

UNTANGLING SAFEGUARD AND PRODUCTION COORDINATION EFFECTS IN LONG-TERM BUYER-SUPPLIER RELATIONSHIPS

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We untangle safeguard and coordination effects of interfirm governance mechanisms in the context of hazardous buyer-supplier relationships. We propose that the extent to which such mechanisms prevail as safeguards or coordination devices varies with the moderating effects of complexity and asset specificity. In nonspecific but complex exchanges, such mechanisms operate more as coordination mechanisms, whereas in specific, noncomplex ones, they are safeguard mechanisms. Through a system of mathematical derivatives, we specify and quantify these conditions to demonstrate when each theoretical perspective is more relevant. We validate our model with survey data from 239 suppliers and explore implications for theory and practice.

Transaction cost economics has become one of the most influential theories in the study of management and organizations (Carter & Hodgeson, 2006: 461; David & Han, 2004: 39; Mayer & Argyres, 2004: 394). Transaction cost economists propose a discriminating alignment between governance choices and exchange hazards; this alignment allows trade partners to coordinate incentives and efforts, so as to realize efficiency gains (see Macher and Richman [2007] and Williamson [2000] for reviews).

Though early on some transaction cost economics scholars conjectured that such inefficiencies involve production *and* negotiation aspects (e.g., Balakrishnan & Wernerfelt, 1986: 348; Williamson, 1985: 93), over time the literature has come to emphasize the latter. According to this prevailing logic, managers implement governance mechanisms to *safeguard* owners of specialized assets from the losses, haggling, and negotiation inefficiencies resulting from exchanges with opportunist

partners. Although research has largely benefited from these efforts, it has also suffered from a dearth of studies on the production coordination logic of such governance choices. Our goal is to help fill this gap and fulfill the above promises to integrate production and negotiation analyses in governance choice contexts.

To do so, we untangle two interdependent yet different efficiency-promoting roles associated with governance choices: safeguard (as explained above) and production coordination. By production coordination, we mean the handling of the organizational complexity inherent in decomposing production tasks and managing their interdependent parts across firms. This concept of coordination differs from the idea of coordination of incentives in the safeguard logic in that the latter is akin to the agency costs and moral hazards involved in organizing resources and aligning incentives for transactions subject to threats of misappropriation (Williamson, 1985). Production coordination is analogous instead to the cognitive and administrative challenges involved in synchronizing decomposed but interdependent tasks over firm boundaries (Gulati & Singh, 1998; Thompson, 1967). We seek to answer two questions: What factors influence the relative importance of the safeguard and coordination roles of interfirm governance mechanisms? To what extent do such mechanisms result in negotiation and production benefits? We set our analysis within the context of *buyer-supplier long-term relationships*, which we generically define here as ongoing, recurrent supply partnerships.

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Our study builds upon and supplements three important streams of research. First, the argument of a growing research stream is that both cooperation and control need to be determined for one to assess interfirm exchange outcomes (Gulati & Singh, 1998; Gulati, Lawrence, & Puranam, 2005; Poppo & Zenger, 1998; White & Lui, 2005; Zajac & Olsen, 1993). The basic proposition of this literature is that an exclusive focus on opportunism control ignores the interdependence of production and exchange relations (Madhok, 2002: 536) and inappropriately discounts the potential for partners to cooperate in good faith (Ghoshal & Moran, 1996). We add to this literature by theoretically and empirically demonstrating the separable effects of complexity and specificity on the respective models of production and negotiation efficiency. Further, by quantifying the relative levels of both efficiencies across models—drawing on an analysis of a system of derivatives—we are able to contrast the circumstances under which governance mechanisms help tackle either opportunism or bounded rationality, thus alternatively yielding negotiation or production efficiencies as their main outcome.

Second, a recent debate among leading scholars, including well-known transaction cost economics proponents, has raised the issue of the status of asset specificity and negotiation concerns in the context of governance issues. One group has treated these as *central* factors behind governance choices and efficiency outcomes (e.g., Klein, 1996; Klein, Crawford, & Alchian, 1978). Another group has contested this standing of specificity and negotiation concerns. For example, Casadesus-Masanell and Spulber (2000: 67) suggested that complexity and production efficiencies are key factors behind governance choices. Coase (2006: 259) went as far as to conclude that specificity is actually irrelevant. Our study helps shed some light on this question. We structure a dual performance (production and negotiation) model to suggest that whether production concerns or negotiation concerns prevail depends on the relative levels of complexity vis-à-vis asset specificity. Specifically, we theorize and empirically demonstrate that where specificity or complexity is greater, the chief performance result from governance choices may be, respectively, negotiation or production efficiencies. The scholarly debate referred to above is rather complex, and our study is far from settling the issue. With this study, we do not aim at proving either school of thought wrong; our hope instead is to illustrate how such views can be context-dependent and to thus take a small step toward bridging these contending perspectives.

Third, a growing debate exists on whether formal and informal mechanisms of governance complement (e.g.,

Mayer, 2006; Poppo & Zenger, 2002; Ryall & Sampson, 2007), substitute for (e.g., Bernheim & Whinston, 1998; Bradach & Eccles, 1989; Dyer & Singh, 1998; Granovetter, 1985; Uzzi, 1997), or even undermine one another (Fehr & Gächter, 2000; Ghoshal & Moran, 1996: 24–27; Macauley, 1963: 64). Determining the nature of the interaction between formal and informal mechanisms is not a central part of our study. However, our analysis does lend itself to a deeper discussion of the topic. We discuss the circumstances within which formal and informal mechanisms can be used as supplemental, substitute, or detrimental mechanisms in buyer-supplier relationships.

THEORETICAL BACKGROUND AND HYPOTHESES

Negotiation Efficiencies in Long-Term Relationships

The basic safeguard model explains that firms implement governance mechanisms to help protect against opportunism directed toward the value of specialized assets, and to thus help reduce transaction costs. Though firms may incur more than one type of such costs, for our context of long-term relationships, we focused on negotiation costs. Negotiation costs are those incurred as firms adapt to new circumstances; these costs are often seen as the “bargaining and haggling” involved in the essentials of an exchange, such as price, delivery, and product specifications (Rubin & Carter, 1990; Williamson, 1985: 21). Such bargaining efforts can take many forms, such as meetings, monitoring efforts, sales calls, bidding rituals, and quibbling (Dyer & Chu, 2003: 59).

Transaction cost economics distinguishes between two types of governance for recurrent transactions: market and bilateral. Market governance is an efficient option for standardized exchanges in which partners are independent and their identities are irrelevant. Such is the case when an exchange does not require significant specialized investments. If disagreement leads to termination of a relationship, both parties can readily associate with other partners on similar terms (Mayer & Argyres, 2004). Bilateral governance, on the other hand, is an efficient option when the continuity of the relationship is of significant value. Here, partners are bilaterally dependent in a nontrivial way, and their identities matter significantly. Such is the case when either party (or both) has made idiosyncratic investments—that is, acquired assets that are partnership-specific and have lower values in other relationships (Klein et al., 1978: 31). Such specificity raises behavioral uncertainties, or the probability that parties may employ calculated

efforts to mislead, renege, cheat, or otherwise take advantage of the vulnerabilities of their trading partners in hopes of achieving a more favorable distribution of the “rents” accruing to exchanges (Williamson, 1985). Thus, as asset specificity and behavioral uncertainties increase, market governance becomes subject to costly haggling, a fact that attracts parties to bilateral governance instead (Williamson, 1985).

Under bilateral governance, parties may seek the reduction of negotiation costs by implementing formal and informal governance mechanisms (Macher & Richman, 2007; Poppo & Zenger, 2002). When using formal mechanisms, parties specify several verifiable contingencies, such as inputs and outputs, the level and timing of actions, task and review processes, performance benchmarks, procedures for dispute resolution, and even penalties for noncompliance (Poppo & Zenger, 2002: 709; Ryall & Sampson, 2007: 12). The more explicit and detailed such specifications are, the more a contract is said to be complete, and therefore, the more it helps protect exchanges. This protection is possible because, given the possibility of legal recourse, parties refrain from opportunism (Mayer & Nickerson, 2005).

Despite the value of contractual completeness, contracts may still be imperfect and offer only limited protection against opportunism. Scholars point to the difficulties involved in drafting verifiable specifications for all possible contingencies and corrective measures associated with exchange hazards (Bernheim & Whinston, 1998; Dyer & Singh, 1998; Grossman & Hart, 1990; Mayer & Nickerson, 2005; Williamson, 1985). As such, firms may find it in their interest to complement formal mechanisms with relational governance (Poppo & Zenger, 2002). Relational governance is defined here as a set of informal norms that affect the behavior of partners when they are dealing with each other (Baker, Gibbons, & Murphy, 2002: 39–40). Such codes of conduct emerge from the values and agreed-upon processes found in social relationships (Baker et al., 2002; Heide & John, 1992; Heide & Miner, 1992; Macneil, 1980; Williamson, 1985: 71). Relational mechanisms also serve as safeguards; parties refrain from opportunistic actions to preserve their reputations and avoid the termination of valuable long-term relationships (Axelrod, 1984: 124; Heide & Miner, 1992: 267; Klein & Leffler, 1981), to balance their resource interdependency (Pfeffer & Salancik, 1978), or even to rationally maintain the trust developed over time from repeated close ties, so as to enable other profitable cooperative gains in the future (Deutsch, 1973).

In hazardous long-term buyer-supplier relationships, relational governance promotes negotiation efficiencies through social processes that foster behavioral norms of flexibility, solidarity, and infor-

mation exchange (Macneil, 1980; Poppo & Zenger, 2002). Flexibility and solidarity enable parties to more often grant concessions in the short term, as they expect any resulting imbalances will be adjusted and reciprocated in the longer term (Dore, 1983). Moreover, norms of information sharing, especially in regards to actions and plans, foster intention transparency. As such, negotiations are likely to be more efficient, as each party will spend less time and resources on monitoring and checking to see if the other is fulfilling the spirit of the agreement (Dyer & Chu, 2003). Lastly, as these norms get reinforced over time, each party can assume the other is acting in good faith, thus interpreting behaviors more positively (Dore, 1983; Granovetter, 1985; Macaulay, 1963; Uzzi, 1997).

In sum, per the received literature, both formal and informal governance help improve negotiation efficiencies in hazardous exchanges. Our interest, however, lies beyond such direct effects. It lies instead in contrasting the specificity and complexity moderating effects leading respectively to negotiation and production efficiencies. Therefore, we proceed next to hypothesize the first of these effects.

Asset Specificity Moderates the Safeguard Effect

Drawing on the above, we propose that asset specificity moderates the effect of governance mechanisms on negotiation efficiencies. Absent specificity, parties organizing exchanges with formal and informal governance mechanisms are not better off in regards to negotiation efficiencies than those organizing them through market mechanisms (Poppo & Zenger, 2002: 710; Williamson, 1985). As asset specificity increases, interfirm formal and informal mechanisms have an increasing and positive effect on negotiation performance. Thus, the effect of the above governance mechanisms on negotiation efficiencies is contingent upon the levels of asset specificity (Artz & Brush, 2000). Our initial hypotheses are:

Hypothesis 1a. Asset specificity positively moderates the association of negotiation efficiencies with contract completeness.

Hypothesis 1b. Asset specificity positively moderates the association of negotiation efficiencies with relational governance.

Production Efficiencies in Long-Term Relationships

Our previous theorizing relied on the concepts of asset specificity and opportunism to explain increases in negotiation efficiencies associated with governance mechanisms. In this section, we rely

instead on the concepts of complexity and bounded rationality to explain increases in production efficiencies associated with those same mechanisms. We define each of these in turn. Complexity arises from the difficulties of managing large numbers of subparts, organizational routines, and process steps in the production of goods (Clark, Chew, Fujimoto, Meyer, & Scherer, 1987: 748; Macher & Richman, 2007: footnote 23; Masten, 1984: 409; Reed & DeFillippi, 1990: 90; Shelanski, 2004: 960). As the numbers of parts and multistage processes increase, the quantity and diversity of the information involved increase with it, making the integration of the various production tasks more cognitively difficult and costly to synchronize.

The concept of complexity differs from that of asset specificity. The former is associated with uncertainties that arise when communications and supportive actions between transactors are lacking, partners have difficult access to decisions, and each lacks information that is available to the other (Koopmans, 1957: 162). The latter instead is associated with behavioral uncertainties, such as the purposeful non-disclosure, disguise, or distortion of information, as occurs with opportunism (Williamson, 1985: 57). Regarding bounded rationality, Simon (1947) pointed out that individuals are only rational to a restricted degree and are in fact emotional or even irrational in the remaining parts of their actions. Thus, boundedly rational agents experience limits in processing larger amounts of information and solving complex problems.

With increasing complexity, parties become involved in a greater number of forecasting and planning sections as they complete each step. As each step is subject to failures, by the logic of cumulative probabilities, complexity increases the possibility of errors at exponential rates. Given that actors are boundedly rational (Simon, 1957), where complexity is pervasive, parties quickly find it difficult to cognitively make sense of their interactions (Ryall & Sampson, 2007: 4), even where they transact honorably.¹ As a result, distortions of demand along the supply chain are more likely to result, thus increasing production and delivery costs (Lee & Padmanaban, 1997). For example, such distortions entail more safety inventory (Cachon & Zipkin, 1999: 936; Chat-

field, Kim, Harrison, & Hayya, 2004); deteriorate production lead time and delivery (Hariharam & Zipkin, 1995; Lee, So, & Tang, 2000); and enhance the likelihood of costly rework and expediting (De Mayer & Ferdows, 1985).

To reduce the damaging effects of complexity on production efficiency, one can craft interfirm formal and informal (coordination) mechanisms. The logic is as follows: First, formal contracts help firms better determine the coordination steps needed to handle the complexities involved in synchronizing interdependent tasks. As organizational scholars have explained, formal documents function not only as enforceable protection against opportunism, but also as blueprints for exchange, representing a means to better plan collaboration (Ryall & Sampson, 2007: 6) and reduce exposure to rationality limits. Such documents help delineate courses of action—that is, standard operating procedures, such as replenishment schedules and the timing of reorder and deliveries (e.g., every Tuesday)—thus helping reduce misunderstandings (Chen, Federgruen, & Zheng, 2001; Lee & Whang, 1999).²

The effectiveness of contractual documents as coordination mechanisms is, however, obviously limited. It is hard for parties to precisely write down detailed plans because of the difficulty of specifically describing all actions and states of the world (Hart, 1995). Thus, parties can also benefit from implementing relational governance mechanisms. The coordinating function of relational governance is three-pronged. First, through norms of information exchange, parties are able to process greater amounts of information and thus track the progress of each other's initiatives and expectations (Gittell, 2002; Gulati & Singh, 1998; Van de Ven & Walker, 1984). For example, by constantly updating each other on their expectations for market demand, parties are better able to size up the need for inventory provisions against the demand contingencies they envision together. Without such information flow, given the temporal discrepancy between customer orders and goods production, the parties would have to rely on costly buffer inventories (Cachon & Zipkin, 1999: 936; Chen, 1999: 1076; Cheung & Lee, 2002; Lieberman, Helper, & Demeester, 1999; Milgrom & Roberts, 1988).³ Second, through norms of flexibility, parties

¹ Our theory linking complexity and production efficiencies is not meant to deny that complexity also influences negotiation efficiencies. In fact, previous research has explained that complexity may enhance the possibility that opportunistic, boundedly rational actors may try to misappropriate value from specialized investments (e.g., Ryall & Sampson, 2007: 6). We also treat this other view in a later section of this article.

² Chen et al. (2001) found that improvements in supply chain efficiencies can drop to as low as 70 percent where parties fail to establish such appropriate coordination mechanisms.

³ Lee, So, and Tang (2000: 626) pointed out that many industries have striven to implement coordination mechanisms to improve the efficiency of their supply chains;

can adjust to each other's difficulties more closely and regularly; thus, firms can reduce uncertainties related to supply disruptions and even to react more quickly to avert major losses when disruptions such as production line breakdowns inadvertently occur (Hopp & Spearman, 2000). Third, through solidarity norms, especially when solving technical matters, partners more effectively coordinate when and how to draw on each other's resources and jointly leverage their capability sets according to shared expectations of industry conditions (Dyer & Nobeoka, 2000: 360). Through solidarity norms, firms also develop a bilateral commitment to "keep on with it," despite the complexities of their exchange (Poppo & Zenger, 2002: 710).

The degree of complexity can vary substantially (White & Lui, 2005; 916), going from low (e.g., simple machine stamping, or minimal labor, as in the production of nuts and bolts) to very high (e.g., integration of many parts and processes, such as in the production of electronic products). Absent complexity, parties organizing exchanges with formal and informal mechanisms are not better off in regards to production efficiencies than those organizing them without such mechanisms. As complexity increases, these governance mechanisms help improve production efficiencies. Thus, the effect of formal and informal mechanisms on production efficiencies is contingent upon level of complexity. Our hypotheses are:

Hypothesis 2a. Complexity positively moderates the association of production efficiencies with contract completeness.

Hypothesis 2b. Complexity positively moderates the association of production efficiencies with relational governance.

Hypotheses 1a–1b and 2a–2b establish that interfirm governance mechanisms enable improvements in both negotiation and production efficiencies. The coexistence of such effects, however, does not mean these functions are equally relevant under all circumstances. Our central proposition is that the relative magnitudes of these effects will vary with the changing levels of complexity and asset specificity. On the one hand, as explicated previously, the safeguard effect is contingent upon asset specificity—that is, when specificity increases, the threat of opportunism increases with it. Therefore, the change in negotiation

efficiencies associated with the use of interfirm formal and informal mechanisms is likely to increase with asset specificity. Instead, the coordination effect follows a different rationale being contingent upon complexity. When complexities increase, the bounds of rationality are reached quicker. Thus, the change in production efficiencies associated with formal and informal coordination mechanisms is likely to increase with complexity. Considering the respective moderating effects of complexity and asset specificity, *ceteris paribus*, we predict:

Hypothesis 3a. With complexity held constant, as asset specificity increases the effect of contract completeness on negotiation efficiencies grows larger than its effect on production efficiencies.

Hypothesis 3b. With complexity held constant, as asset specificity increases the effect of relational governance on negotiation efficiencies grows larger than its effect on production efficiencies.

Hypothesis 4a. With asset specificity held constant, as complexity increases the effect of contract completeness on production efficiencies grows larger than its effect on negotiation efficiencies.

Hypothesis 4b. With asset specificity held constant, as complexity increases the effect of relational governance on production efficiencies grows larger than its effect on negotiation efficiencies.

The underlying theoretical rationale behind Hypotheses 3a–3b and 4a–4b is of special interest. The focus of our model is to explain that, within the realm of recurrent transactions, whether production or negotiation efficiency becomes the driving economic logic behind governance mechanisms depends on the relative levels of complexity and asset specificity. Specifically, under high complexity and low specificity, firms reach rationality bounds more quickly, though they face low threats of opportunism. Under these circumstances, interfirm governance mechanisms yield more gains in production efficiencies than negotiation efficiencies. As asset specificity increases (with complexity held constant), the effects converge. Alternatively, under low complexity and high specificity, firms face low risks of reaching rationality bounds, but high threats of opportunism. Under these circumstances, interfirm governance mechanisms yield more gains in negotiation efficiencies than production efficiencies. As complexity increases (with specificity held constant), the effects converge. These individual and convergence effects

such programs are intended to reduce inventory and "stock outs." The potential savings from such efforts can be astronomical, they noted, ranging from \$14 billion for the food service industry to \$30 billion for the grocery industry.

are shown in Figure 2, where changing levels of complexity and asset specificity indicate that the chief economic benefit arising from interfirm governance mechanisms is context-specific. Whether the safeguard effect eventually overtakes the coordination effect and vice versa as these factors change are empirical questions addressed in our post hoc analysis.

RESEARCH METHODS

Research Setting, Research Design, and Data Collection

We tested our hypotheses on a sample of vendors supplying recurrently purchased parts to equipment manufacturers (i.e., makers of farm, construction, and industrial tractors). We chose this setting because several sector experts indicated that a special set of common trends and pressures had led to a higher likelihood of these firms adopting mechanisms to govern and coordinate relationships. These trends included industry overcapacity (Bossong-Martinez, 2000), customer inclinations to base buying less on impulse and more on cost-benefit trade-offs (Menes, 2000), a growing trend toward the adoption of “advanced production systems” (APS), such as lean or just-in-time manufacturing (e.g., Stundza, 2001; Siekman, 1999) and, most importantly, a large commodity-parts base (Forrester Research, 2000).

Our survey process mostly followed prescriptions by Dillman (2000). We developed a questionnaire by identifying construct items used in previous research. We also summoned the help of other academics and managers to develop items where precedent was missing, to refine survey wording, and to check the questions’ overall validity vis-à-vis the industry environment. We gathered an initial list of approximately 900 suppliers from the largest tractor manufacturers. Following advice from the management science scholars we consulted, we selected a subsample of firms with like production activities, so as to ensure comparability of production performance. We selected approximately 500 firms producing goods that involved basic materials processing (e.g., cutting, machining, and stamping sheet metal) and component assembly. Our response rate was just below 50 percent, yielding 239 responses.⁴

⁴ To obtain a high response rate, we followed five steps outlined in Dillman (2000). These steps included (1) calling key informants, prior to sending out the questionnaire, and obtaining their participation consent, (2) mailing the questionnaire immediately after this initial contact, (3) following up with a reminder letter about nine days after the initial questionnaire was sent, (4) sending a second survey questionnaire to key informants who failed to respond to

To minimize key informant bias, we surveyed each firm’s *most knowledgeable informant* (Kumar, Stern, & Anderson, 1993). Here, we contacted each supplier by phone, prior to sending the survey, and identified the manager who, according to indications, would be the most knowledgeable about the firm’s relationships with their customers in this industry group, as well as with production-related information. One may question the use of single informants as to whether they have sufficient knowledge and ability to assess the collective orientation of a supplier toward a buyer. Though responses from multiple informants may have been preferable (at the cost of a much smaller sample), we believe that our informants were well positioned to make the assessment asked of them for the following reasons: First, our analysis being at the relationship level, we do not believe that a general assessment of the aggregate feelings of one company toward another would accurately represent the nature of more focused exchanges. In fact, the single respondent approach is particularly appropriate when only a few employees in a firm can reasonably be expected to have complete and detailed knowledge about the phenomena under investigation (Kumar et al., 1993). Second, the key informants had been employed with their organizations for an average of 12 years, in addition to having held their current management positions for an average of 5.5 years. These tenure figures led us to be confident about their knowledge of particular customers. Third, these individuals had primary responsibility for managing the relationships with the particular customers, and they were well aware of the histories of interactions between their firms and these customers. Scholars have agreed that the key informant approach is often preferable when

the first by the third week, and (5) telephoning nonrespondents to remind of data collection deadlines by the sixth week. We took three additional steps (also discussed in Dillman, 2000) to help improve response rates even further: First, respondents were promised a final survey report contingent upon their participation. Second, we placed two- to three-line messages from the tractor manufacturers sponsoring the study on the second pages of the surveys; these messages encouraged their suppliers to participate. Third, participation was anonymous; respondents were guaranteed that no one—not even their customers—would ever know of their individual responses or participation. These data collection techniques are fairly common in management studies. With similar techniques, Mudambi and Helper (1998) gained response rates as high as 66 percent. Our initial response level was 253 questionnaires. However, based on requests for two new measures, by reviewers, we surveyed respondents a second time by telephone. As a result, our response level fell to 239 questionnaires.

specialized knowledge is to be gathered, or where specific individuals are known to be able to generalize about patterns of behavior and better integrate observed organizational relationships (Seidler, 1974). Further, for 40 suppliers, we surveyed a second top executive separately to evaluate interrater reliability (see Dyer and Chu [2003] for a similar treatment). The degree of similarity of the responses was exceptional. Rarely did we find the responses to vary by more than one point. Thus, we believe the key informant responses are highly consistent.

We asked respondents to qualify the past three years of their relationship to avoid biased responses due to aberrant experiences (Artz & Brush, 2000). We also asked them to assess relationship and performance characteristics related to one particular ongoing relationship. We defined this partnership along two dimensions. First, the supplier was to respond to questions relative to "the customer the respondent was most knowledgeable about," which we referred to in the questionnaire as "THIS customer." Second, where the supplier serviced "THIS" customer from multiple facilities or with multiple products, the respondent was to refer to the facility and product family that were most representative for her or his business.

We assessed whether nonrespondents could have produced any significant biases using a *t*-test comparing early with late respondents on key variables, such as performance, firm size, tenure of respondent with the firm, and levels of specificity and complexity (Armstrong & Overton, 1977). The logic behind this procedure was that late respondents share characteristics and biases with nonrespondents. We found no significant differences. We also performed Harman's single-factor test (Harman, 1967); here, if a significant amount of common method bias exists in data (e.g., respondents may tend to report on positive rather than negative partnerships), then a factor analysis of all the variables in the model will generate a single factor that accounts for most of the variance. Unrotated factor analysis using the eigenvalue-greater-than-one criterion revealed that the first factor explained 17.1 percent of the variance in the data. We thus concluded our data were not subject to common method bias.

Operational Measures

Most of our measures were from prior research; some of them were modified to suit our research setting. We used a multi-item approach to assess several of our theoretical constructs and tracked responses on a scale ranging from 1, "not at all," to

5, "to a large degree." All measures were standardized to facilitate cross-model comparisons.

Relational governance. Following previous research, we measured the degree to which firms relied on behavioral norms of information exchange, flexibility, and solidarity (e.g., Macneil, 1980; Poppo & Zenger, 2002). Our indicators were adjusted to ensure the external validity of our questions. Thus, we asked informants to indicate the degree to which they were committed to (1) sharing information on plans and schedules, (2) being transparent in regards to intent (e.g., when communicating with one another), (3) being flexible (which in the survey we illustrated as, "When an unexpected situation arises, you prefer to work out a new deal as opposed to holding each other to the original agreement"), and (4) practicing reciprocity and procedural justice in negotiating shares of efforts and results.

Contract completeness. We based our construct measure of contractual completeness on the definition presented earlier as well as on the literature. Overall, our measure is similar in concept to that of Poppo and Zenger (2002: 717), grounded in the view that the more contingencies a contract covers, the more complete it is.⁵ However, the dimensions we used differed from Poppo and Zenger's. Specifically, they used a one-item measure of contract customization (noting that more tailored contracts require more extensive legal work); we instead used a broader set of dimensions representing both input from the managers we interviewed and prior research. Specifically, we asked informants to indicate their level of agreement with the stem statement, "The supply contracts between your firm and THIS customer fully and clearly specify . . ." for each of the following: (1) "responsibilities involved in production and exchange" (Argyres, Bercovitz, & Mayer, 2007; Ryall & Sampson, 2007), (2) "expected supply processes" (Lerner & Merges, 1998) and outcomes, and (3) "monitoring activities and penalties for non-compliance" (Mayer, Nickerson, & Owan, 2004; Ryall & Sampson, 2007).

Specific assets and capabilities. Similarly to Artz and Brush (2000) and Poppo and Zenger

⁵ An earlier work by Crocker and Reynolds defines contractual completeness as synonymous with fewer contingency specifications. The logic is that since contracts with fewer specifications cover broader issues, the coverage of such contracts would encompass larger domains of dispute. Our measure of completeness is different in nature from such definition, in that more specified contracts are more complete. Our interpretation is based on the empirical perceptions of managers we interviewed, as well as on the literature cited above.

(2002), we tried to capture the degree to which the following human knowledge, skills, physical, and dedicated assets were customized to serve the unique needs of an informant's focal ("THIS") customer: (1) order-processing and inventory-handling routines, (2) production routines, (3) tools, machines, designated physical space, and (4) product design.⁶

Complexity. Our measure of complexity followed the definition presented earlier. We asked respondents to agree or disagree with the following: "To the best of your knowledge, compared to other parts supplied to THIS customer by other firms, the production and exchange of this product is complex because they involve . . . (1) a large number of subcomponents and/or process steps, (2) subcomponents which are hard to handle, insert and align, and (3) process steps which are multifaceted, difficult, or time consuming." Our measure differed from White and Lui's (2005); they measured the "sum of HK\$ dollars involved in a particular contracted project." We believed their measure was a good proxy for complexity, although it may confuse complexity with project size (e.g., large standardized/noncomplex projects would also be classified as complex). However, our measure was more similar to Masten's (1984), in that it captured managers' perceptions, though it was more suited to our context in that it relied on items that were specific to our manufacturing context and used a broader scale range more suitable for continuous variable computations.

Negotiation efficiency. Though exchange renegotiations tend to involve a wide variety of costs, most are labor-related (Dobler, Burt, & Lee, 1990). We thus followed the lead of Anderson and Narus (1990), Artz and Brush (2000), and Dyer and Chu (2003) and gauged the amount of time a firm spent preparing for and actually renegotiating supply arrangements and the amount of effort spent in resolving conflicts in the negotiations. We measured the amount of (1) excessive bargaining sessions before efficiently reaching a deal, (2) the amount of excessive haggling in negotiations, and (3) the degree to which partners got agitated with each other. Although Anderson and Narus did not refer to "excessive" bargaining or haggling, we found through interviews that managers often accepted some degree of haggling and negotiation in reaching deals,

deeming it "normal." Thus, we asked respondents to indicate the amount of haggling and the number of bargaining sessions that would be deemed as exceeding what was considered normal for their dealings, a measure that would in turn indicate inefficiencies. We reverse-coded responses on the above "costs" to capture "efficiencies."

Production efficiency. According to management science scholars, the performance evaluation of a supply chain often involves inventory turns and timely delivery of goods (Cachon & Zipkin, 1999: 936; Chen, 1999: 1076; Cheung & Lee, 2002; Lee & Padmanabhan, 1997). Thus, we measured (1) "the number of inventory turns to support 12 months of sales" and (2) "the percentage of goods delivered on time." Construct validity analysis suggested that the two performance dimensions measured the same underlying construct. Our measure was consistent with those used in strategy and marketing studies of buyer-supplier relationships (e.g., Dyer & Nobeoka, 2000; Kotabe, Martin, & Domoto, 2003; Lieberman et al., 1999; Noordewier, John, & Nevin, 1990).

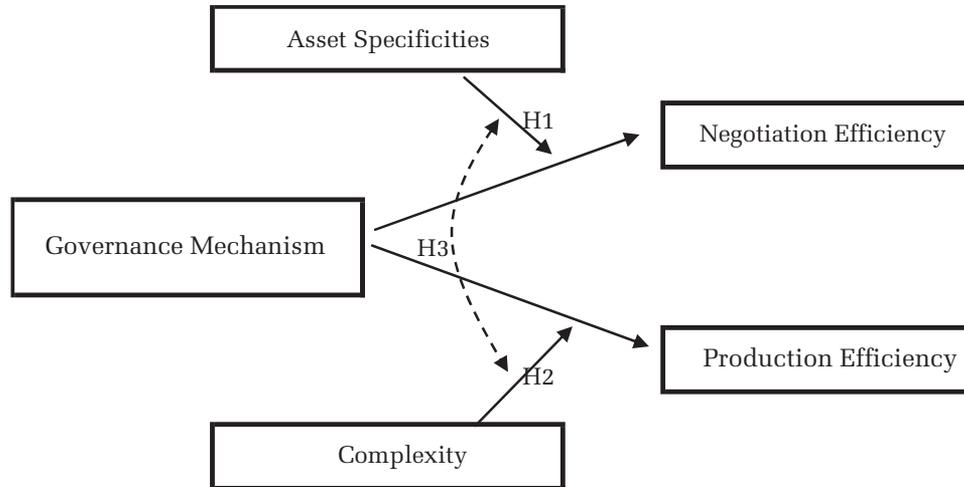
Control Variables

Although we were interested in developing a parsimonious model, we acknowledged that alternative factors might also be involved in our model proposed in Figure 1. We included sets of control variables to ensure results would not be unjustifiably influenced by these factors.

Cross-effects. Our first set of variables controlled for the possible cross-effects of *asset specificity* on production efficiencies and *complexity* on negotiation efficiencies. Asset specificity is known to be sought after for its quality- and efficiency-enhancing properties (Dyer, 1996; Williamson, 1985); thus, we wanted to ensure improvements in production efficiencies were not unjustifiably explained by the presence of such assets. Moreover, complexity may enhance the number of opportunities parties have to be opportunistic (Ryall & Sampson, 2007: 4; Williamson, 1985); thus, we also wanted to ensure that we controlled for deterioration in the level of negotiation efficiencies as complexity rises. Following the same rationale, we also controlled for the possible cross-moderating effects: in the safeguard model, we controlled for the *moderating effect of complexity on the association of negotiation efficiency with (1) contract completeness and (2) relational governance*, whereas in the coordination model, we controlled for the *moderating effect of asset specificity on the association of production efficiency with (1) contract completeness and (2) relational governance*.

⁶ Though our measure above is intended to capture most forms of specificity, Williamson (1996: 58–60) identified another form of specificity that may also impact performance in our setting: temporal specificity. We treat this issue in the control variables section of our study.

FIGURE 1
Integrated Model: Relational Governance as Safeguard and Coordination Mechanisms,
in the Context of Long-Term Buyer-Supplier Relationships



Formal contract provisions and hostage exchanges. Though our hypotheses relate to effects of relational governance and contractual completeness on performance, in hazardous exchanges, those performance effects can also be associated with the threat of enforcement of verifiable contractual provisions, such as duration, and “take-or-pay,” or even with mutual hostage exchanges. Contract duration specifies a longer time period that signals an appropriate horizon within which the return on specialized investments is to be secured (Helper, 1991; Joskow, 1988; Saussier, 2000). Take-or-pay provisions, on the other hand, specify a minimum quantity of output one must pay for, even if delivery is not taken. Such provision offers investors assurance that the utilization of specific assets will be met with assured orders, thus helping reduce exchange uncertainties (Hubbard & Weiner, 1986: 72; Masten & Crocker, 1985: 1083). Thus, we used the number of months of a current contract to control for *contract duration* and the percentage of the ordered quantity buyers were required to take to control for *take-or-pay*. To control for *mutual hostage exchange*, we used the percentage of supplier equity owned by a buyer. Scholars have argued that equity investments are often used to exchange hostages to enhance the level of commitment and trust between buyer and supplier (e.g., Ahmadjian & Oxley, 2006; Helper, 1991).

We also controlled for *time specificity*, which captures the idea that goods may be much less valuable if they are exchanged after a specific point in time and space (Masten, Meehan, & Snyder, 1991; Pirrong, 1993). According to the literature, time specificity matters under three conditions: (1)

safety inventories are low or nonexistent, such as with services or perishable goods. For example, because fruit deteriorates fast once it is harvested, orange farmers may be vulnerable to time specificity hold-up by orange juice factories (Neves, Zylbersztajn, & Neves, 1998: 442). Time specificity is also relevant when (2) a vulnerable firm can perform no other economic activity until the time-specific good or service is rendered. For example, Masten et al. (1991) portrayed opportunistic suppliers who held up the provision of services needed in an inflexible production sequence, thus bringing entire shipbuilding activities to a halt. Time-specificity hold-up threats also increase in (3) thinner markets, where the availability of alternative supplies is low (e.g., the good is not substitutable, or is highly specific, or its suppliers are few [Pirrong, 1993]). The severity of time specificity dissipates as the time between contracting and exchanges increases (Pirrong, 1993: 942). Thus, a firm can temporarily defend itself against such threats by operating with reasonable safety stocks, by choosing goods available in “thick” markets, or, if the goods are perishable (e.g., fresh fruit), by forward-contracting supplies.

Many scholars and practitioners believe that the implementation of advanced production systems such as JIT increases exposure to time-specificity hold-up threats. The logic here is that because JIT exchanges involve minimum inventory, when opportunism materializes, the vulnerable partner can suffer costly production breakdowns. Nevertheless, given the time-specificity theories above, the literature on JIT practices, and insights from managers we interviewed, we reasoned that time-specificity

hold-up threats would be minimal in our context. First, though JIT exchanges are indeed popularly known for their low inventories, JIT is actually defined by the implementation of streamlined production and administrative techniques that enhance the speed, flexibility, and efficiency with which firms respond to changing market conditions (Hopp & Spearman, 2000: 153–154). Low inventory is just the natural result of rational production reorganization into sleek processes, not the mindless destruction of safety stocks. Liker (1997), for example, showcased a JIT bird-cage maker that averted opportunistic buyers by quickly setting up its factory to make alternative goods; likewise, Womack, Jones, and Roos (1990) described how Toyota could turn its auto production to other models on very short notice when key suppliers, willingly or not, defaulted on delivery. The management science research cited above thus suggests that implementation of JIT techniques is more likely to *decrease* a firm's exposure to time specificity, not raise it.

Second, JIT firms are known to actively seek the *thickening* of their supply markets in many ways to effectively avoid hold-up. Interviews with managers revealed that most parts were readily available in thick markets; moreover, even where supplies were customer-specific, buyers sustained relationships with at least two sources, or even implemented systems of *concurrent* sourcing (whereby firms make *and* buy specialized goods), thereby protecting themselves from partners' uncertain behavior (Parmigiani, 2007: 291). With either of these multisourcing options, markets thicken, making hold-up ineffective in the short term. In the long term, then, reputation effects work as an incentive to normalize the behaviors of would-be opportunists. Third, we asked survey respondents to indicate their agreement with two statements: (1) "In our supply partnerships, the implementation of Advanced Production Systems (such as JIT) and the related reduction of safety stocks have increased the likelihood one party could hold the other up to costly production breakdowns, in order to obtain more favorable deals" and (2) "In our context, the implementation of JIT practices makes one more flexible to respond to sudden changes in supplier and buyer markets." The average response on our scale (1 = "not at all"; 5 = "completely agree") for the first was a low 1.26, whereas for the second, it was a high 4.23. We thus had strong evidence that in our context JIT practices worked more to decrease exposure to time-specificity hold-ups than the reverse.

Although we did not believe our context was subject to time-specificity hold-ups, we still included a control variable. We did so to address the

possibility that our logic presented above might be mistaken. We thus controlled for the *percentage of goods made and delivered to order*. This measure identifies the extent to which supply exchanges are carried without inventory. If lower inventory is a result of senseless stock-slashing policies, as opposed to the implementation of production-rationalizing techniques, then the threat is likely to be high; in such a case, one should see negative effects on negotiation and production efficiencies.

Relationship characteristics. We controlled for the *importance of customer* and *relationship length*. In regards to customer importance, if a firm supplies most of its goods to a particular customer, strong power dynamics may affect negotiation behavior. We measured customer importance as the percentage of the dollar value of a firm's total annual sales that were to a focal customer ("THIS customer"). Length of relationship, in its turn, can drive negotiation and production efficiencies in itself. Firms learn to communicate and coordinate with one another better over time (Mayer & Argyres, 2004); the longer two firms work together, assuming outside options are available, smoother product exchanges are likely to follow.

ANALYSES

Analysis of the correlation matrix (Table 1) suggested that our multi-item measures had good convergent validity (that is, items are fairly correlated with one another) and discriminant validity (that is, items representing different constructs clearly measure different constructs). Specifically, all values greater than .62 involved intrafactor correlations, and values below .37 involved interfactor correlations. Additionally, to assess convergent validity, we computed *t*-tests for factor loadings; we only kept indicators for which loadings were greater than twice their standard errors (Anderson & Gerbing, 1988). To assess discriminant validity, we performed chi-square difference tests for constrained and unconstrained measurement factor models (Anderson & Gerbing, 1988). A constrained model sets the correlation between two constructs equal to 1; a significantly lower chi-square for the unconstrained model supports the discriminant validity criterion. All constructs exhibited satisfactory discriminant validity. White's test (White, 1980) and residual plot analyses indicated no problems of heteroskedasticity or error term distribution. Our variance inflation factor analysis indicated no severe issues of multicollinearity.

We performed multivariate regression analysis to empirically validate our model. We preferred mul-

TABLE 1
Correlation Coefficients^a

Variables ^b	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1. Negotiation efficiency: Excessive bargaining sessions																									
2. Negotiation efficiency: Excessive hagglng	.78**																								
3. Negotiation efficiency: Parties get agitated	.75**	.73**																							
4. Production efficiency: Inventory turns	.05	.06	.01																						
5. Production efficiency: Delivery efficacy	.06	.02	.05	.68**																					
6. Relational governance: Information exchange	.35**	.36**	.36**	.36**	.35**																				
7. Relational governance: Flexibility	.30**	.29**	.35**	.35**	.37**	.86**																			
8. Relational governance: Solidarity and procedural justice	.33**	.34**	.35**	.34**	.34**	.82**	.83**																		
9. Contract completeness: Noncompliance penalties	.15*	.13 [†]	.15*	.14*	.13 [†]	.13 [†]	.14*	.10																	
10. Contract completeness: Production responsibilities	.14*	.12	.12 [†]	.15*	.16*	.19**	.21**	.19**	.73**																
11. Contract completeness: Supply procedures & outcome	.13 [†]	.14*	.16*	.16*	.12 [†]	.18**	.17**	.20**	.75**	.77**															
12. Specificity: Order processing/inventory handling	-.16*	-.13*	-.12 [†]	.15*	.14*	.18**	.18**	.15*	.15*	.15*	.16*														
13. Specificity: Production routines	-.17*	-.14*	-.14*	.14*	.12 [†]	.18**	.17**	.18**	.13 [†]	.14*	.15*	.88**													
14. Specificity: Tools, machines, equipment, designated physical space	-.10	-.12 [†]	-.10	.14*	.13*	.13*	.11	.13*	.13*	.13*	.12 [†]	.69**	.85**												
15. Specificity: Product design	-.17*	-.13*	-.15*	.09	.07	.15*	.12 [†]	.13*	.16*	.14*	.11	.65**	.62**	.76**											
16. Complexity: Number of components/processes	-.18**	-.17*	-.14*	-.15*	-.17*	.13*	.14*	.15*	-.12 [†]	.14*	-.15*	.06	.10	.03	.07										
17. Complexity: Component is hard to handle	-.15*	-.14*	-.15*	-.13*	-.11	.13 [†]	.11*	.14*	-.10	-.11	-.13*	.09	.10	.03	.02	.67**									
18. Complexity: Process is difficult	-.19**	-.18**	-.18**	.12 [†]	-.16*	.12 [†]	.10	.12	-.09	-.08	-.10	.10	.04	.03	.02	.72**	.61**								
19. Contract duration	-.16*	-.13*	-.15*	.09	.08	-.10	-.06	-.09	-.08	-.09	-.09	.10	.91	.08	.07	-.12 [†]	-.13*	-.14*							
20. Take-or-pay provision	-.11	-.10	-.11	.10	.09	-.09	-.05	-.02	-.05	-.03	.02	.07	.07	-.07	-.07	-.13*	-.10	-.09	.13 [†]						
21. Mutual hostage exchange	.05	.03	.02	.06	.02	.03	.03	.03	.04	.03	.04	.04	.05	.04	.05	.04	.05	.06	.06						
22. Importance of customer relationship length	.13 [†]	.10	.12 [†]	.07	.05	.11	.10	.05	.02	.06	.08	.07	.07	.08	.08	.04	-.07	-.07	.04	.03	-.07				
23. Relationship length	-.07	-.08	.02	.14*	.12 [†]	.07	-.06	.05	.00	.02	.06	.12 [†]	.10	.09	-.03	.08	.01	.03	.07	.08	.05	.06			
24. Firm size	-.18**	-.15*	-.16*	.09	.10	-.11 [†]	-.10	-.08	.09	-.05	.08	.05	.05	.05	.06	.08	.05	.04	.01	-.03	-.08	.06	.07		
25. Competitive pressure of direct competitors	-.07	-.07	-.05	.05	.08	-.08	-.06	-.07	.07	.05	.06	.17*	.15*	.10	.13*	.01	.05	.06	.00	.02	.06	.09	.08	.07	

^a $n = 239$ firms.

^b Negotiation efficiencies scales were reverse-coded.

[†] $p < .10$

* $p < .05$

** $p < .01$

Two-tailed tests.

tivariate regression over other methods, such as structural equation modeling (SEM), for two main reasons. First, multivariate regression analysis enables comparisons of parameters in models involving interaction terms more easily than does SEM (Ping, 1996). Further, multivariate regression also enabled our controlling for sample selection bias through a two-stage regression technique. Sample selection bias has been a recurrent problem in similar studies (Heckman, 1979). Its control is necessary as alliance form choices were not randomly assigned in the sample; this was likely to yield unreliable estimates. We specifically applied a two-stage technique (e.g., Masten et al., 1991).⁷ This technique uses a probabilistic choice model to describe the self-selection decision in a first stage and then adjusts for self-selection in a second stage by incorporating a predicted probability of self-selection via the inverse Mills ratio into the analysis. The resulting estimation revealed that the inverse Mills ratio (i.e., lambda) was not significant and its inclusion in the model did not significantly change the other estimated coefficients. We thus concluded that self-selection did not affect our analyses.

Because our analyses relied on the separability of complexity and specificity, we took additional steps to gauge the possibility that higher complexity might induce higher specificity, or vice versa. If this were the case, the two concepts would be endogenously determined, and as such their parameter interpretations would be subject to errors. For example, one of our measures of complexity captures whether subcomponents are difficult to handle, insert, and align with one another. This measure could unwarrantedly capture the specialized nature of a part design (when a part design is customer-specific, workers may require more time to fit it). To gauge the extent to which this possible endogeneity tainted our sample, we took two steps. First, we surveyed respondents on the extent to which the customer-specific nature of the goods

and processes involved in transactions with a focal customer raised complexity levels above what was usually observed in exchanges of goods of the same product family. On a scale from 1 ("not at all") to 5 ("to a large extent"), we had a low (1.12) average response.⁸ Second, our discriminant validity analysis indicated that the two constructs were measured by different items; an analysis of the correlation matrix further indicated that cross-item correlations were low and insignificant. These results gave us confidence that specificity did not breed complexity, or vice versa, to an extent that would jeopardize our analysis. Specificity and complexity were not only different and separate constructs at the conceptual level; they were so at the empirical level as well.

The safeguard (Equation 1) and coordination (Equation 2) models were specified as follows:

$$\begin{aligned}
 \text{Negotiation efficiency} = & A_0 + A_1 \text{ relational} \\
 & \text{governance} + A_2 \text{ contract completeness} \\
 & + A_3 \text{ asset specificity} + A_4 \text{ complexity} \\
 & + A_5 \text{ relational governance} \\
 & \times \text{asset specificity} + A_6 \text{ relational} \\
 & \text{governance} \times \text{complexity} \\
 & + A_7 \text{ contract completeness} \times \text{asset} \\
 & \text{specificity} + A_8 \text{ contract completeness} \\
 & \times \text{complexity} + A_9 \text{ asset} \\
 & \text{specificity} \times \text{complexity} \\
 & + A_{10i} \text{ control}_i.
 \end{aligned} \tag{1}$$

⁷ We followed similar techniques shown in Leiblein and Miller (2003); that is, we split the sample at the mean of our measure of relational governance into two groups: one with firms in alliances with high relational content (112 firms) and another with low relational content (127 firms). We used several independent variables in the probit stage that could endogenously lead to the choice of alternative governance forms, such as asset specificity, complexity, firm size, relative sales volume, percentage of goods made to order, and distance in miles from buyer to supplier. We used the output from the probit model to calculate the probability that a firm with a given set of attributes would choose more complete contracts and deeper relational content.

⁸ From our survey, we know that exchanges involve products that more or less fall into one of four categories: (1) nonspecific/noncomplex, such as nuts and bolts, (2) complex/nonspecific, such as generic hydraulic systems, (3) noncomplex/specific, such as fuel tanks (i.e., each fuel tank is custom designed to fit a particular tractor model, though its making involves simple metal cutting and bending), and (4) complex/specific, such as tractor rear axles (rear axles are highly complex pieces of equipment; they include dented wheels that match tractor model specifications, as well as precise combinations of myriads of valves, washers, and custom designed steel parts). Although most product exchanges in our sample involved either specificity or complexity characteristics, fewer than ten of our respondents indicated that the specialized nature of the products exchanged determined a level of complexity higher than that normally expected in exchanges of generic products of comparable nature. We were thus confident that specificity and complexity were not endogenously determined.

$$\begin{aligned}
\text{Production efficiency} = & B_0 + B_1 \text{ relational} \\
& \text{governance} + B_2 \text{ contract completeness} \\
& + B_3 \text{ asset specificity} + B_4 \text{ complexity} \\
& + B_5 \text{ relational governance} \\
& \times \text{asset specificity} + B_6 \text{ relational} \\
& \text{governance} \times \text{complexity} \\
& + B_7 \text{ contract completeness} \times \text{asset} \\
& \text{specificity} + B_8 \text{ contract completeness} \\
& \times \text{complexity} + B_9 \text{ asset} \\
& \text{specificity} \times \text{complexity} \\
& + B_{10i} \text{ control}_i.
\end{aligned} \tag{2}$$

For the above models, we used a first-stage regression model, as captured in Equation 3:

$$\begin{aligned}
& \text{Relational governance/complete contracts} \\
= & \Gamma_0 + \Gamma_1 \text{ asset specificity} + \Gamma_2 \text{ complexity} \\
& + \Gamma_3 \text{ firm size} + \Gamma_4 \text{ relative sales volume} \\
& + \Gamma_5 \text{ percentage of goods made to order} \\
& + \Gamma_6 \text{ distance in miles between} \\
& \times \text{buyer and supplier}.
\end{aligned} \tag{3}$$

Effects of Control Variables

Table 2 summarizes the regression results. Our first set of controls relate to the cross-effects of asset specificity on production efficiency and complexity on negotiation efficiency. On the one hand, asset specificity does seem to positively affect production efficiencies, though at a marginal level ($\beta = 0.12, p < .10$); likewise, complexity does seem to undermine negotiation efficiency ($\beta = -0.15, p < .05$). On the other hand, we do not find significant results for the cross-moderating effects. The effect of complexity on the association between relational governance and negotiation efficiencies is insignificant, as is the effect of complexity on the association between contract completeness and negotiation efficiencies. Asset specificity has a non-significant effect on the association between relational governance and production efficiencies; the same can be said about the effect on the association between contract completeness and production efficiencies.

The effects of contract duration on negotiation efficiency are highly significant ($p < .05$), but in the

direction opposite expectation ($\beta = -0.15$). It seems that in our population, contract duration diminished negotiation flexibility and therefore undermined the fluency with which partners adapted to changing circumstances. Contract duration did not seem to affect production efficiencies in any significant way. As for take-or-pay provisions, they did not seem to have any significant effects on negotiation or production efficiencies. Likewise, hostage exchanges (i.e., the percentage of supplier equity owned by a customer) did not influence negotiation or production efficiencies.

As we expected, time specificity (i.e., the percentage of goods made and delivered to order) did not seem to encourage hold-up threats. The effect on negotiation efficiencies was not significant, whereas its effect on production efficiencies was positive and significant ($\beta = 0.12, p < .10$). This positive effect on production efficiencies confirms what we gathered through both interviews with managers and the literature: that the lack of inventory in JIT exchanges is more strongly associated with the implementation of manufacturing techniques than with unjustifiable and mindless reductions in safety stocks.

The importance of a customer and relationship length were both significant, but for different forms of performance. Where two parties exchanged a large volume of business (customer importance), they observed improvements in negotiation efficiencies ($\beta = 0.12, p < .10$). In a way, the more important a customer is to a supplier, the more fluid their negotiations will be, as suppliers are wary of confrontations that could terminate important relationships. Customer importance had, however, no significant effect on production efficiencies. Relationship length, on the other hand, had a significant and positive association with production efficiencies ($\beta = 0.13, p < .10$). It appears that the longer parties have been working together, the more they learn to work with one another, much as Mayer and Argyres (2004) argued. Relationship length had no significant effect on negotiation efficiencies.

Main Effects

To test Hypotheses 1a–1b and 2a–2b, we looked at the size and significance of the respective moderating effects of specificity and complexity on the associations between governance with negotiation (Hypotheses 1a–1b) and production efficiencies (Hypotheses 2a–2b). Baron and Kenny (1986: 1174) explained that for the analysis of moderator hypotheses, interpreting the interaction term is sufficient, whereas interpreting the main effect pa-

TABLE 2
Results of Regression Analysis^a

Variables	Second Stage, Safeguard Model: Negotiation Efficiency				Second Stage, Coordination Model: Production Efficiency							
	First Stage: Relational Governance	First Stage: Contract Completeness	Control Set 1	Control Set 2	Control Set 3	Basic Model	Full Model	Control Set 1	Control Set 2	Control Set 3	Basic Model	Full Model
Relational governance						0.34** (5.58)	0.32** (5.29)				0.34** (5.57)	0.35** (5.60)
Contract completeness						0.15* (1.86)	0.14* (1.67)				0.17** (2.68)	0.17** (2.65)
Asset specificity	0.15* (3.38)	0.15* (3.41)				-0.15** (-3.32)	-0.15** (-2.87)				0.13 [†] (1.87)	0.12 [†] (1.65)
Complexity	0.12 [†] (1.72)	0.15* (3.11)	-0.17* (-2.84)			-0.16** (-2.74)	-0.15* (-2.57)				-0.15* (-2.41)	-0.15* (-2.33)
Relational governance × asset specificity							0.15** (2.42)				-0.02 (-0.28)	0.004 (0.03)
Relational governance × complexity			0.07 (0.89)			0.06 (0.90)	0.05 (0.85)					0.21** (3.73)
Contract completeness × asset specificity							0.10 (1.52)					-0.03 (-0.39)
Contract completeness × complexity					0.05 (0.87)		0.04 (0.79)					0.14* (2.61)
Asset specificity × complexity							0.09 (1.06)	0.09 (1.29)				0.08 (1.25)
Contract duration	-0.02 (-0.27)	-0.07 (-0.95)	-0.16* (-2.47)			-0.15* (-2.34)	-0.15* (-2.33)				0.09 (1.20)	0.08 (1.02)
Take-or-pay provisions	-0.01 (-0.19)	-0.02 (-0.21)				-0.10 (-1.54)	-0.10 (-1.53)				0.10 (1.23)	0.10 (1.26)
Hostage exchange	-0.11 (-1.53)	-0.08 (-1.33)				0.00 (0.02)	0.00 (0.03)	0.00 (0.01)			0.00 (0.01)	0.00 (0.01)
Percentage of goods made to order	0.13* (2.61)	0.12 [†] (1.81)	0.04 (0.59)			0.04 (0.58)	0.04 (0.55)				0.13* (1.91)	0.12 [†] (1.72)
Importance of customer relationship length							0.11 (1.60)	0.11 (1.70)	0.07 (0.77)		0.05 (0.49)	0.06 (0.67)
Firm size	0.00 (0.03)	0.00 (0.04)	0.06 (0.88)			0.03 (0.48)	0.04 (0.49)				0.14 [†] (1.94)	0.13 [†] (1.91)
Competitive pressure of direct competitors	0.08 (1.04)	0.07 (1.03)				-0.16* (-3.18)	-0.17** (-3.33)				0.09 (1.23)	0.09 (1.02)
						-0.07 (-0.95)	-0.06 (-0.86)	0.09 (1.35)			0.09 (1.35)	0.05 (0.35)
Inverse Mills ratio for relational governance											0.04 (0.06)	0.08 (0.99)
Inverse Mills ratio for contract completeness											0.02 (0.15)	0.06 (0.71)

^a $n = 239$ firms. Standard errors are in parentheses.

[†] $p < .10$

* $p < .05$

** $p < .01$

Two-tailed tests.

parameter is irrelevant. This is because the main effect parameter represents only the mean effect over the variance range of the moderator factor, whereas the moderator parameter represents the change, from the mean, of the effect of the moderator variable. In sum, although the main effect must be included in the model, its interpretation is not required.

Hypothesis 1a (asset specificity positively moderates the association of negotiation efficiency with contract completeness) is not supported. The coefficient of the interaction term is positive but non-significant. Hypothesis 1b, on the other hand (asset specificity positively moderates the association between negotiation efficiency with relational governance) is supported. The coefficients of the interaction term are positive ($\beta = 0.15$) and significant ($p < .10$).

Hypotheses 2a and 2b (complexity positively moderates the association between production efficiency with (2a) contract completeness and (2b) relational governance) are both supported. The coefficients of interaction terms are both positive (respectively, $\beta = 0.14$ and $\beta = 0.21$) and significant (respectively, $p < .05$ and $p < .01$).

Results from Hypotheses 1a–1b and 2a–2b helped establish an initial basis for us to move to the analysis of our central hypotheses, Hypotheses 3a–3b and 4a–4b. Specifically, the results confirm that specificity and complexity respectively moderate the safeguard and coordination effects of formal and informal governance mechanisms. Thus, we next contrast these moderating effects in the negotiation and production efficiency models. To carry out this analysis, we used *t*-tests to compare the moderating effects of complexity and asset specificity for the safeguard and the production coordination models.

Hypotheses 3a–3b are supported. As shown in Table 2, asset specificity moderates the effect of relational governance on negotiation efficiency at a rate of 0.15, whereas it only moderates the effect of relational governance on production efficiency at a rate of 0.004 (compare the interaction of asset specificity with relational governance in the two models). We confirm that these parameters are significantly different at the .05 level. In regards to contractual completeness, asset specificity moderates the effect of contract completeness on negotiation efficiency at a rate of 0.10, whereas it only moderates the effect of contract completeness on production efficiency at a rate of -0.03 . We confirm that these parameters are significantly different at the .10 level. In view of the above, we concluded that the moderating effect of asset specificity (holding complexity constant) is greater

for the negotiation than for the production efficiency model.

Hypotheses 4a–4b are also supported. Complexity only moderates the effect of relational governance on production efficiency at a rate of 0.09, whereas it moderates the effect of relational governance on production efficiency at a rate of 0.21 (Table 2). These parameters are significantly different at the .01 level. In regards to contractual completeness, asset specificity moderates the effect of contract completeness on negotiation efficiency at a rate of 0.06, whereas it moderates the effect of contract completeness on production efficiency at a rate of 0.14. These parameters are significantly different at the .10 level. Thus, we conclude that the moderating effect of complexity (holding asset specificity constant) is greater for the production than for the negotiation efficiency model.

What Our Results Mean

The results above indicate that complexity and asset specificity respectively moderate the relative values of the safeguard and coordination effects (Hypotheses 1a and 1b and 2a and 2b). Hypotheses 3a–3b and 4a–4b then help determine that specificity matters more for negotiation efficiencies than for production efficiencies, whereas complexity matters more for production efficiencies than for negotiation efficiencies. From here, we conclude that at lower levels of specificity, and higher levels of complexity, the coordination logic of formal and informal governance matters more than the safeguard logic—that is, governance mechanisms yield more production than negotiation efficiencies. Likewise, at lower levels of complexity and higher levels of asset specificity, the safeguard logic matters more than the production coordination logic (i.e., formal and informal governance mechanisms yield more negotiation than production efficiencies). As both complexity and specificity increase, the two effects converge.

These conclusions help address an early concern of leading transaction cost economics scholars about the integrated production and negotiation benefits arising from governance choices (Balakrishnan & Wernerfelt, 1984; Williamson, 1985). In our model, whether interfirm governance choices yield negotiation or production efficiencies depends on the relative levels of specificity and complexity. Thus, integrating dual efficiency models into an analysis of governance effects helps expand knowledge beyond that offered by previous isolated analyses.

For the above inferences to gain further visibility,

we further quantified the gains in negotiation and production efficiencies (arising from formal and informal mechanisms) at alternative high/low levels of complexity and specificity. This additional empirical examination depended on the analysis of sums of multiple coefficients; thus, direct examination of results in Table 2 would not suffice. Here, we looked instead at the derivatives of negotiation and production efficiency models (Equations 1 and 2) with respect to both relational governance and contract completeness.

As an example, the derivative of negotiation efficiency with respect to relational governance measures the gain in negotiation efficiency for a unit change in relational governance. Likewise, the derivative of production efficiency with respect to relational governance measures gains in production efficiency for changes in relational governance. These derivatives are represented in Equations 4 and 5.

$$\begin{aligned} \delta \text{Negotiation efficiency} / \delta \text{relational} \\ \text{governance} &= A_1 + A_5 \text{ asset specificity} \\ &+ A_9 \text{ complexity.} \end{aligned} \quad (4)$$

$$\begin{aligned} \delta \text{Production efficiency} / \delta \text{relational} \\ \text{governance} &= B_1 + B_5 \text{ asset specificity} \\ &+ B_9 \text{ complexity.} \end{aligned} \quad (5)$$

Replacing the parameters of Equations 4 and 5 with values from Table 2, while holding complexity constant at its mean 0, we obtain:

$$\begin{aligned} \delta \text{Negotiation efficiency} / \delta \text{relational} \\ \text{governance} &= 0.32 + 0.15 \\ &\times \text{ asset specificity} \end{aligned}$$

and

$$\begin{aligned} \delta \text{Production efficiency} / \delta \text{relational} \\ \text{governance} &= 0.35 + 0.004 \\ &\times \text{ asset specificity.} \end{aligned}$$

Overall, we evaluated whether firms gain more negotiation than production efficiencies from relational governance mechanisms by comparing the two equations above for given levels of specificity (e.g., quartiles or deciles). We replicated the above analysis for complexity as well as for contractual completeness. For simplicity, we refrain from presenting these other derivative computational mechanics; these can be easily replicated with param-

eters from Table 2. Below, we move on to report results instead.

Table 3 summarizes our quantifications for gains in production and negotiation efficiencies. At low levels of specificity (with complexity held constant at average levels), as firms increase relational governance, they attain lower gains in negotiation than in production efficiencies (in Table 3a, 0.12 versus 0.34); at high specificity, in turn, they attain more gains in negotiation than production efficiencies for increases in relational governance (0.50 versus 0.35). The same type of relative gains is observed for contractual completeness (in Table 3b, 0.01 versus 0.21 for low specificity; 0.26 versus 0.13 for high specificity). The analysis for quartiles of complexity demonstrates an opposite effect. At low levels of complexity (with specificity held constant at average levels), as firms increase relational governance, they attain lower gains in production than in negotiation efficiencies (in Table 3c, 0.05 versus 0.25); at high levels of complexity, in turn, they attain more gains in production than in negotiation efficiencies for increases in relational governance (0.61 versus 0.38). The same type of relative gains is observed for contractual completeness (in Table 3d, -0.07 versus 0.07 for low complexity; 0.30 versus 0.18 for high complexity).

DISCUSSION AND CONCLUSION

In this study, we develop a dual performance model, looking at the production and negotiation efficiencies that arise from buyer-supplier long-term relationships. Through an analysis of the moderating effects of two conditioning factors, complexity and asset specificity, we untangled the conditions creating alternative forms of efficiencies. In doing so, we demonstrate that the relative importance of production or negotiation efficiency gains arising from such relationships depends respectively on the relative levels of complexity and specificity. From here, we infer that whether production and negotiation efficiencies become chief motivators for firms engaging in bilateral governance is context-dependent.

Our study raises important implications for the literature. First, a growing literature concerns the determination of cooperation benefits that go beyond the costs involved in the deterrence of opportunism (Ghoshal & Moran, 1996; Gulati & Singh, 1998; Madhok, 2000, 2002; Parmigiani, 2007; Poppo & Zenger, 1998; White & Lui, 2005; Zajac & Olsen, 1993). A fundamental proposition of this research is that an exclusive focus on controlling partners' opportunism discounts the potential for cooperation and good faith interactions (Ghoshal &

TABLE 3
Quantifying Gains in Negotiation vis-à-vis Production Efficiencies,
across Levels of Specificity and Complexity^a

(3a) Safeguard × production coordination effects of relational governance for quartiles of asset specificity

Quartile of Asset Specificity	(δ Negotiation Efficiency/ δ Relational Governance) $\alpha 2 + \alpha 5$ <i>asset specificity</i>	(δ Production Efficiency/ δ Relational Governance) $\beta 2 + \beta 5$ <i>asset specificity</i>
1st (low)	0.12	0.34
2nd	0.27	0.35
3rd	0.38	0.35
4th (high)	0.50	0.35

(3b) Safeguard × production coordination effects of contract completeness for quartiles of asset specificity

Quartile of Asset Specificity	(δ Negotiation Efficiency/ δ Contract Completeness) $\alpha 1 + \alpha 7$ <i>asset specificity</i>	(δ Production Efficiency/ δ Contract Completeness) $\beta 1 + \beta 7$ <i>asset specificity</i>
1st (low)	0.01	0.21
2nd	0.10	0.18
3rd	0.18	0.16
4th (high)	0.26	0.13

(3c) Safeguard × production coordination effects of relational governance for quartiles of complexity

Quartile of Complexity	(δ Negotiation Efficiency/ δ Relational Governance) $\alpha 2 + \alpha 6$ <i>complexity</i>	(δ Production Efficiency/ δ Relational Governance) $\beta 2 + \beta 6$ <i>complexity</i>
1st (low)	0.25	0.05
2nd	0.30	0.28
3rd	0.34	0.43
4th (high)	0.38	0.61

(3d) Safeguard × production coordination effects of contract completeness for quartiles of complexity

Quartile of Complexity	(δ Negotiation Efficiency/ δ Contract Completeness) $\alpha 1 + \alpha 8$ <i>complexity</i>	(δ Production Efficiency/ δ Contract Completeness) $\beta 1 + \beta 8$ <i>complexity</i>
1st (low)	0.07	-0.07
2nd	0.12	0.08
3rd	0.14	0.18
4th (high)	0.18	0.30

^a This analysis contrasts the relative changes in the safeguard and production coordination effects, given changing levels of specificity and complexity. For example, in Table 3a, as asset specificity goes from low to high, the effect of relational governance on negotiation efficiency increases from 0.12 to 0.50, whereas the effect of relational governance on production efficiency remains relatively stable. The same analysis can be drawn for contract completeness, in Table 3b. Tables 3c and 3d repeat the analysis for different levels of complexity.

Moran, 1996). Some studies have integrated the logics of complexity and specificity (e.g., Gulati & Singh, 1998; White & Lui, 2005). To paraphrase Gulati and colleagues' (2005: 417) words, vertical collaboration encompasses not only cooperation, i.e., the alignment of interests, but also coordination, i.e., the alignment of actions. With a few exceptions, however (see Noordewier et al. [1990] for a study of the production and exchange of bearings), organization scholars have overlooked the role of governance mechanisms as production co-

ordination mechanisms. Production issues associated with interfirm governance are often subject to attention from management science researchers (Cachon & Zipkin, 1999; Chatfield et al., 2004; Lee & Padmanaban, 1997; Lee, So, & Tang, 2000). We help to unite management science considerations and to expand both production management and transaction costs analysis. Essentially, depending on whether asset specificity or complexity is greater, the chief performance outcome from alliance governance choices may be production or ne-

negotiation efficiencies. With concomitant rises in specificity and complexity, both negotiation and production efficiencies result.

Proponents of transaction cost economics recognized in prominent early studies that governance matters for both negotiation and production (e.g., Balakrishnan & Wernerfelt, 1986; Williamson, 1985).⁹ Over time, the transaction cost economics literature has come to emphasize governance in detriment to production issues. Our work thus also helps fulfill the early promise of this research stream, especially in new exchange domains. For example, Williamson (1985: 3) first proposed that exchange governance choices affect both negotiation and production efficiencies. He contrasted how vertical integration fundamentally affects contracting and administrative efficiencies but only marginally matches the production scale efficiencies available in market governance. As such, he concluded that negotiation efficiencies are the chief economic reason why firms eventually choose to vertically integrate. We have expanded this analysis into a new context—interfirm exchanges involving negotiation and production efficiencies—to show how formal and informal governance mechanisms can affect these two types of efficiencies. By untangling safeguard and production coordination issues, we demonstrate that contractual completeness and relational governance help firms synchronize their interdependent production systems more than they help protect from opportunism in highly complex but nonspecialized exchanges. On the other hand, they help improve negotiation efficiencies more than production efficiencies in highly specific but noncomplex contexts. Our conclusion is that whether governance choices enable negotiation more than production efficiencies in buyer-supplier relationships depends on the relative levels of complexity or specificity.

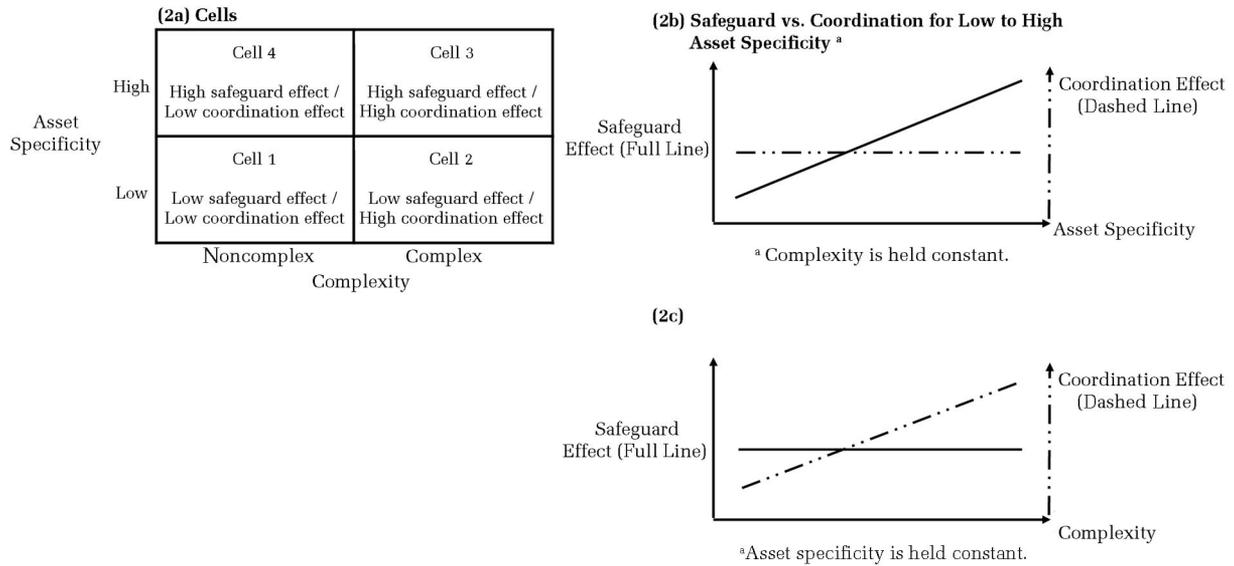
Second, a recent debate about the importance of specificity and negotiation concerns has placed prominent transaction cost economics scholars on opposite sides. One group has treated these as *central* factors behind governance choices and efficiency outcomes; complexity and production efficiency concerns are often regarded as *support* factors (e.g., Klein, 1996; Klein et al., 1978). This view is best summarized by Ryall and Sampson (2007: 4), who noted that the complexity surrounding collaborative efforts creates a fertile environment for partner opportu-

ism. A contending group has questioned the central importance of specificity and negotiation efficiencies (Casadesus-Masanell & Spulber, 2000; Coase, 2000, 2006; Freeland, 2000; Miwa & Ramseyer, 2000). Casadesus-Masanell and Spulber (2000: 67) argued that managing complexity and attaining production efficiencies instead could be the real reasons behind governance choices (see also Coase, 2006: 259). Using similar reasoning, Miwa and Ramseyer (2000: 2667) suggested that asset specificity logic seems to explain a narrower band of phenomena than originally thought. Current work in transaction cost economics seems unable to resolve this conflict. Studies often use single models to determine governance choices based on complexity and asset specificity (Gulati & Singh, 1998; Masten, 1984) or lump production and negotiation costs into single measures, such as overall relationship satisfaction (Poppo & Zenger, 2002) or ROA (Dyer, 1996).

It has been our hope to shed some light on this debate. Specifically, we developed a dual performance model that allows a look at the production and negotiation efficiency implications of formal and informal governance mechanisms. We do not defy any of the views about centrality from either group; we instead integrate production coordination with safeguard concerns into the economics of governance efficiency to demonstrate that whether asset specificity or complexity is a central or determining factor can be context-specific. Referring back to Figure 2, firms representative of cell 2 (low specificity, high complexity) benefit from relational governance and contract completeness mostly for the production efficiencies they enable. Within this context, as Coase (2006) argued, asset specificity is immaterial for firms to benefit from more hierarchical governance modes. Firms in cell 4 (high specificity, low complexity) benefit from relational governance and contract completeness mostly for the safeguard efficiencies they enable. Within this context, as Klein (1998) argued, asset specificity becomes a *sine qua non* condition for more hierarchical governance mechanisms to pay off. Firms in cell 3 (high specificity, high complexity) benefit from relational governance and contract completeness for both the production and negotiation efficiencies they enable. Firms in cell 1 receive few benefit improvements from choosing any governance mechanism other than markets. We do not suggest that our study finally resolves the arduous and multifaceted debate referred to above. We believe, however, that with this dual approach, we can better determine when production concerns or negotiation concerns become key economic out-

⁹ Also see Parmigiani (2007), a recent study of concurrent sourcing, whereby firms both make and buy.

FIGURE 2
Changes in the Safeguard and Coordination Effects of Formal and Informal Governance Mechanisms
Contingent upon Complexity and Asset Specificity



comes of governance choices, given relative levels of specificity and complexity. Thus, we illustrate how such views can be context-dependent; our hope is to help researchers take a partial yet non-trivial step toward bridging these contending perspectives.

Our work also helps expand the debate on whether formal and informal mechanisms of governance have complementary (e.g., Poppo & Zenger, 2002; Mayer, 2006; Ryall & Sampson, 2007), substitute (e.g., Bernheim & Whinston, 1998; Bradach & Eccles, 1989; Dyer & Singh, 1998; Granovetter, 1985; Uzzi, 1997), or even detrimental effects (Fehr & Gachter, 2000; Ghoshal & Moran, 1996: 24–27; Macauley, 1963: 64). Determining the nature of the interaction among formal and informal mechanisms is not a central goal of our study, although our analysis lends itself to a deeper comprehension of the issue. Our findings suggest that relational governance and contractual completeness are at times supplements; mirroring the analysis of Poppo and Zenger (2002), our analysis shows that both mechanisms effectively help enhance production efficiencies; moreover, these mechanisms seem to correlate quite highly. Thus, for the context of production efficiencies, we agree with Poppo and Zenger (2002) that these mechanisms are complements. However, the same cannot be said for the context of negotiation efficiencies; it seems that only relational governance functions as both a safeguard and production coordination mechanism, and in our sample, contractual completeness does not seem to be a statistically significant safeguard

mechanism. Within our context of long-term buyer-supplier relationships in the equipment industry, we suggest that relational governance is a good substitute for contractual completeness.

An analysis of contract duration and take-or-pay-provisions helped us make further inferences. Contract duration is significantly detrimental to negotiation efficiencies. Here, a more appropriate explanation of the interaction between formal and informal mechanisms of governance would be that since formal contracts actually undermine performance as well as a firm's capacity to develop relational governance (an analysis of the association between relational governance and contract duration actually shows a strongly negative relationship, although it is nonsignificant), it seems that the explicit provision for longer duration signals mistrust of an exchange partner, as Ghoshal and Moran (1996: 24–27) proposed (see also Fehr & Gachter, 2000; Macauley, 1963: 64). Coase (2006: 261–262) also argued that hold-up threats can be created from the rigidity of long-term contractual clauses. Our finding defies previous suggestions that longer contractual duration has a positive impact on performance (e.g., Helper, 1991). The logic behind this finding may be that such contracts promote inflexibility, as opposed to flexibility (which is naturally required in flexible production systems). Thus, parties are likely to observe increases in negotiation time and haggling. As far as take-or-pay contractual provisions are concerned, we see no association between them and relational governance.

Lastly, our study is also relevant for practitioners. Through an isolated analysis of safeguard effects, one would see a decrease in the benefits of more hierarchical governance modes (e.g., relational governance or formal contracts), and thus more firms would favor arm's-length exchanges. As one integrates production efficiencies into the economic rationale of governance choices, we observe that many firms continue to pursue structured governance choices for the other benefits they confer (White & Lui, 2005). Thus, we demonstrate that an exclusive focus on the safeguard logic can taint efficient managerial conclusions. We do not aim at defying the safeguard logic; our study simply demonstrates that a more integrated view is necessary for firms to make more complete decisions.

Admittedly, our study also has shortcomings. First, although we deal with the coordinating complexities involved in the integration of production systems, other research will have to assess not only whether our theorizing holds for other forms of exchanges (e.g., transfer of know-how as well as the exchange of technologies), but also for other environments (e.g., services, high-tech). Further, it is also important to note that the theory sections leading to each hypothesis could function in reverse. Because we are unable to determine the causal direction of the effects (at this point, our central interest is the more simple statistical association between the constructs), these effects will have to be determined in future research as they develop over time. Another important limitation is that our sample seemed to involve only low to intermediate (as opposed to very high) levels of specificity and complexity—that is, levels leading to interfirm agreements (as opposed to vertical integration). At such a low to intermediate specificity range, for example, the relative importance of safeguard and production coordination may differ from that observed at very high levels. The same can be said for the value of relational governance versus formal contracts. Thus, future research must replicate our study at more extreme levels of specificity and complexity, especially the upper ranges leading to vertical integration. Overall, we believe that until more models integrating safeguard and production coordination logics are carefully crafted and empirically explored, scholars' understanding of vertical relationships will remain significantly limited.

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