy of Management Annals, 15*, 111–150.

Das, T. (2004). Time-span and risk of partner opportunism in strategic alliances. *Journal of Managerial Psychology, 19*, 744–759.

De Vita, G., Tekaya, A., & Wang, C. L. (2011). The many faces of asset specificity: A critical review of key theoretical perspectives. *International Journal of Management Reviews, 13*, 329–348.

Delbufalo, E. (2021). Asset specificity and relationship performance: A meta-analysis over three decades. *Journal of Business Research, 134*, 105–121.

Dyer, J. H. (1996). Does governance matter? Keiretsu alliances and asset specificity as sources of Japanese competitive advantage. *Organization Science, 7*, 649–666.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*, 660–679.

Dyer, J. H., Singh, H., & Hesterly, W. S. (2018). The relational view revisited: A dynamic perspective on value creation and value capture. *Strategic Management Journal, 39*, 3140–3162.

Edwards, J. R., & Cable, D. M. (2009). The value of value congruence. *Journal of Applied Psychology, 94*, 654–677.

Edwards, J. R., & Parry, M. E. (1993). On the use of polynomial regression equations as an alternative to difference scores in organizational research. *Academy of Management Journal, 36*, 1577–1613.

Elfenbein, D. W., & Zenger, T. (2017). Creating and capturing value in repeated exchange relationships: The second paradox of embeddedness. *Organization Science, 28*, 894–914.

Fein, A. J., & Anderson, E. (1997). Patterns of credible commitments: Territory and brand selectivity in industrial distribution channels. *Journal of Marketing, 61*, 19–34.

Fiske, S. T., & Taylor, S. E. (2008). *Social Cognition: From Brains to Culture*. New York: McGraw-Hill.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*, 39–50.

Graebner, M. E., Lumineau, F., & Fudge Kamal, D. (2020). Unrequited: Asymmetry in interorganizational trust. *Strategic Organization, 18*, 362–374.

Gundlach, G. T., Achrol, R. S., & Mentzer, J. T. (1995). The structure of commitment in exchange. *Journal of Marketing, 59*, 78–92.

Haans, R. F., Pieters, C., & He, Z. L. (2016). Thinking about U: Theorizing and testing U- and inverted U-shaped relationships in strategy research. *Strategic Management Journal, 37*, 1177–1195.

Handley, S. M., & Angst, C. M. (2015). The impact of culture on the relationship between governance and opportunism in outsourcing relationships. *Strategic Management Journal, 36*, 1412–1434.

Handley, S. M., & Benton, W., Jr (2012). The influence of exchange hazards and power on opportunism in outsourcing relationships. *Journal of Operations Management, 30*, 55–68.

Handley, S. M., de Jong, J., & Benton, W. C., Jr. (2019). How service provider dependence perceptions moderate the power-opportunism relationship with professional services. *Production and Operations Management, 28*, 1692–1715.

Heide, J. B., & John, G. (1990). Alliances in industrial purchasing: The determinants of joint action in buyer-supplier relationships. *Journal of Marketing Research, 27*, 24–36.

Heide, J. B., & Miner, A. S. (1992). The shadow of the future: Effects of anticipated interaction and frequency of contact on buyer-seller cooperation. *Academy of Management Journal, 35*, 265–291.

Heide, J. B., Wathne, K. H., & Rokkan, A. I. (2007). Interfirm monitoring, social contracts, and relationship outcomes. *Journal of Marketing Research, 44*, 425–433.

Homburg, C., Klarmann, M., Reimann, M., & Schilke, O. (2012). What drives key informant accuracy? *Journal of Marketing Research, 49*, 594–608.

Huo, B., Ye, Y., Zhao, X., Wei, J., & Hua, Z. (2018). Environmental uncertainty, specific assets, and opportunism in 3PL relationships: A transaction cost economics perspective. *International Journal of Production Economics, 203*, 154–163.

Jap, S. D., & Anderson, E. (2003). Safeguarding interorganizational performance and continuity under ex post opportunism. *Management Science, 49*, 1684–1701.

Jap, S. D., & Ganesan, S. (2000). Control mechanisms and the relationship life cycle: Implications for safeguarding specific investments and developing commitment. *Journal of Marketing Research, 37*, 227–245.

Jin, J. L., & Zhou, K. Z. (2021). Is ambidextrous innovation strategy beneficial to international joint venture performance? Evidence from China. *Journal of International Marketing, 29*, 1–21.

Joshi, A. W., & Stump, R. L. (1999). The contingent effect of specific asset investments on joint action in manufacturer-supplier relationships: An empirical test of the moderating role of reciprocal asset investments, uncertainty, and trust. *Journal of the Academy of Marketing Science, 27*, 291–305.

Kaufmann, P. J., & Dant, R. P. (1992). The dimensions of commercial exchange. *Marketing Letters, 3*, 171–185.

Klein, B., Crawford, R. G., & Alchian, A. A. (1978). Vertical integration, appropriable rents, and the competitive contracting process. *Journal of Law and Economics, 21*, 297–326.

Krishnan, R., Martin, X., & Noorderhaven, N. G. (2006). When does trust matter to alliance performance? *Academy of Management Journal, 49*, 894–917.

Kumar, V., Jones, E., Venkatesan, R., & Leone, R. P. (2011). Is market orientation a source of sustainable competitive advantage or simply the cost of competing? *Journal of Marketing, 75*, 16–30.

Lado, A. A., Dant, R. R., & Tekleab, A. G. (2008). Trust-opportunism paradox, relationalism, and performance in interfirm relationships: Evidence from the retail industry. *Strategic Management Journal, 29*, 401–423.

Lioukas, C., & Reuer, J. (2015). Isolating trust outcomes from exchange relationships: Social exchange and learning benefits of prior ties in alliances. *Academy of Management Journal, 58*, 1826–1847.

Liu, Y., Luo, Y., & Liu, T. (2009). Governing buyer–supplier relationships through transactional and relational mechanisms: Evidence from China. *Journal of Operations Management, 27*, 294–309.

Liu, Y. H. S., Deligonul, S., Cavusgil, E., & Chiou, J. S. (2018). Always trust in old friends? Effects of reciprocity in bilateral asset specificity on trust in international B2B partnerships. *Journal of Business Research, 90*, 171–185.

Lui, S. S., Wong, Y. Y., & Liu, W. (2009). Asset specificity roles in interfirm cooperation: Reducing opportunistic behavior or increasing cooperative behavior? *Journal of Business Research, 62*, 1214–1219.

Lumineau, F., & Oliveira, N. (2018). A pluralistic perspective to overcome major blind spots in research on interorganizational relationships. *Academy of Management Annals, 12*, 440–465.

Lumineau, F., & Oliveira, N. (2020). Reinvigorating the study of opportunism in supply chain management. *Journal of Supply Chain Management, 56*, 73–87.

Luo, Y., Liu, Y., & Xue, J. (2009). Relationship investment and channel performance: An analysis of mediating forces. *Journal of Management Studies, 46*, 1113–1137.

Luo, Y., Liu, Y., Yang, Q., Maksimov, V., & Hou, J. (2015). Improving performance and reducing cost in buyer–supplier relationships: The role of justice in curtailing opportunism. *Journal of Business Research, 68*, 607–615.

Lusch, R. F., & Brown, J. R. (1996). Interdependency, contracting, and relational behavior in marketing channels. *Journal of Marketing, 60*, 19–38.

Macneil, I. (1980). *The New Social Contract: An Inquiry into Modern Contractual Relations*. New Haven, CT: Yale University Press.

Malhotra, D., & Lumineau, F. (2011). Trust and collaboration in the aftermath of conflict: The effects of contract structure. *Academy of Management Journal, 54*, 981–998.

Martin, G., Gözübüyük, R., & Becerra, M. (2015). Interlocks and firm performance: The role of uncertainty in the directorate interlock-performance relationship. *Strategic Management Journal, 36*, 235–253.

McEvily, B., Zaheer, A., & Kamal, D. K. F. (2017). Mutual and exclusive: Dyadic sources of trust in interorganizational exchange. *Organization Science, 28*, 74–92.
McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review, 31*, 132–152.
Menguc, B., Auh, S., Katsikeas, C. S., & Jung, Y. S. (2016). When does (mis) fit in customer orientation matter for frontline employees' job satisfaction and performance? *Journal of Marketing, 80*, 65–83.
Miller, K. D. (2007). Risk and rationality in entrepreneurial processes. *Strategic Entrepreneurship Journal, 1*, 57–74.
Molina, J., & Dyer, J. H. (1999). On the relational view/response to relational view commentary. *Academy of Management Review, 24*, 184–186.
Palmatier, R. W., Houston, M. B., Dant, R. P., & Grewal, D. (2013). Relationship velocity: Toward a theory of relationship dynamics. *Journal of Marketing, 77*, 13–30.
Paulssen, M., Leischnig, A., Ivens, B. S., & Birk, M. M. (2016). Relational norms in customer–company relationships: Net and configurational effects. *Journal of Business Research, 69*, 5866–5874.
Pellicano, M., Perano, M., & Casali, L. (2016). The Enterprise Relational View (ERV): Exploring future in strategic management. In *Governing Business Systems: Theories and Challenges for Systems Thinking in Practice-4th Business Systems Laboratory International Symposium Book of Abstracts* (pp. 228–233). Business Systems Laboratory.
Penney, C. R., & Combs, J. G. (2020). A transaction cost perspective of alliance portfolio diversity. *Journal of Management Studies, 57*, 1073–1105.
Petrin, A., & Train, K. (2010). A control function approach to endogeneity in consumer choice models. *Journal of Marketing Research, 47*, 3–13.
Podolny, J. M. (1994). Market uncertainty and the social character of economic exchange. *Administrative Science Quarterly, 39*, 458–483.
Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*, 879–903.
Poppo, L., Zhou, K. Z., & Li, J. J. (2016). When can you trust "trust"? Calculative trust, relational trust, and supplier performance. *Strategic Management Journal, 37*, 724–741.
Poppo, L., Zhou, K. Z., & Ryu, S. (2008a). Alternative origins to interorganizational trust: An interdependence perspective on the shadow of the past and the shadow of the future. *Organization Science, 19*, 39–55.
Poppo, L., Zhou, K. Z., & Zenger, T. (2008b). Examining the conditional limits of relational governance: Specialized assets, performance ambiguity, and long-standing ties. *Journal of Management Studies, 45*, 1195–1216.
Provan, K. G., & Skinner, S. J. (1989). Interorganizational dependence and control as predictors of opportunism in dealer-supplier relations. *Academy of Management Journal, 32*, 202–212.
Rindfleisch, A., & Heide, J. B. (1997). Transaction cost analysis: Past, present, and future applications. *Journal of Marketing*, 30–54.
Rindfleisch, A., Malter, A. J., Ganesan, S., & Moorman, C. (2008). Cross-sectional versus longitudinal survey research: Concepts, findings, and guidelines. *Journal of Marketing Research, 45*, 261–279.
Roh, J. A., Whipple, J. M., & Boyer, K. K. (2013). The effect of single rater bias in multi-stakeholder research: A methodological evaluation of buyer-supplier relationships. *Production and Operations Management, 22*, 711–725.
Rokkan, A. I., Heide, J. B., & Wathne, K. H. (2003). Specific investments in marketing relationships: Expropriation and bonding effects. *Journal of Marketing Research, 40*, 210–224.
Samaha, S. A., Palmatier, R. W., & Dant, R. P. (2011). Poisoning relationships: Perceived unfairness in channels of distribution. *Journal of Marketing, 75*, 99–117.
Schilke, O. (2014). On the contingent value of dynamic capabilities for competitive advantage: The nonlinear moderating effect of environmental dynamism. *Strategic Management Journal, 35*, 179–203.
Schilke, O., & Cook, K. S. (2013). A cross-level process theory of trust development in interorganizational relationships. *Strategic Organization, 11*, 281–303.
Scuotto, V., Caputo, F., Villasalero, M., & Del Giudice, M. (2017). A multiple buyer–supplier relationship in the context of SMEs' digital supply chain management. *Production Planning & Control, 28*, 1378–1388.
Sears, J. B., McLeod, M. S., Evert, R. E., & Payne, G. T. (2020). Alleviating concerns of misappropriation in corporate venture capital: Creating credible commitments and calculative trust. *Strategic Organization*. forthcoming.
Seggie, S. H., Griffith, D. A., & Jap, S. D. (2013). Passive and active opportunism in interorganizational exchange. *Journal of Marketing, 77*, 73–90.
Shanock, L., Baran, B., Gentry, W., Pattison, S., & Heggestad, E. (2010). Polynomial regression with response surface analysis: A powerful approach for examining moderation and overcoming limitations of difference scores. *Journal of Business and Psychology, 25*, 543–554.
Sharma, A., Kumar, V., Yan, J., Borah, S. B., & Adhikary, A. (2019). Understanding the structural characteristics of a firm's whole buyer–supplier network and its impact on international business performance. *Journal of International Business Studies, 50*, 365–392.
Sheng, S., Zhou, K. Z., & Li, J. J. (2011). The effects of business and political ties on firm performance: Evidence from China. *Journal of Marketing, 75*, 1–15.
Skowronski, K., Benton, W. C., Jr., & Hill, J. A. (2020). Perceived supplier opportunism in outsourcing relationships in emerging economies. *Journal of Operations Management, 66*, 989–1023.
Tekleab, A. G., Takeuchi, R., & Taylor, M. S. (2005). Extending the chain of relationships among organizational justice, social exchange, and employee reactions: The role of contract violations. *Academy of Management Journal, 48*, 146–157.
Trada, S., & Goyal, V. (2020). Tripartite role of communications in channel relationships: Mitigating exchange hazards, reducing opportunism, and curtailing its ill effects on relationship performance. *Industrial Marketing Management, 85*, 281–294.
Villena, V. H., & Craighead, C. W. (2017). On the same page? How asymmetric buyer–supplier relationships affect opportunism and performance. *Production and Operations Management, 26*, 491–508.
Wagner, S. M., & Bode, C. (2014). Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing. *Journal of Operations Management, 32*, 65–78.
Walker, G., & Poppo, L. (1991). Profit centers, single-source suppliers, and transaction costs. *Administrative Science Quarterly, 36*, 66–87.
Walsh, J. P., & Ungson, G. R. (1991). Organizational memory. *Academy of Management Review, 16*, 57–91.
Wang, L., Jiang, F., Li, J., Motohashi, K., & Zheng, X. (2019). The contingent effects of asset specificity, contract specificity, and trust on offshore relationship performance. *Journal of Business Research, 99*, 338–349.
Wang, M., Zhang, Q., Wang, Y., & Sheng, S. (2016). Governing local supplier opportunism in China: Moderating role of institutional forces. *Journal of Operations Management, 46*, 84–94.
Wang, L., Zhang, C., Li, J., Huo, D., & Fan, X. (2020). The influence of unilateral supplier transaction-specific investments on international buyer opportunism: Empirical findings from local suppliers in China. *International Marketing Review, 37*, 213–239.
Wang, Q., Li, J. J., Ross, W. T., & Craighead, C. W. (2013). The interplay of drivers and deterrents of opportunism in buyer–supplier relationships. *Journal of the Academy of Marketing Science, 41*, 111–131.
Wang, Y., Lee, J., Fang, E., & Ma, S. (2017). Project customization and the supplier revenue–cost dilemmas: The critical roles of supplier–customer coordination. *Journal of Marketing, 81*, 136–154.
Wathne, K. H., Heide, J. B., Mooi, E. A., & Kumar, A. (2018). Relationship governance dynamics: The roles of partner selection efforts and mutual investments. *Journal of Marketing Research, 55*, 704–721.
Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *American Economic Review, 83*, 519–540.
Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. New York: Free Press.
Wolfolds, S. E., & Siegel, J. (2019). Misaccounting for endogeneity: The peril of relying on the Heckman two-step method without a valid instrument. *Strategic Management Journal, 40*, 432–462.
Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (2nd ed.). Cambridge, MA: MIT Press.
Wu, L. Y., Chen, K. Y., Chen, P. Y., & Tung, P. J. (2016). Revisiting associations between specific asset investment and loyal and cooperative behavior: A complexity theory perspective. *Journal of Business Research, 69*, 3545–3552.
Xue, J., Yuan, H., & Shi, B. (2016). Investigating partners' opportunistic behavior in joint ventures in China: The role of transaction costs and relational exchanges. *Journal of Business Research, 69*, 6067–6078.
Zaheer, A., McEvily, B., & Perrone, V. (1998). Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance. *Organization Science, 9*, 141–159.
Zaheer, A., & Venkatraman, N. (1995). Relational governance as an interorganizational strategy: An empirical test of the role of trust in economic exchange. *Strategic Management Journal, 16*, 373–392.
Zhou, K. Z., & Poppo, L. (2010). Exchange hazards, relational reliability, and contracts in China: The contingent role of legal enforceability. *Journal of International Business Studies, 41*, 1–21.
Zhou, K. Z., & Xu, D. (2012). How foreign firms curtail local supplier opportunism in China: Detailed contracts, centralized control, and relational governance. *Journal of International Business Studies, 43*, 677–692.
Zhou, K. Z., Zhang, Q., Sheng, S., Xie, E., & Bao, Y. (2014). Are relational ties always good for knowledge acquisition? Buyer–supplier exchanges in China. *Journal of Operations Management, 32*, 88–98.

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