

THE EFFECTIVENESS OF CONTRACTUAL AND TRUST-BASED GOVERNANCE IN STRATEGIC ALLIANCES UNDER BEHAVIORAL AND ENVIRONMENTAL UNCERTAINTY

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Research summary: We examine the interplay of behavioral and environmental uncertainty in shaping the effectiveness of two key governance mechanisms used by strategic alliances: contractual and trust-based governance. We develop and test hypotheses, using a meta-analytic dataset encompassing over 15,000 strategic alliances across 82 independent samples. We find that contractual governance works best under low to moderate levels of behavioral uncertainty and moderate to high levels of environmental uncertainty, while it is detrimental to alliance performance when both types of uncertainty are low or high. Trust-based governance is most effective at high levels of behavioral uncertainty and low levels of environmental uncertainty. It suffers a large loss of usefulness at high behavioral uncertainty as environmental uncertainty increases.

Managerial summary: Strategic alliances allow firms to gain greater efficiency and create value. Yet, many such alliances fail because they are not able to deal with the twin challenges posed by behavioral and environmental uncertainty. Findings from our meta-analysis imply that under conditions of high behavioral uncertainty and low-to-moderate levels of environmental uncertainty, the use of trust-based governance alongside contractual governance might enhance the latter's effectiveness. The combined effectiveness of contractual and trust-based governance under high levels of both behavioral and environmental uncertainty is not obvious. When both behavioral and environmental uncertainty are high, contractual governance hurts alliance performance while trust-based governance does not function at its best either. Under these conditions, it might be better for firms to turn to hierarchy or vertical integration. Copyright © 2015 John Wiley & Sons, Ltd.

INTRODUCTION

Strategic alliances have risen in prominence over the past two decades, allowing firms to gain greater

efficiency and create value (Faems *et al.*, 2008). These benefits notwithstanding, many strategic alliances fail because they are not able to deal with the twin challenges posed by behavioral and environmental uncertainty (Gulati and Singh, 1998; Sutcliffe and Zaheer, 1998). Behavioral uncertainty is the uncertainty that arises because of the possibility of “strategic non-disclosure, disguise, or distortion of information” by the exchange partners (Williamson, 1985: 57). Certain transaction

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attributes increase the potential for opportunistic gains from behavioral uncertainty. Environmental uncertainty, the difficulty in predicting external changes outside the control of the alliance, is a key factor underlying coordination difficulties that are “innocent” and “non-strategic” (Williamson, 1985: 57). Coordination failures may arise even if the potential for opportunistic gains from behavioral uncertainty is low (Gulati, Lawrence, and Puranam, 2005).

Alliance success under conditions of behavioral and environmental uncertainty relies heavily on effective alliance governance. Consequently, much research has been devoted to understanding the efficacy of the governance mechanisms that can be crafted by strategic alliance partners. Our understanding of these governance mechanisms is guided by two dominant theoretical lenses (Faems *et al.*, 2008)—transaction cost theory (Williamson, 1975) and relational theory (Dyer and Singh, 1998). Scholars relying on transaction cost theory maintain that contractual governance—the crafting of detailed contracts covering as many contingencies as possible—safeguards against opportunism concerns and facilitates coordinated response to the environment (Mayer and Argyres, 2004). Inspired by Macaulay (1963), scholars following the relational perspective propose that trust-based governance is also capable of dealing with the challenges posed by behavioral and environmental uncertainty (Gulati, 1995; Uzzi, 1997). In the case of trust-based governance, partners govern their relationship informally, based on the bilateral expectation that the other will act in a way that serves, or at least is not inimical to, one’s interests (McEvily, Perrone, and Zaheer, 2003).

There has been considerable scholarly debate on whether contractual governance and trust-based governance substitute or complement each other in strategic alliances (e.g., Faems *et al.*, 2008; Lui and Ngo, 2004; Luo, 2002b; Puranam and Vanneste, 2009). But while scholars have been debating *whether* contractual and trust-based governance substitute or complement each other, the fact that contractual and trust-based governance might have *differential effects* under behavioral and environmental uncertainty is yet to gain attention. In this spirit, we set out to assess whether the two governance mechanisms are more effective in dealing with one type of uncertainty and less effective in dealing with the other. We test our predictions on the collectivity of empirical evidence, using a

meta-analysis of more than two decades of research. In meta-analysis, the abundance of accumulated empirical research across thousands of alliances is taken into account, weighed, and corrected for artifacts to obtain an accurate estimate of the effectiveness of the two governance mechanisms under behavioral and environmental uncertainty.

THEORY AND HYPOTHESES

Contractual and trust-based governance

Contracts are legally binding agreements between two parties with each promising to perform particular actions in the future. Contracts can be simple or complex. Simple contracts are suitable for standard exchanges that are akin to market transactions (e.g., a standard purchase order for commodities) (Williamson, 1979). Elaborate contracts serve as a form of quasi-integration by establishing an inter-firm authority relation (Stinchcombe, 1985). We define *contractual governance* as the use of an extensive set of terms and clauses specifying mutual rights and obligations with legal and private sanctions for noncompliance (cf. Klein, 1980, 1996; Wuyts and Geyskens, 2005). As we argue below, if both behavioral and environmental uncertainty are moderate and manageable, the details laid out in the contract can effectively curb opportunistic appropriation and provide well-coordinated responses to the environment. Contractual governance safeguards against opportunism by constraining partner behavior through extensive monitoring and the threat of relationship termination. Similarly, by providing structure for information flow, contractual governance allows for coordinated response to shifts in the environment.

Trust-based governance relies on the bilateral expectation held by the exchange partners that the other will act in a way that serves, or at least is not inimical to, one’s interests (Barney and Hansen, 1994). Following Mayer, Davis, and Schoorman (1995) and considering the majority of research on trust in the context of strategic alliances, we focus on two types of trust: integrity-based trust and benevolence-based trust. In the case of integrity-based trust, exchange partners are confident that neither side will engage in behavior that is self-interested in nature because such behavior would violate a set of principles that the partners find acceptable (Mayer *et al.*, 1995: 719). Integrity-based trust includes aspects such as a

belief that the partner has a strong sense of fairness and that its actions are congruent with its words. In the case of benevolence-based trust, partners trust each other that they will not behave in a self-interested manner because they believe that the other “wants to do good . . . aside from an egocentric profit motive” (Mayer *et al.*, 1995: 718). Whether partners will take each other’s best interest into account when making decisions is considered one of the vital aspects of benevolence-based trust in the inter-organizational context (e.g., Carson *et al.*, 2003).¹

Trust-based governance is not founded on naïve faith, where partners unconditionally take for granted the integrity and benevolence of their counterpart (McEvily *et al.*, 2003). On the contrary, firms intermittently probe their counterparts to see if they can maintain their expectations about the other’s intentions, and therefore, their level of trust (Schilke and Cook, 2015).² This information includes the partners’ reputation and their knowledge of each other’s behavior under prior instances that involved vulnerability (Dirks and Ferrin, 2001; Jones and George, 1998). However, rather than acquiring *all* relevant information to make a comprehensive, rational decision, the partners use the information that is available. The gaps in information are what necessitate “leaps of faith” in the face of uncertainties. Our position echoes that of McEvily *et al.* (2003:93) “while our view of trust includes an element of calculated expectation, it also encompasses a noncalculative component, recognizing the bounded rationality . . . of organizational life.”

¹ Mayer, Davis, and Schoorman (1995) also consider competence-based trust, which reflects the confidence in a partner’s ability to perform certain tasks. However, considering that only 16 percent of all the studies examining the trust-performance relationship accounted for competence-based trust, and hence, it is not widely represented in this stream of research, we did not consider this form of trust. Much of the inter-organizational trust research arose in response to Williamson’s (1991) notion of opportunism. As opportunism emphasizes actors’ “self-interest seeking with guile,” much of the inter-organizational trust research responded through emphasizing the inherent integrity and benevolent aspects of the trustee’s behavior more than his or her competence, which may or may not include guile.

² As explained by McEvily *et al.* (2003: 93), trust and trustworthiness coevolve. When there is a match between trust and trustworthiness (i.e., when trustworthy partners are trusted), equilibrium is obtained. When there is a mismatch between trust and trustworthiness, trust will increase or decrease until an equilibrium is reached over time. For example, in the case where untrustworthy partners are trusted, negative consequences are likely; trust will decline; and over time, an equilibrium will be reached where untrustworthy actors will be distrusted.

As we argue below, the bilateral expectation that partners will not exploit each other’s vulnerabilities in the presence of trust-based governance inculcates shared norms among exchange partners. However, the very same qualities of trust that reduce the need to monitor each other under behavioral uncertainty are likely to introduce systematic biases that can result in flawed judgments and partners failing to respond appropriately to environmental changes.

Behavioral and environmental uncertainty

Williamson refers to *behavioral uncertainty* as the uncertainty that arises because of the possibility of “strategic non-disclosure, disguise, or distortion of information” by the exchange partners (Williamson, 1985: 57). In the presence of behavioral uncertainty, there is a potential for opportunistic gains as either partner may misrepresent its capability, may renege on promises previously agreed on, or may intentionally fail to perform its responsibilities (Hoetker and Mellewigt, 2009; Mayer and Nickerson, 2005). Although this feature of the alliance context is never completely absent, its magnitude varies considerably among alliances. Specifically, the potential for opportunistic gains in the presence of behavioral uncertainty is higher in alliances belonging to R&D-intensive industries, where monitoring and evaluating intellectual activity is difficult (Ulset, 1996), and in alliances belonging to service industries, where monitoring performance is hard, owing to inseparability of production and consumption (Eramilli and Rao, 1993).³

Environmental uncertainty results from changes in the environment that are difficult to predict, such as volatility in the product market (Wholey and Brittain, 1989) as well as regulatory changes (Sutcliffe and Zaheer, 1998). Williamson (1985: 57) refers to environmental uncertainty as “innocent” and “non-strategic.” Because environmental uncertainty requires speedy and responsive decisions from alliance partners (Huber, Miller, and Glick, 1990), it is vital that partners engage in timely sharing and accurate processing of new information about the environment and that they agree on appropriate responses to environmental changes. Coordination difficulties related to the disagreements and

³ In the remainder of this article, we will use “the degree/level of behavioral uncertainty” as a shortcut for “the potential for opportunistic gains resulting from the transaction attributes in the presence of behavioral uncertainty.”

misunderstandings arising from the complexity of organizing interdependent activities and managing information flows among alliance partners are very likely in inter-organizational relationships exposed to environmental uncertainty (Gulati *et al.*, 2005).

The effectiveness of contractual governance under behavioral and environmental uncertainty

Contractual governance, behavioral uncertainty, and alliance performance

The potential for opportunistic gains from behavioral uncertainty is high in certain types of alliances (e.g., R&D alliances, service alliances). Writing down binding contractual terms has the obvious benefit that the court can be used to impose penalties if partners fail to adhere to contractual terms (Klein, 1980). Through clearly articulated clauses, contracts reduce partners' ability and willingness to compromise on their performance or to opportunistically appropriate each other's proprietary resources (Wuyts and Geyskens, 2005). Yet, there is a real risk that court-enforced contracts are not honored as they tend to be incomplete (Klein 1980, 1996). Hence, contracts in every transaction essentially adopt a combination of "court-enforced written terms" and "privately-enforced unwritten terms," which Klein (1980) describes as the "self-enforcing range" of contracts. Partners are able to enforce the unwritten terms through private sanctions, which can take the form of threat of relationship termination in the event of opportunistic behavior by a partner.

If uncertainty regarding the partner's possible opportunism is so high that it exceeds the range where contracts are self-enforcing, contractual governance tends to fail as even private enforcement may be incapable of restraining opportunistic behavior. For example, for alliances in R&D-intensive industries where patents only offer imperfect protection of proprietary technology and unintended leakage of technology is inevitable, the written terms of the contract may not be able to offer complete protection (Mayer and Nickerson, 2005). Even private enforcement through threat of relationship termination may not be able to deter opportunistic behavior if partners value the benefits of quickly outlearning one another in an alliance more than the costs of relationship termination. The same is the case for alliances in industries where it is difficult to measure performance, such as service

industries. Tying effort to performance may not be straightforward, and thus, may not be effectively covered in a contractual agreement, leaving ample room for intentionally failing to perform (Mayer and Nickerson, 2005). Hence, if the potential for opportunistic gains from behavioral uncertainty is very high, contractual governance fails to improve alliance performance as it can neither align incentives of partners nor function as an effective hierarchical control mechanism (Williamson, 1991).

Contractual governance may not be effective under low behavioral uncertainty either. Because alliance performance is determined by discriminatingly aligning the type of the contract (simple versus sophisticated) with the type of transaction, simple contracts that are less costly would suffice for transactions that are relatively straightforward. This is the case when behavioral uncertainty is low. The costs of negotiating and writing detailed contracts may not be justified if partners can assess each other's behavior without much difficulty (Williamson, 1979: 239). Hence, investing in detailed contracts when behavioral uncertainty is low can hamper alliance performance.

Collectively, these arguments suggest that contractual governance is most effective if behavioral uncertainty is moderate, and is least effective if behavioral uncertainty is low or high. At moderate levels, behavioral uncertainty is low enough to be well within the self-enforcing range of contracts and high enough to justify the costs of writing detailed contracts, while at very low or very high levels of behavioral uncertainty, the costs and lack of flexibility imposed by contracts may not outweigh their benefits. Hence:

Hypothesis 1: The effect of contractual governance on alliance performance under behavioral uncertainty follows an inverted-U shape. Contractual governance is most effective at moderate levels of behavioral uncertainty, but its effect declines at low and high levels of behavioral uncertainty and may even become detrimental at extreme levels.

Contractual governance, environmental uncertainty, and alliance performance

Contractual governance brings about effective coordination, which is useful under environmental uncertainty. Detailed contracts lay out a specific division of labor and operating procedures for the "integration of dispersed activities" (Faems *et al.*,

2008: 1054). The contingency clauses written into the contractual terms delineate actions to be taken under different environmental conditions. In addition to planning for contingencies, contracts also build in communication terms into the agreement, which determine how partners plan to communicate with one another under different environmental conditions (Argyres and Mayer, 2007).

Appropriate communication structures are crucial under environmental uncertainty, which requires partners to not only share information in a timely manner, but also to agree quickly on the appropriate response. Such disciplined synchronization of activities reduces conflicts between partners and allows them to agree on the best course of action when having to adapt to new circumstances, thus improving alliance performance (John and Weitz, 1988). Recent theoretical research supports the latter contention by suggesting that carefully crafted contracts are effective in enabling coordination (Argyres and Mayer, 2007).

Adopting contractual governance under very high environmental uncertainty, however, may hamper rather than help alliance performance. Very high environmental uncertainty introduces information overload (Mintzberg, 1978) and information unfamiliarity (Park and Sheath, 1975). Hence, providing speedy and well-informed responses may become difficult. Contractual governance may not be effective under such conditions as bounded rationality limits the number of contingencies that can be accounted for in a contract. As a result, inappropriate response to the environment and a subsequent damage to alliance performance are a distinct possibility.

Under low environmental uncertainty, however, the need to provide speedy responses to unexpected environmental shifts will be less of a concern and the associated need to account for unforeseen contingencies in the contract will also be less. Hence, if the environment is stable, the costs of writing detailed contracts are not justified as it diverts effort and resources that could have otherwise been usefully deployed in improving alliance performance. We therefore hypothesize:

Hypothesis 2: The effect of contractual governance on alliance performance under environmental uncertainty follows an inverted-U shape. Contractual governance is most effective at moderate levels of environmental uncertainty, but its effect declines at low and high levels of

environmental uncertainty and may even become detrimental at extreme levels.

So far, we have theorized about the moderating effect of behavioral uncertainty on the “contractual governance—alliance performance” relationship, keeping environmental uncertainty constant, and that of environmental uncertainty, keeping behavioral uncertainty constant. However, behavioral and environmental uncertainty may not always operate in isolation in strategic alliances; instead, they can co-occur. The transaction cost literature has yet to explicitly consider the effect of the interplay between behavioral and environmental uncertainty on the “contractual governance—alliance performance” relationship, but based on Williamson (1985), we theorize that if environmental uncertainty is high, the potential for opportunistic appropriation resulting from behavioral uncertainty becomes more prominent as environmental uncertainty increases the potential for limited transparency. If exogenous disturbances are high, it is difficult to attribute the cause of under-performance to internal or external forces. Courts or other third party appeals may not be effective as unexpected exogenous disturbances might render the original terms of the contract irrelevant/invalid (Williamson, 1985: 59). Hence, high environmental uncertainty is likely to aggravate the detrimental effect of contractual governance under high levels of behavioral uncertainty.

Hypothesis 3: If environmental uncertainty is high, then there will be a sharper downturn of the inverted-U shaped relationship between contractual governance and alliance performance under behavioral uncertainty (H1) than if environmental uncertainty is low.

The effectiveness of trust-based governance under behavioral and environmental uncertainty⁴

Trust-based governance, behavioral uncertainty, and alliance performance

The potential⁴ for opportunistic gains inherent in some situations (e.g., in R&D and service

⁴ Our arguments concerning the effectiveness of trust-based governance are premised on a close alignment of trust with trustworthiness. The degree and speed of alignment between trust and trustworthiness affects the effectiveness of trust-based governance. We revisit this issue in the Discussion section.

alliances) introduces equivocality into evaluations of the counterparty's behavior, which may exacerbate a firm's tendency to protect its own resources and proprietary knowledge at the risk of hampering the synergistic benefits of the alliance relationship (Kale, Singh, and Perlmutter, 2000). Trust-based governance can counteract such problems with a reliance on each partner's confidence that the other will not abuse its vulnerability (Barney and Hansen, 1994), even in situations with an inherent potential for opportunistic gains. This makes each partner more likely to respect the boundaries of the other's resources and knowledge (Krishnan *et al.*, 2006). Trust-based governance therefore alleviates apprehensions regarding the sharing of valuable information (Dyer and Chu, 2003). Further, trust-based governance encourages partners to interpret each other's ambiguous actions constructively (McEvily *et al.*, 2003). Trust, therefore, reduces the need to use safeguarding to cope with behavioral uncertainty through the bilateral expectation that one will not take advantage of the other even when opportunistic gains to be had in a situation are high.

In sum, in the face of behavioral uncertainty, trust is all the more essential for alliance performance as it facilitates the open sharing of resources and information among partners (Dyer and Chu, 2003), thereby encouraging the partners to cooperate with each other without constraints (Balliet and Van Lange, 2013; Curseu and Schruijer, 2010). This allows them to channel their efforts productively toward improving alliance performance rather than toward monitoring each other's behavior (Dirks and Ferrin, 2001; McEvily *et al.*, 2003). In contrast, we expect trust-based governance to have a weaker effect on alliance performance under conditions of low behavioral uncertainty as the scope for equivocal actions, appropriation of resources, and misinterpretations is likely to be lower as well. Hence, the benefits derived from trust-based governance are lower.⁵

Hypothesis 4: The positive effect of trust-based governance on alliance performance is stronger if behavioral uncertainty is high than if it is low.

⁵ Since we do not expect trust-based governance to hurt alliance performance when behavioral uncertainty is low, we only theorize that the effect of trust-based governance on alliance performance is likely to be more or less positive when behavioral uncertainty is high or low.

Trust-based governance, environmental uncertainty, and alliance performance

Recent research on the dark side of trust-based governance argues that the very same qualities of trust-based governance that reduce the need to invest in costly monitoring under behavioral uncertainty are likely to introduce cognitive limitations under environmental uncertainty, thereby compromising the partners' responses to the environment (e.g., Gargiulo and Ertug, 2006; Krishnan *et al.*, 2006). First, scholars have acknowledged the heuristic quality of trust (McEvily *et al.*, 2003; Uzzi, 1997). Like all cognitive heuristics, trust-based governance facilitates decision-making, but it may also introduce systematic biases that can result in judgments that are flawed (Krishnan *et al.*, 2006).

Specifically, because trust-based governance is based on the bilateral expectation that each partner will take the other's best interest into account, partners may not verify each other's information about the environment (Gargiulo and Ertug, 2006; McEvily *et al.*, 2003). This may limit the cross-fertilization of views required for crafting well-informed responses to the environment. Hence, partners may end up choosing suboptimal responses to environmental changes that may hamper alliance performance. Second, research suggests that trust-based governance can even result in partners becoming outright insensitive to environmental shifts. Because cultivating trust costs time, partners may have apprehensions about responses to environmental change that would require major changes. Their fear of jeopardizing their relationship may encourage them to prefer "inaction over action and status quo over any alternatives" (Kahneman and Lovallo, 1993: 18). Thus, trust-based governance can even result in partners failing to provide any kind of response to environmental changes (Krishnan *et al.*, 2006; McEvily *et al.*, 2003), thereby hurting alliance performance. Therefore:

Hypothesis 5: As environmental uncertainty increases, the positive relationship between trust-based governance and alliance performance first weakens, and then, under conditions of extreme environmental uncertainty, may even turn negative.

As we argued earlier, trust-based governance is highly effective when behavioral uncertainty is high as it is based on the bilateral expectation that

one will not exploit the vulnerabilities of the other. However, even as trust-based governance reduces the need to invest in costly monitoring, it may fail to contribute positively to alliance performance if the cognitive limitations generated by trust interfere with providing optimal responses to the environment. Environmental uncertainty requires partners to engage in timely sharing and accurate processing of information about the environment (Huber *et al.*, 1990). Research on the dark side of trust suggests that, under environmental uncertainty, partners in a trusting relationship might engage in specialized search by independently processing different pieces of information about the environment. Such division of labor in processing information about the environment can introduce cognitive limits and lead to biased responses to the environment (Krishnan *et al.*, 2006). Similarly, in their discussion of the dark side of trust, McEvily *et al.* (2003) argue that intimate knowledge of each other's competencies results in partners restricting their search efforts locally rather than expanding their efforts more broadly. Hence, as environmental uncertainty increases, the pressure to respond quickly to the environment can easily sway partners in a trusting relationship into accepting information from each other at face value rather than verifying the accuracy of the information provided by the other pertaining to the environment. Effective mitigation of the need to monitor each other under behavioral uncertainty will be of little value if partners are unable to respond optimally to the environment. Hence, as environmental uncertainty increases, it is likely to become harder for the partners to leverage the benefits derived from trust-based governance under high behavioral uncertainty. We therefore hypothesize:

Hypothesis 6: The positive effect of trust-based governance on alliance performance under high behavioral uncertainty will weaken as environmental uncertainty increases.

METHOD

Literature search

We define *strategic alliances* as extended cooperative agreements intended to exchange, share, or co-develop products, technologies, or services (Gulati, 1998). We combined multiple data collection strategies to identify empirical studies on

strategic alliances as input for our meta-analysis. First, we searched six computerized databases (ABI/Inform Global, EconLit, JSTOR, Kluwer Online, Elsevier Science Direct, and Social Science Citation Index) using the search term "alliance(s)." Second, we performed manual searches of leading journals in management and marketing from 1980 through early 2015, including *Academy of Management Journal*, *Administrative Science Quarterly*, *International Journal of Research in Marketing*, *Journal of International Business Studies*, *Journal of Management*, *Journal of Marketing*, *Journal of Marketing Research*, *Management Science*, *Marketing Science*, *Organization Science*, *Organization Studies*, and *Strategic Management Journal*. Third, we performed Internet searches using standard search engines. Finally, we examined the reference sections of all the articles retrieved and of prior narrative reviews (e.g., Gulati, 1995) to identify any studies that we might have overlooked.

We determined the eligibility of studies for our meta-analysis on the basis of two criteria. First, a study had to report on (1) one or more relationships between one of the two governance mechanisms and alliance performance, or (2) the interrelationship between the two governance mechanisms. Second, a study had to report the sample size and a correlation coefficient or another outcome statistic (e.g., univariate F , t , χ^2) that allows the computation of a correlation coefficient using the formulas provided by Hunter and Schmidt (1990: 272).

Effect size coding

Two judges (the first author and an independent coder) independently categorized all harvested effect sizes on the basis of the construct operationalizations. Interrater agreement was 98 percent. We resolved remaining discrepancies via discussion. This resulted in a data set of 82 studies (84 independent samples) of which four were unpublished, involving 15,377 alliances and spanning 20 years. Removal of two outliers—details of which are provided in the meta-analytic procedure below—resulted in a final data set of 80 studies (82 independent samples) involving 15,111 alliances spanning 20 years. Seventy-five empirical studies, involving 14,000 alliances, contained data on the relationship between at least one of the two governance mechanisms and alliance performance. Of these 75 studies, seven studies involving 1,183 alliances also contained data on the interrelationship between the

two governance mechanisms, while seven other studies involving 1,111 alliances only contained data on the interrelationship between the two governance mechanisms. Studies included in the meta-analysis are listed in Appendix S1.

Measurement of alliance performance, contractual governance, and trust-based governance

Alliance performance measures include objective measures of financial performance, subjective measures of goal attainment, financial performance, and/or overall performance of the alliance (e.g., Parkhe, 1993; Luo, 2002b).⁶ *Contractual governance* measures capture the extent to which the contract governing the alliance is detailed, includes an extensive set of terms, clauses, and procedures, and specifies responses to a wide range of contingencies (e.g., Lui and Ngo, 2004). *Trust-based governance* measures capture the extent to which an alliance is governed informally based on the bilateral expectation that the partner acts in a way that serves, or at least is not inimical to, one's interests, and include integrity-based measures (e.g., Zaheer, McEvily, & Perrone, 1998) as well as benevolence-based measures (e.g., Carson *et al.*, 2003). We categorized all trust measures on the basis of the percentage of items that measured (1) integrity-based trust, (2) benevolence-based trust, (3) "overall" trust, and (4) another type of trust (e.g., competence-based trust) or a more blended relational construct. We only incorporated those trust measures that captured at least 75 percent of integrity- and/or benevolence-based items (which was the case for 95% of the studies in our meta-analysis) or that captured "overall" trust in the relationship using a single, global item (which was the case for 5% of the studies in our meta-analysis).

Measurement of uncertainty moderators

It is notable that only a few primary studies in our sample have explicitly tested for the effectiveness of the two governance modes under uncertainty

⁶ We excluded studies on alliance survival and duration as a proxy for alliance performance. Survival fails to distinguish between alliance termination that is due to failure versus due to the alliance completing the predefined duration. Duration may not reflect performance but the presence of barriers to exiting the alliance (Gulati, 1998).

through interaction effects.⁷ To test our hypotheses on the effectiveness of the two governance mechanisms under behavioral and environmental uncertainty, we therefore relate the retrieved study-level correlations between the governance mechanisms and alliance performance to *study-level* measures of behavioral and environmental uncertainty, such as the proportion of alliances in each sample that faces high versus low levels of uncertainty. We use a unit-weighted composite measure to operationalize each type of uncertainty. Appendix S2 provides descriptive statistics.

The main pros of using composite measures are that they "can be used to summarize complex or multi-dimensional issues," "provide the big picture," and "can be easier to interpret than trying to find a trend in many indicators" (Saisana, Saltelli, and Tarantola, 2005: 307). The most debated problem in using composite measures is the difficulty in determining the relative importance of the indicators (Cox *et al.*, 1992; Saisana *et al.*, 2005), an issue that we address in our Robustness section.

Behavioral uncertainty

We measure the potential for opportunistic gains from behavioral uncertainty using two indicators: (1) the proportion of alliances in a study sample that are in R&D-intensive industries, and (2) the proportion of alliances in a study sample that are in service industries.

Proportion of alliances in R&D-intensive industries. Across disciplines, scholars have argued that the potential for opportunistic gains is likely to be high in alliances belonging to R&D-intensive industries. Ulset (1996: 65)

⁷ The effectiveness of trust-based governance under environmental uncertainty has been investigated most frequently, that is, by four studies, yielding highly inconsistent results: two studies report a positive interaction effect between trust and environmental uncertainty (Luo, 2002a; Ryu, Min, and Zushi, 2008), one a negative interaction effect (Krishnan *et al.*, 2006), and one an insignificant effect (Aulakh, Kotabe, and Sahay, 1996). The effectiveness of contractual governance under environmental uncertainty was tested in three studies, two of which reported insignificant findings (Lee and Cavusgil, 2006; Luo and Tan, 2003), and one a negative interaction effect (Aulakh and Gencurk, 2008). The effectiveness of the two governance mechanisms under behavioral uncertainty has received even less attention. Whereas the effectiveness of trust-based governance under behavioral uncertainty has only been tested once (Krishnan *et al.*, 2006), the effectiveness of contractual governance under behavioral uncertainty has, to the best of our knowledge, never been investigated.

argues that inter-organizational relationships in R&D-intensive industries are beset with “transaction cost hazards ... due to a considerable degree of *endogenous* project uncertainty.” Ulset (1996) further emphasizes that the potential for leakage of valuable proprietary technology is high when partnering with firms in such industries. Similarly, Allen and Phillips (2000: 2796) indicate that alliances in R&D-intensive industries are more likely to be subject to information asymmetries. In a study on corporate acquisitions, Coff (2003) finds that potential for opportunism rises with R&D intensity and Folta (1998) reports that transactions in industry subfields with high R&D intensity are more likely to involve acquisitions as it provides superior administrative controls to deal with opportunistic behavior. Mayer and Nickerson (2005) submit that, unlike in traditional manufacturing industries, in R&D intensive and service industries (see below), contracting hazards associated with behavioral uncertainty are likely to be attributed to expropriation concerns and measurement difficulties inherent in these industries. To measure this variable, we use the proportion of alliances in each study sample that are in R&D-intensive industries, based on the OECD classification.

Proportion of alliances in service industries. Alliances in the service sector are more likely to experience the potential for opportunistic gains than those in the manufacturing sector because of inseparability—the difficulty in decoupling production and consumption (Bowen and Jones, 1986; Zeithaml, Parasuraman, and Berry, 1985). Because production and consumption occur almost simultaneously in the service sector, monitoring costs accrued in order to reduce opportunistic behavior of partners and to ensure effective delivery of service are likely to be higher in alliances in the service sector (Erramilli and Rao, 1993). To measure this variable, we use the proportion of alliances in each study sample that are in service industries, categorized based on the NAICS list.

Composite behavioral uncertainty measure. We create a composite measure for behavioral uncertainty by standardizing the sum of the standardized scores of both indicators.

Environmental uncertainty

We use two indicators—(1) environmental unpredictability in the host industry, and (2) poor

regulation quality in the host country—to operationalize environmental uncertainty. Whereas the former dimension captures uncertainty in the product-market, the latter captures uncertainty in the wider, national context.

Environmental unpredictability in the host industry. *Environmental unpredictability in the host industry* captures the extent to which alliance partners can predict future trends in their host product-markets from the recent past (Wholey and Brittain, 1989). Specifically, we calculate environmental unpredictability scores for each of the industries included in a primary study’s sample as the coefficient of alienation ($1 - R^2$) of the regression of industry sales in the sample year on the industry sales of the three preceding years (c.f. Delacroix and Swaminathan, 1991; Krishnan *et al.*, 2006).⁸ We then calculate a weighted environmental unpredictability score, by multiplying the environmental unpredictability score for each industry by the proportion of alliances in the sample that belong to that industry, and summing across industries. Environmental unpredictability scores range between 0 and 1. We obtained industry sales figures for all 50 industries included in the primary studies’ samples from Compustat and the INDSTAT4 database published by the United Nations.

Poor regulation quality in the host country. *Poor regulation quality in the host country* captures primary uncertainty (Williamson, 1985), arising from operating in a country where risky policies are introduced by regulatory bodies. We measure poor regulation quality based on Kaufmann, Kraay, and Mastruzzi (2008) as a composite indicator of the incidence of market-unfriendly policies such as price controls or inadequate bank supervision as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development in the host country. For each study sample, we used the regulation quality score for the year in which the data were collected.⁹ Scores can range from 2.5 to 2.5. We reverse scored the original scores so that higher values reflect poorer regulation quality.

⁸ The sample year is the year in which the data were collected. When an article does not mention the year of data collection, we based our calculations on the year of publication.

⁹ When the year of data collection was unavailable, we used the score for the year of publication of the study.

Composite environmental uncertainty measure. We create a composite measure for environmental uncertainty, by standardizing the sum of the standardized scores of both indicators.

Meta-analytic procedure

Our meta-analyses were conducted following the steps outlined by Geyskens *et al.* (2009).

Correction for interdependent effect size

When multiple publications were based on the same dataset, we did not include correlations between the same variables from more than one study. In such cases, we included the correlation that was based on the larger sample size. In cases where a study reported closely related, but multiple measurements of the same construct, these correlations were averaged and only the average correlation was included in the meta-analysis (Hunter and Schmidt, 1990).

Identification of outliers

We identified two outlying observations (i.e., correlations) that were more than two standard deviations away from the mean, both for the relationship between trust-based governance and alliance performance. These were subsequently dropped from the dataset. This exclusion resulted in a final dataset of 80 studies (82 independent samples), involving 15,111 alliances.

Meta-analytic calculations

Our meta-analyses were conducted using Hunter and Schmidt's (1990) psychometric approach. We first correct each retrieved correlation for the biasing influence of (1) artificial dichotomization of continuous variables, (2) range restriction in dichotomous variables, and (3) the downward bias in r as a measure of the population correlation. The corrected correlations were then meta-analyzed and further corrected for sampling error. Finally, and because information on measurement error was not available for all individual correlations, the meta-analytic correlations were corrected for measurement error in the dependent and independent variables, using the method of artifact distributions. These corrections yielded the following summary statistics for each relationship of interest to our study: the average corrected correlation (mean ρ),

the corresponding variance of the mean ρ , and the 95 percent confidence intervals around the mean ρ .

We examined the adequacy of the mean ρ for representing the entire distribution of effect size values, using four tests: (1) credibility intervals, which indicate the presence of moderators if these intervals are wide (exceeding 0.110) or include 0; (2) the residual standard deviation, which suggests the presence of moderators in case it is larger than 0.190; (3) the 75 percent rule-of-thumb, stating that moderator search is warranted if statistical artifacts explain less than 75 percent of the observed variance in correlations; and (4) Hunter and Schmidt's (1990) Chi-square test, a statistical significance test for whether the observed variation is greater than that expected by chance.

Testing the moderator hypotheses

We test our hypotheses using weighted least squares regression analysis to give more weight to more precise estimates (Geyskens *et al.*, 2009). We estimate the following regression models:

$$\begin{aligned} \text{RM1 : } r_{\text{contract,performance}} &= a_0 + a_1 \text{BehUnc} \\ &+ a_2 \text{BehUnc}^2 + a_3 \text{EnvUnc} \\ &+ a_4 \text{EnvUnc}^2 + a_5 \text{BehUnc} * \text{Envunc} + e_1 \end{aligned} \quad (1)$$

$$\begin{aligned} \text{RM2 : } r_{\text{trust,performance}} &= b_0 + b_1 \text{BehUnc} \\ &+ b_2 \text{EnvUnc} + b_3 \text{BehUnc} * \text{EnvUnc} + e_2 \end{aligned} \quad (2)$$

$r_{\text{contract,performance}}$ is a vector of (artifacts-corrected) correlations between contractual governance and alliance performance. Similarly, $r_{\text{trust,performance}}$ represent the (artifacts-corrected) correlations between trust-based governance and alliance performance. *BehUnc* and *EnvUnc* are the composite measure for behavioral and environmental uncertainty. Both variables are standardized to facilitate interpretation. The intercept a_0 in RM1 represents the effect of contractual governance on alliance performance at average levels of behavioral and environmental uncertainty (i.e., if both *BehUnc* and *EnvUnc* are zero). Similarly, the intercept b_0 in RM2 represents the effect of trust-based governance on alliance performance at average levels of *BehUnc* and *EnvUnc*. The a and

Table 1. Meta-analytical descriptive statistics^a

Relationship	<i>k</i>	<i>N</i>	Mean <i>r</i>	95% confidence interval	Mean ρ	Var ρ	95% credibility interval	SD _{res}	% variance accounted for	<i>Q</i>
Contractual governance – trust-based governance	14	2,294	0.151	0.111–0.191	0.190	0.060	–0.290–0.670	0.195	13.573	103.144
Contractual governance – alliance performance	25	5,790	0.100	0.074–0.125	0.124	0.068	–0.385–0.633	0.209	8.976	278.513
Trust-based governance – alliance performance	57	9,393	0.472	0.456–0.487	0.559	0.041	0.163–0.956	0.171	11.010	429.197

^a *k* = number of effect sizes; *N* = total sample size; Mean *r* = sampling-error-corrected average correlation; 95% confidence interval = lower and upper bounds of confidence interval for the average correlation; Mean ρ = estimate of corrected population correlation; Var ρ = estimated variance of mean ρ ; 95% credibility interval = lower and upper bounds of credibility interval for mean ρ ; SD_{res} = residual standard deviation; % variance accounted for = percentage of observed variance accounted for by statistical artifacts; *Q* = chi-square test for heterogeneity.

b are coefficients to be estimated, and *e*₁ and *e*₂ are the random error components.

RESULTS

Interrelationship between contractual and trust-based governance

The top row in Table 1 presents the meta-analytic correlation between the two governance mechanisms. We find that the use of contractual governance is significantly, but only weakly, correlated with the use of trust-based governance, the mean ρ being 0.190 ($p < 0.05$).

Governance mechanisms and alliance performance

The two bottom rows in Table 1 show the meta-analytic results for the effects of the two governance mechanisms on alliance performance. The average size for the effect of contractual governance on alliance performance is $\bar{\rho} = 0.124$ ($p < 0.05$), while $\bar{\rho} = 0.559$ ($p < 0.05$) for trust-based governance. These results indicate that, *on average*, each of the governance mechanisms is positively and significantly related to alliance performance, with the relationship between trust-based governance and alliance performance being the strongest. However, the wide credibility intervals for both ρ 's indicate that averages do not mean much in the present context. The population distribution of ρ 's for the “contractual governance–alliance performance” relationship includes positive as well as negative values, while the population distribution

of ρ 's for the “trust-based governance–alliance performance” relationship ranges from near-zero to large positive values. Thus, under certain conditions, use of a particular governance mechanism is ineffective or may even reduce alliance performance, while in other conditions, the same governance mechanism is conducive to achieving a better alliance performance. This suggests that the effect of each mechanism is critically dependent on the presence or absence of moderators.

The presence of moderators is further evidenced by three additional analyses (Geyskens *et al.*, 2009). The residual standard deviations are 0.209 for the “contractual governance–performance” relationship and 0.171 for the “trust-based governance–performance” relationship, which is high compared to other meta-analyses (Cortina, 2003). Further, the percentage of variance accounted for by the statistical artifacts is small (8.98 and 11.01%). Finally, the *Q* statistics are significant.

The effectiveness of contractual governance under uncertainty

Table 2 reports the results of the regression model predicting the effectiveness of contractual governance. We observe an inverted-U shaped relationship between behavioral uncertainty and the effectiveness of contractual governance ($a_1 = -0.024$, *n.s.*; $a_2 = -0.061$, $p < 0.001$) and between environmental uncertainty and the effectiveness of contractual governance ($a_3 = 0.108$, $p < 0.001$; $a_4 = -0.058$, $p < 0.001$). These findings support Hypothesis 1 and Hypothesis 2. We also find support for Hypothesis 3, which predicts a

Table 2. Governance effectiveness under behavioral and environmental uncertainty^a

Predictor	Contractual governance – alliance performance RM1	Trust-based governance – alliance performance RM2
Behavioral uncertainty	-0.024	0.107*
Behavioral uncertainty squared	-0.061*	
Environmental uncertainty	0.108*	-0.032*
Environmental uncertainty squared	-0.058*	
Behavioral uncertainty × environmental uncertainty	-0.054*	-0.037*
Intercept	0.277*	0.551*
R²	0.641	0.250

^a Estimates are unstandardized regression coefficients.

* $p < 0.001$.

negative interaction effect between behavioral and environmental uncertainty ($a_5 = -0.054$, $p < 0.001$).

Figure 1 depicts the simultaneous interplay of all these effects. The plot illustrates several findings that may not be obvious from the “dry” regression coefficients. First, contractual effectiveness is indeed highest at low to moderate levels of behavioral uncertainty and moderate to high levels of environmental uncertainty, in which case the details laid out in the contract can effectively curb opportunistic appropriation and provide well-coordinated responses to the environment. Second, the surface dips sharply if both behavioral and environmental uncertainty are low, up to a point where contractual governance becomes not just ineffective, but also outright detrimental. Third, contractual governance also becomes damaging if both behavioral and environmental uncertainty are high, although not as damaging as in the low-low scenario. Fourth, if environmental uncertainty is high, then there is a sharper downturn of the inverted-U shaped relationship between contractual governance and alliance performance under behavioral uncertainty than if environmental uncertainty is low. To graphically illustrate this point more clearly, we “slice” Figure 1 at three points along the environmental uncertainty continuum: low (two standard deviations below the mean), average, and high (two standard deviations

above the mean), to arrive at Figure 2. Figure 2 shows that the “optimum” level of behavioral uncertainty (in terms of contract effectiveness) is higher with lower levels of environmental uncertainty.

The effectiveness of trust-based governance under uncertainty

Our findings support the predictions of relational theory (Hypothesis 4) that the positive effect of trust-based governance on alliance performance strengthens when behavioral uncertainty increases ($b_1 = 0.107$, $p < 0.001$). Further, the effect of trust-based governance on alliance performance decreases when environmental uncertainty increases ($b_2 = -0.032$, $p < 0.001$), providing support for Hypothesis 5. We also find support for Hypothesis 6, which predicts a negative interaction effect between behavioral and environmental uncertainty ($b_3 = -0.037$, $p < 0.001$).

We again create a surface plot. Figure 3 shows that the positive relationship between trust-based governance and alliance performance is strongest when behavioral uncertainty is high but environmental uncertainty is low, and weakest if both uncertainties are low. Figure 3 also demonstrates that when behavioral uncertainty is high, trust-based governance improves alliance performance as environmental uncertainty decreases. When behavioral uncertainty is low, trust-based governance does not lead to marked improvements in alliance performance, regardless of the level of environmental uncertainty. These findings suggest that trust-based governance can handle very high levels of behavioral uncertainty and also suggests that when both types of uncertainty are low, the cost of governing the alliance using trust-based governance is not commensurate with the benefits. When environmental uncertainty is high, the relationship between trust-based governance and alliance performance is insensitive to different levels of behavioral uncertainty. Although trust-based governance is highly effective when behavioral uncertainty is high, its effect on alliance performance begins to weaken as environmental uncertainty increases. To illustrate this point more clearly, Figure 4 depicts three slices of the multivariate surface plane (at low, average, and high values on environmental uncertainty), and shows that the effectiveness of trust-based governance under behavioral uncertainty declines with higher levels of environmental uncertainty.

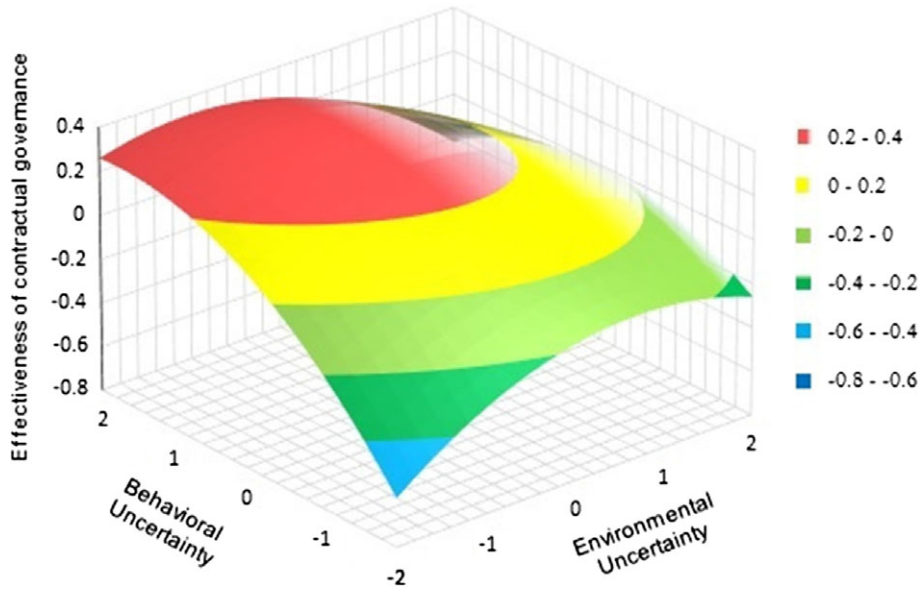


Figure 1. The effectiveness of contractual governance under behavioral and environmental uncertainty

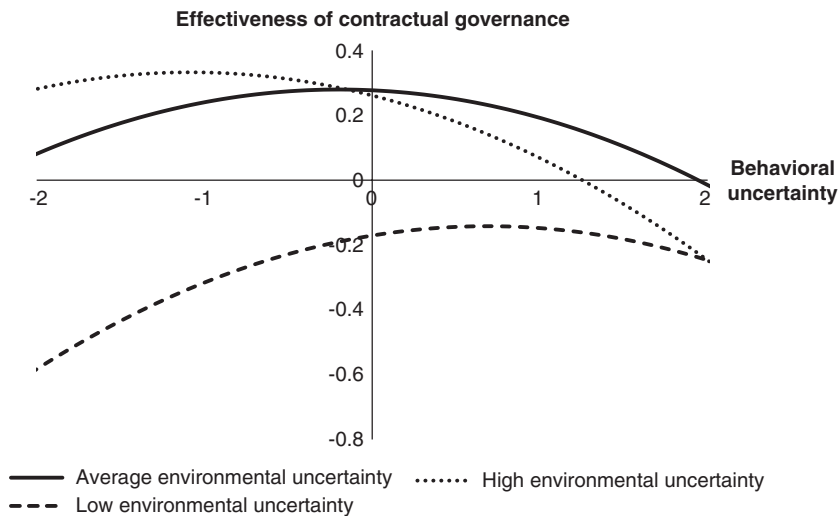


Figure 2. The effectiveness of contractual governance as a function of behavioral uncertainty for three levels of environmental uncertainty

ROBUSTNESS CHECKS

Are the results robust when extreme cases are dealt with differently?

We performed a series of sensitivity analyses on the extreme cases in the data.

Inclusion of outliers

We dropped two outliers from the trust-based governance sample because those two effect sizes

($r_{trust,performance}$) were more than two standard deviations away from their mean. We reran our analysis on a sample that included these two extreme observations.

Extremity on the independent variables

Our dataset contains a few intersecting cases for behavioral uncertainty where both the R&D indicator and the Service indicator equaled one (three cases in the contractual governance sample;

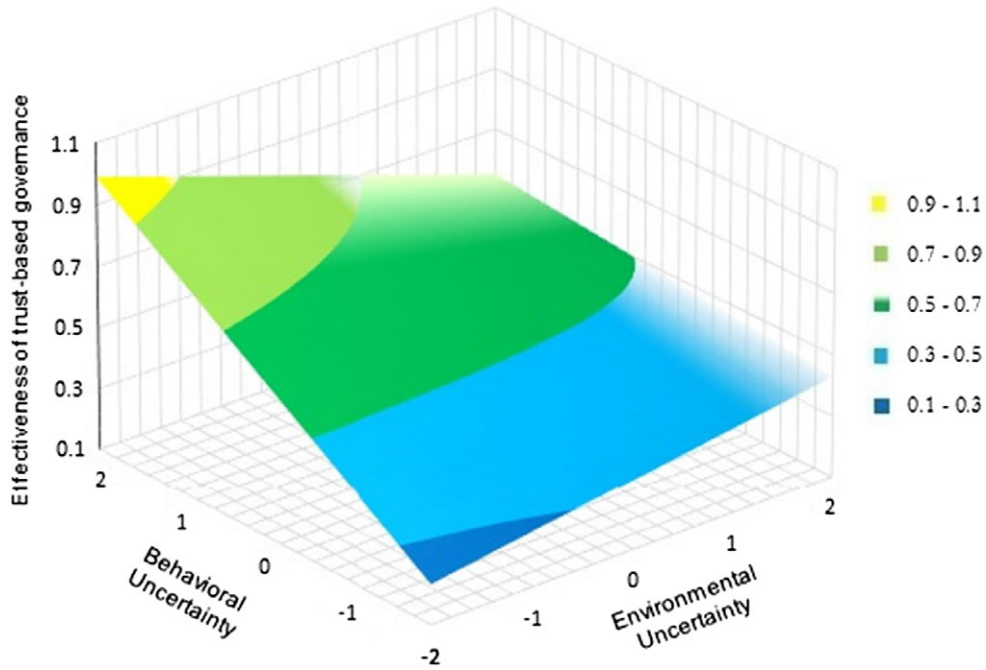


Figure 3. The effectiveness of trust-based governance under behavioral and environmental uncertainty

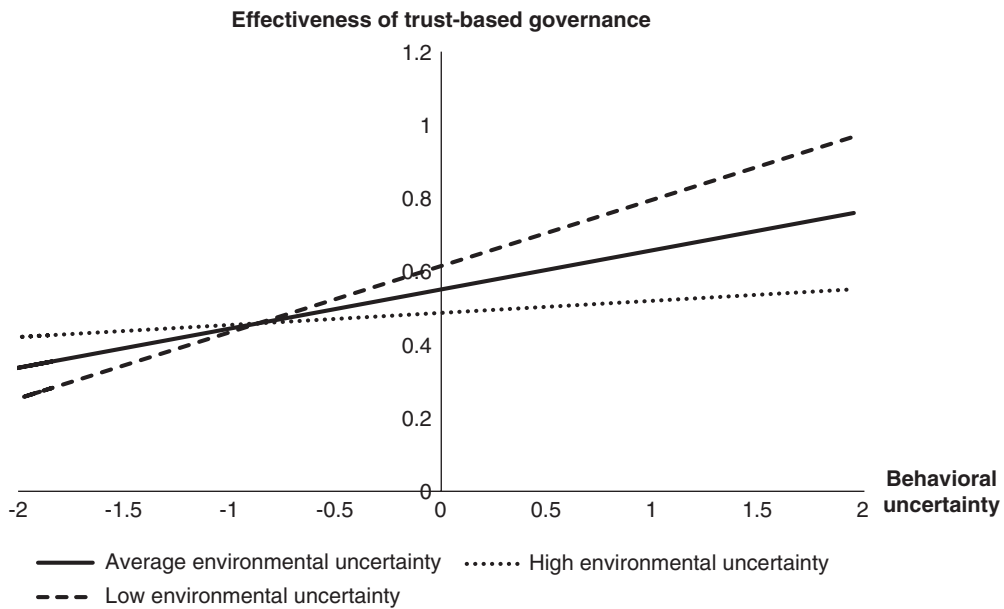


Figure 4. The effectiveness of trust-based governance as a function of behavioral uncertainty for three levels of environmental uncertainty

five cases in the trust-based governance sample) or zero (one case in the contractual governance sample; two cases in the trust-based governance sample). We reestimated Equations 1 and 2, dropping these intersecting cases.

Are the results robust when the composites are constructed differently?

Composite indicators are a *weighted* combination of *normalized* indicators' values. To assess the quality of composite indicators, Saisana *et al.* (2005)

recommend an assessment of the sensitivity of the results to (1) alternative normalization methods, and (2) alternative weighting schemes.

Alternative normalization method

The normalization method most frequently used in the literature is to standardize indicator values before calculating the composite. This is also the approach we used. An alternative method is to rescale values by expressing the original value for each indicator on a (unit free) scale from 0 to 1, using the formula $(\text{original value} - \text{observed minimum value}) / (\text{observed maximum value} - \text{observed minimum value})$ (Saisana *et al.*, 2005). We reestimated Equations 1 and 2 using this alternative normalization method.

Alternative weighting schemes

Absent theory, equal weighting of indicators is standard practice in composite indicator construction (Bobko *et al.*, 2007). To assess how sensitive our results are to the equal-weighting scheme used for the two indicators (R&D, Service) of the behavioral uncertainty composite, we created two alternative composites using unequal weighting—one in which we underweighted the R&D indicator (1/3 weight) and overweighted the Service indicator (2/3 weight), and one in which we overweighted the R&D indicator (2/3 weight) and underweighted the Service indicator (1/3 weight). In a similar way, we created two alternative composites for environmental uncertainty using unequal weighting. We reestimated Equations 1 and 2 using these alternative composites.

Inclusion of separate indicators rather than composites

Finally, we investigated the robustness of our findings to the inclusion of the separate indicators rather than the composites. We were only able to do so for the trust-based governance sample as the number of additional parameters to be estimated (seven extra parameters, for a total of 13 parameters) was too large relative to the sample size of the contractual sample ($N = 25$) to obtain stable estimates.

Are the results robust when we use an alternative behavioral uncertainty measure?

We measured behavioral uncertainty using two indicators: (1) the proportion of alliances in a

study sample that are in R&D-intensive industries, and (2) the proportion of alliances in a study sample that are in service industries. Prior research by transaction cost scholars confirms that these transaction attributes capture the potential for opportunistic gains from behavioral uncertainty (see, e.g., Coff, 2003; Erramilli and Rao, 1993; Folta, 1998; Mayer and Nickerson, 2005). Notwithstanding adequate support for our measures in the literature, alternatives exist. We assessed the robustness of our results to one such alternative based on Santoro and McGill (2005: 1263), which “focus on partner and task uncertainty as forms of behavioral uncertainty.”¹⁰ According to Santoro and McGill (2005), “partner uncertainty decreases as partners gain mutual experience,” and task “uncertainty also arises in task requirements, especially in knowledge-intensive industries... where emerging and highly specialized technologies make it difficult to monitor and evaluate a partner’s capabilities and contributions.” Following Santoro and McGill (2005), we created a composite that includes both partner uncertainty and task uncertainty. We measured partner uncertainty by reverse scoring the mean age of the alliances in the primary study samples.¹¹ Partner uncertainty (and therefore, behavioral uncertainty) is likely to be higher in younger than in older alliances as partners have not had enough time to observe each other’s behavior. In the spirit of Santoro and McGill (2005), we measured task uncertainty as the proportion of alliances in R&D-intensive industries in the primary study samples. For the subset of studies where information on alliance age was available, we reran our analyses using this alternative behavioral uncertainty measure.

Are the results robust when we control for studies that include both types of governance?

Seven studies include/measure both contractual governance and trust-based governance. We reestimated Equations 1 and 2 while controlling for an

¹⁰ Although yet other measurement alternatives exist, the data are typically not available consistently across the primary studies used in a meta-analysis. For example, Krishnan *et al.* (2006) have captured behavioral uncertainty using inter-partner competition and interdependence. Inter-partner competition and interdependence are measures that need fine-grained information, which is typically not available across all primary studies in a meta-analysis.

¹¹ We log-transformed the reverse scored mean age to account for decreasing returns to scale.

extra explanatory variable that captures whether a study includes/measures both types of governance.

Robustness results

Our results are stable, as Table 3 details. For contractual governance, we consistently find the two main effects of behavioral and environmental uncertainty across all robustness checks. With one exception (“Overweight unpredictability”), also the negative interaction effect of behavioral and environmental uncertainty is consistent across all robustness checks, although the significance of this negative interaction drops somewhat when we overweight R&D ($p = 0.199$).

We observed a similar pattern of consistent results in the trust-based governance sample. The main effects of behavioral and environmental uncertainty are both significant and consistent in sign across all robustness checks. With two exceptions (“Underweight R&D” and “Alternative behavioral uncertainty measure”), also the negative interaction effect of behavioral and environmental uncertainty is consistent across all robustness checks. Finally, when we included the individual indicators rather than the composites, with one exception (the interaction effect between “Service” and “Poor regulation quality”), our findings are always consistent in sign, although the significance of the main effect of “Unpredictability” became slightly less significant at $p = 0.197$.¹² All in all, the robustness checks increase the confidence in our findings as even in the few instances where the significance of the results was somewhat lower, a similar message is conveyed.

DISCUSSION

Alliances have emerged as major inter-organizational arrangements that allow firms to pool resources in order to gain efficiencies in the use of existing resources as well as opportunities to create new resources. Successful alliances effectively manage the twin challenges posed by behavioral and environmental uncertainty. Academics have devoted much attention to the extent to which contractual and trust-based governance

contribute to alliance performance. Research in this stream has implicitly assumed that contractual and trust-based governance are equally effective in handling behavioral and environmental uncertainty. In this study, we theorize that the effectiveness of contractual and trust-based governance in dealing with each type of uncertainty varies. We test our predictions using a meta-analytic dataset covering nearly 20 years of research and encompassing more than 15,000 strategic alliances across 82 samples, published in 80 studies.

Theoretical contributions and research implications

First, we examine how the interplay of behavioral and environmental uncertainty alters the effectiveness of the governance mechanisms. Our findings resonate with the discriminating alignment hypothesis (David and Han, 2004; Williamson, 1991), in that contractual governance is least effective if both behavioral and environmental uncertainty are low. If the two types of uncertainty are low, market governance is preferable to contractual governance. Similarly, our findings show that contractual governance hurts performance if both behavioral and environmental uncertainty are high, which is in line with transaction cost theory’s prediction that hierarchical governance is superior to contractual governance under such conditions. Hence, in line with transaction cost reasoning, contractual governance is less effective if both behavioral and environmental uncertainty are either high or low. It is most effective when behavioral uncertainty is low to moderate and environmental uncertainty is moderate to high. When environmental uncertainty is high, there is a sharper downturn of the inverted-U shaped relationship between contractual governance and alliance performance under behavioral uncertainty than when environmental uncertainty is low. This suggests that at high levels of environmental uncertainty, strategic alliances might find it hard to cope with rising levels of behavioral uncertainty that aggravate concerns of opportunistic gains to be had in a relationship.

Second, our study contributes to research on trust-based governance. Specifically, trust-based governance suffers a larger loss in effectiveness at high behavioral uncertainty as environmental uncertainty increases. Also, when environmental uncertainty is high, the relationship between trust-based governance and alliance performance

¹² Detailed results for this robustness check are reported in Appendix S3.

Table 3. Robustness analyses^a

	Treatment of extreme cases			Normalization		Different measures				Extra controls		
	Hypothesis	Focal model	BU: Drop (1,1) and (0,0) cases	Rescale i.s.o. standardize	Overweight R&D	Underweight R&D	Overweight unpred.	Underweight unpred.	Separate indicators	Alternative BU measure	Inclusion of both types of governance	
												Include outliers
Contractual governance												
BU	∩	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU	∩	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BU × EU	-	✓	✓	✓	(✓)	✓	✓	✓	✓	✓	✓	✓
Trust-based governance												
BU	+	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
R&D												
Service												
EU	-	✓	✓	✓	✓	✓	(✓)	✓	✓	✓	✓	✓
Unpredictability												
Regulation quality												
BU × EU	-	✓	✓	✓	✓	✓	✓	✓	(✓)	✓	✓	✓
R&D × unpred.												
R&D × reg. qual.												
Service × unpred.												
Service × reg. qual.												

^a BU indicates behavioral uncertainty; EU indicates environmental uncertainty. ✓ indicates that our hypothesis is supported. (✓) indicates that even though the parameter of this effect is robust in sign, its *p*-value is >0.10, but <0.20. N.A. means that the robustness check is not applicable.

is insensitive to different levels of behavioral uncertainty. This suggests that the cognitive limits introduced by environmental uncertainty suppress any economic benefits derived from trust-based governance's mitigation of the need to use costly monitoring. Hence, as environmental uncertainty increases, partners may not be able to leverage the benefits derived from trust-based governance under behavioral uncertainty as much as they should. However, the effect of trust-based governance on alliance performance does not turn negative even at high levels of environmental uncertainty. These findings suggest that when both types of uncertainty are high, even if organizations should choose hierarchical governance as per transaction cost reasoning, investing in trust-based governance may still provide a reasonable compromise.

Upon further probing, we find that at very low levels of behavioral and environmental uncertainty (exceeding three standard deviations below the mean), the effect of trust-based governance on alliance performance turns strongly negative; for example, at -4SDs, $r_{\text{trust,performance}} = -0.341$. While this finding is interesting, it should be treated with some caution as we move outside of the observed range for both types of uncertainty (lowest value for behavioral [environmental] uncertainty observed was -2.136 [-2.225]). This might be attributed to the underrepresentation of the negative effects of trust in the literature. Indeed, it is only recently that scholars have conceptualized negative effects of trust-based governance (e.g., Garguilo and Ertug, 2006; Krishnan *et al.*, 2006; Szulanski, Cappetta, & Jensen, 2004), making reporting negative effects of trust-based governance more acceptable.¹³ Moreover, as we document above, for the dark side of trust to be fully revealed, extreme values should jointly occur on all the predictors appearing in the interaction term. McClelland and Judd (1993) show that such extreme values on predictors rarely co-occur in field research. Experiments conducted in controlled lab settings, on the other hand, can afford to have optimal designs that concentrate observations at the extremes. Therefore, compared to surveys, experiments have a better chance of detecting the dark side of trust. We encourage future research on governance effectiveness to also rely on experimental designs to test their hypotheses.

Our primary finding regarding the positive properties of trust-based governance should not blind

us to its downside. Although trust and trustworthiness typically coevolve (McEvily *et al.*, 2003), trust by itself does not *guarantee* trustworthy behavior. Trust can be misplaced. Misplaced trust can have dire consequences not only for the trustor, but also cost the alliance its economic performance. The trustee's self-interest will deprive the trustor of its private benefits, and the alliance of resources and joint efforts that could have been employed toward obtaining common benefits. Moreover, the trustee's self-interest will also damage its own reputation putting at risk future exchange opportunities. Examining the conditions that can lead to misplaced trust is a fertile area for future research. However, if trust had been misplaced more often than not, we would not have found a stronger relationship between trust and alliance performance under behavioral uncertainty. Nevertheless, its limited effectiveness under environmental uncertainty echoes recent research on the dark side of trust-based governance that highlights the cognitive limits introduced by trust under conditions that increase ambiguity (e.g., Krishnan *et al.*, 2006; Szulanski *et al.*, 2004).

Further, we reveal that the effectiveness of contractual and trust-based governance varies under behavioral and environmental uncertainty. Contractual governance is effective if environmental uncertainty is in the moderate-to-high range and behavioral uncertainty is in the low-to-moderate range. This finding suggests that the role of contractual governance in facilitating coordinated response to the environment should not be underestimated. Trust-based governance is most effective if behavioral uncertainty is high and environmental uncertainty is low, suggesting that it has a strong role in alleviating the potential for opportunistic gains resulting from the transaction attributes in the presence of uncertainty. The cognitive limits introduced by trust-based governance under environmental uncertainty make it less effective when both uncertainties are high than when behavioral uncertainty is high and environmental uncertainty is low.

In order to obtain a better understanding of the nature of the relationship between the two governance mechanisms, we examined the effect of contractual and trust-based governance on alliance performance when the two governance mechanisms are used together. Specifically, the correlation between contractual governance and trust-based governance was available for seven studies in our sample. A high correlation suggests that partners are using both contractual and trust-based governance. First,

¹³ We thank an anonymous reviewer for this suggestion.

we estimated a simple model in which we regressed the “contractual governance–performance” relationship (the dependent variable) on the “contract-trust” relationship (the independent variable), and we find that the coefficient is positive and highly significant ($b = 0.849$, $p < 0.001$), implying that the relationship between contractual governance and alliance performance is stronger when partners use trust-based governance along with contractual governance. A similar probe for the “trust-based governance–alliance performance” relationship (where we regressed the “trust-performance” relationship on the “contract-trust” relationship) revealed that there is a significant improvement in the effectiveness of trust-based governance when it is supplemented with contractual governance ($b = 0.358$, $p < 0.01$).

These probes, along with the finding that contractual governance is most effective under moderate levels of behavioral and environmental uncertainty, and trust-based governance is most effective under high behavioral uncertainty and low environmental uncertainty, shed some light on the nature of the relationship between the two governance mechanisms. Under conditions of high behavioral uncertainty and low-to-moderate levels of environmental uncertainty, the use of trust-based governance alongside contractual governance might enhance the latter’s effectiveness. Specifically, trust-based governance might mitigate the need to use costly monitoring and allow the division of labor and communication structures built in contractual governance to operate effectively in providing well-coordinated responses to environmental changes. However, the mean ρ between contractual and trust-based governance is only 0.190. Overall, these findings suggest that although partners do not always use contractual and trust-based governance in combination—as is reflected in the low correlation between the two—when they do employ contractual and trust-based governance in tandem, the benefits are significant as together they might make up for each other’s limits. While these findings are preliminary due to the small number of studies involved, they may be useful to future research that seeks to examine the conditions under which contractual and trust-based governance substitute or complement each other.

The combined effectiveness of contractual and trust-based governance under high levels of both behavioral and environmental uncertainty is not obvious. When both behavioral and environmental

uncertainty are high, contractual governance hurts alliance performance while trust-based governance does not function at its best either. In these conditions, it might be better for firms to turn to hierarchy or vertical integration.

Limitations and future research

Whereas our meta-analysis examined the relationship between trust-based governance and alliance performance under behavioral and environmental uncertainty, prior research on the contingent effect of trust on alliance performance has examined other conditions that give rise to opportunism and increased coordination demands. One of the moderators that highlights expectations of low opportunism in trusting relationships and that has received increased attention in research examining the link between trust and alliance performance is partner interdependence (Krishnan *et al.*, 2006; Luo, 2002a, 2008). Luo (2002a) showed that the trust-alliance performance link is stronger in alliances between culturally similar partners, suggesting that trust might be effective only when coordination demands are low. Similarly, Carson *et al.* (2003) argued that the effect of trust on relationship performance in vertical R&D relationships strengthens if the ambiguity pertaining to partner capabilities decreases. This suggests that once partner capabilities are unambiguous, making coordination of tasks easier, trust does what it does best by reducing the need to invest in costly monitoring. Overall, findings of the few studies that do examine the contingent effect of trust on alliance performance echo our findings obtained systematically through meta-analysis that trust is more effective in mitigating the potential for opportunistic gains resulting from the transaction attributes in the presence of uncertainty and less effective in bringing about coordination.

In a related vein, whereas our meta-analysis examined the effectiveness of contractual and trust-based governance under two challenges often encountered by strategic alliance partners—behavioral and environmental uncertainty—it might be worthwhile for future meta-analytic studies to examine conditions such as post-formation relational factors that are capable of mitigating the weaknesses of contractual and trust-based governance. For example, the information processing view suggests that high quality information exchange between partners through face-to-face

communication improves their information processing ability (Galbraith, 1973). Second, using the concept of “relation-specific skills” coined by Asanuma (1989), scholars have examined how, over time, partners develop idiosyncratic inter-organizational routines that allow them to communicate more effectively (Kotabe, Martin, and Domoto, 2003). This allows them to prevent costly mistakes before they occur, thereby making up for the adaptive limits of contractual governance and the cognitive limits of trust-based governance. As our study shows, trust-based governance can give rise to cognitive limits under certain conditions, and information processing capabilities resulting from face-to-face communication or relation-specific skills can give rise to mindfulness in a relationship. Similarly, such information processing capabilities can be used to refine contractual clauses for effective functioning of the alliance. Besides, face-to-face communication or relation-specific skills can be highly effective in relationships that use contractual and trust-based governance in tandem as partners may not be too defensive about refining contractual clauses as new possibilities are unraveled through superior information processing abilities.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

- Appendix S1.** Studies included in the meta-analysis
- Appendix S2.** Descriptive statistics
- Appendix S3.** Inclusion of separate indicators rather than composites