A R T I C L E S

ORGANIZING AROUND TRANSACTION COSTS: WHAT HAVE WE LEARNED AND WHERE DO WE GO FROM HERE?

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Transaction cost economics has long been a key perspective on the organization of economic activity. Over the past three decades, numerous studies have examined transaction cost economics' assertion that the costs surrounding exchanges, called transaction costs, direct managers' decisions about whether to organize activities via market, hybrid, or hierarchy, and whether organizing this way enhances performance. By aggregating the results of 143 studies via meta-analysis, we take a step toward better understanding the extent to which transaction cost economics' core predictions are supported and whether more recent theoretical developments shed additional light on organizing decisions. Our results reveal that transaction cost economics explains organizing decisions and resulting performance, but the size of the effects reveals that there is still much to learn. Overall, our findings suggest that transaction cost economics must be augmented with other perspectives to explain how firms organize economic activity.

Economic theory dating back to Adam Smith (1776) has proclaimed that market transactions are the most efficient way to organize economic life. Yet early theory left two important questions unanswered: If markets are the most efficient way to organize, why do firms even exist? And given that firms do exist, how do managers decide which activities to organize within firms while using markets for others? Coase (1937) began to answer these questions by explaining that organizing through markets involves certain costs—later called transaction costs—that can be reduced under some circumstances by organizing within firms. Williamson (1975, 1979, 1985) built on Coase's insights to describe the main attributes that give rise to transaction costs; in doing so, he formalized transaction cost economics (TCE). Since then, TCE's tenets have been routinely taught in business schools worldwide (Ghoshal, 2005), and the enormity of

TCE's influence helped Williamson earn a share of the 2009 Nobel Prize in economics.

TCE focuses on transactions—transfers of goods or services across workgroups where one stage of economic activity ends and another begins (Williamson, 1975). According to TCE, transactions can be organized under one of three structural alternatives: markets, hybrids (such as alliances, franchises, and joint ventures), or hierarchies (i.e., firms). Managers should select the alternative that minimizes transaction costs, which are expenses that arise from identifying qualified exchange partners, negotiating contracts, monitoring performance, and adapting to changing conditions (Williamson, 1991). Williamson (1985) argued that these costs are driven by the unique attributes surrounding each transaction (i.e., asset specificity, uncertainty, and frequency). When transactions involve high levels of these attributes, internalizing

activities within firms minimizes transaction costs. Otherwise, exchanging with others through markets or hybrids minimizes transaction costs. When managers "match" each transaction's unique attributes to the structural alternative that minimizes transaction costs, firm performance is maximized through a process Williamson (1991) called "discriminating alignment."

Scores of studies have tested TCE's predictions that attributes of transactions affect organizing decisions and that, in turn, these decisions shape firm performance. The resulting evidence has been summarized in narrative reviews (e.g., Gibbons, 2010; Rindfleisch & Heide, 1997). Although they can offer a rich description of past studies, narrative reviews do not permit accurate assessment of a theory's level of support or allow a systematic investigation of moderator variables—factors that explain the conditions under which effects are stronger or weaker. In contrast, meta-analytic reviews quantitatively synthesize a body of research by estimating a summary effect size from prior results, and also allow investigation of moderator variables (Aguinis, Pierce, Bosco, Dalton, & Dalton, 2011). Further, meta-analysis is able to separate "artifactual" sources of variability, such as sampling and measurement error, from substantive sources of variability (Hunter & Schmidt, 2004).

Geyskens, Steenkamp, and Kumar (2006) offered a significant contribution by aggregating TCE evidence using meta-analysis. The findings related to two core TCE predictions, however, have not yet been synthesized via meta-analysis. In particular, evidence regarding Williamson's (1985, 1991) prediction about transaction frequency and his prediction about discriminating alignment have yet to be aggregated. Perhaps more important, newer theories offer competing explanations for core TCE relationships (Carter & Hodgson, 2006). These developments raise important questions about TCE's explanatory power—questions that can be informed via meta-analysis.

Given TCE's importance to theory and practice (Ghoshal, 2005; Williamson, 1996), it seems important to know how much support exists for each of TCE's core predictions and to learn about its predictive reach. We therefore meta-analyzed the available evidence. Specifically, we attempted to collect the population of studies that investigated one or more of TCE's core predictions and that reported the necessary statistics. Overall, the evidence we present is based on 143 studies comprising 101,937 observations.

First, we find that Williamson's predictions involving relationships among the transaction attributes and governance decisions are mostly supported. In contrast to the theory, however, one type of uncertainty (i.e., volume) leads firms toward hybrid, not hierarchical, governance. Second, consistent with newer (i.e., resource-based) theory, assets that are both specific and strategic (i.e., valuable, rare, hard to copy or substitute) are more strongly related to hierarchical governance than assets that are just specific. Last, we also find support for the discriminating alignment hypothesis: "Matching" transactions to governance structures enhances firm performance. By aggregating extant results via meta-analysis, we are able to offer strong evidence of TCE's successes and limitations, which is important for researchers seeking the next important questions and for students and practitioners seeking to understand the best way to organize different economic activities.

A PRIMER ON TRANSACTION COST ECONOMICS

In TCE, transactions are the unit of analysis and transaction costs are the expenses associated with searching for exchange partners, negotiating and crafting agreements, creating dispute resolution mechanisms, and haggling when parties revise agreements to meet changing conditions (Williamson, 1985). Transaction costs also include the "maladaptation" costs that come from being held to a contractual promise even after changing conditions make it costly to do so (Williamson, 1991).

According to Williamson, transaction costs differ from costs involved with production, and they directly influence how transactions are structured. Williamson (1975) began with the assumption that managers are boundedly rational. If information were complete and economic actors were perfectly rational, competent, and trustworthy, transaction costs would theoretically not occur because all contingencies would be known, and economic actors would willingly adjust to these contingencies as needed. However, bounded rationality, which stems from humans' information processing limitations, restricts actors' abilities to identify qualified exchange partners, establish prices, and write contracts that anticipate all contingencies and sources of potential future conflict (Simon, 1945; Williamson, 1985).

This human limitation opens the potential for two exchange hazards that create transaction costs: opportunism and maladaptation (Williamson, 1999). First, opportunism means that some economic actors will not only act self-servingly, but also take advantage of others when circumstances permit (Williamson, 1975). Because managers do not know a priori which potential partners will

act opportunistically, they must incur transaction costs to identify the best potential partners and negotiate agreements that will protect them from opportunism (Klein, Crawford, & Alchian, 1978; Williamson, 1985). Second, maladaptation arises because even when economic actors are perfectly trustworthy, circumstances sometimes change. In some cases, one actor might be unwilling to adjust the contract (Klein et al., 1978). In others, an actor might lack the ability to fulfill needed requirements (Williamson, 1999). Maladaptation creates transaction costs because managers must disentangle from existing agreements, search out new partners, and negotiate new agreements.

Markets, Hybrids, and Hierarchies

TCE focuses on three generic alternatives for structuring economic activities and adapting to changing conditions—markets, hybrids, and hierarchies (Williamson, 1991). Markets and hierarchies are polar structural alternatives, with hybrids situated in between (Williamson, 1985). Market transactions are simple pay-for-delivery or service exchanges between buyers and sellers, sometimes called "arm's-length" transactions (Williamson, 1975). Market transactions are often supported by formal, short-term, negotiated contracts. Hybrid transactions are between two or more firms, but involve long-term, greater-than-market commitments such as in alliances, franchises, research partnerships, and joint ventures (Kale & Singh, 2009; Siegel & Zervos, 2002). In hierarchies, activities that could take place across multiple firms instead take place within one firm.

These three structural alternatives differ mainly in their use of authority and in the strength of available incentives (Williamson, 1991). Authority pertains to the type of controls and dispute resolution mechanisms available (Williamson, 1985). Hierarchies are defined by firms having broad discretion to monitor and direct behavior (i.e., fiat). When disputes arise within a firm, they can be resolved by upper-level managers (Foss, 1996). Contracts, in contrast, might need to be canceled or renegotiated. Parties conducting hybrid exchange often seek credible commitments upfront, such as equity investments or long-term binding contracts, to minimize potential conflict (Dyer, 1997). Hybrids also typically have routines for mutual monitoring (Heide & John, 1990), and if negotiations fail to resolve a dispute, third-party mediation or arbitration procedures are prearranged. In contrast, whereas market contracts can benefit from protective legal clauses, such as price limits and termination provisions, these clauses do not anticipate all possible contingencies, and the court system is the arbiter of last resort when disputes arise (Williamson, 1991). Thus, as firms move transactions from markets to hybrids to hierarchies, increased authority allows for greater monitoring and control and simplifies dispute resolution.

What markets lack in authority, they make up for in incentives. Markets furnish high-powered incentives (Williamson, 1991; Zenger & Hesterly, 1997); customers will shift contracts elsewhere if they are not satisfied. In contrast to markets, the increased commitments found in hybrids make it more difficult for parties to walk away, which reduces incentive power. Hierarchies offer only low-powered incentives because typically only a small portion of compensation for employees in the firm is tied directly to performance (Williamson, 1991).

Consequently, markets are managers' first choice according to TCE. They are well suited for simple transactions where the need for close coordination among parties is low. When conditions change, the price system that defines markets autonomously adjusts to new supply and demand information (Hayek, 1945), leading Williamson (1991) to claim that markets are best for "autonomous adaptation." However, as transactions become more complex and exchange partners become exposed to potentially costly exchange hazards (i.e., opportunism and maladaptation risks), simple adaptation based on price is no longer efficient. Value creation becomes dependent on partners' ability to coordinate outputs from highly specific investments so that they fit together and create maximum value for customers (Dyer & Singh, 1998). Thus, as transactions become more complex, TCE predicts that coordinated adaptation will be increasingly needed when conditions change. Managers will move toward hybrid and eventually hierarchy because they are willing to trade off the incentive power and autonomous adaptation of markets for enhanced authority and coordinated adaptation (Williamson, 1991).

Asset Specificity, Uncertainty, and Frequency

Williamson (1985) identified three main transaction attributes that raise the complexity of transacting, give rise to exchange hazards, and drive managers toward hierarchy: asset specificity, uncertainty, and frequency. Asset specificity refers to the level of unique investment supporting a transaction; it is considered TCE's "big locomotive" (Williamson, 1985, p. 56). As assets become more specific (e.g., tooling used to manufacture a single product), they become more costly to redeploy without loss in value (Williamson, 1985). In con-

trast, nonspecific assets (e.g., a pickup truck) can be sold or otherwise redeployed without loss. Researchers have investigated three types of uncertainty: (1) Volume uncertainty is created by unpredictability regarding future demand levels, (2) technological uncertainty is created by the unknown future trajectory surrounding an emerging technology, and (3) behavioral uncertainty occurs when managers are unable to evaluate the quality of activities because they are either technologically complex or hidden from view (Williamson, 1985). The third transaction attribute, frequency, refers to how often a transaction occurs (Williamson, 1985).

According to Williamson (1985), each of these transaction attributes increases transaction costs and thus leads managers progressively from market to hybrid and from hybrid to hierarchy. Because specific assets are costly to redeploy, one party to a market contract might opportunistically renege on an original agreement and seek better terms, knowing the other must comply or lose the value of the specific asset (Klein et al., 1978). Alternatively, conditions might change so that a coordinated redeployment might put the specific asset to better use, but the other party to the contract might not agree to the needed coordination. Volume and technological uncertainty raise transaction costs by limiting managers' abilities to anticipate and specify contingencies in contracts. If an unforeseen event requires coordination among parties, one party might exploit the other, or might simply be unable to deliver as needed. Behavioral uncertainty, in contrast, is created by the inability to evaluate exchange partners' activities. Thus, it increases transaction costs by raising the probability that unobserved, an opportunistic party might reduce effort or input quality (Alchian & Demsetz, 1972). Finally, contracts can easily be written to facilitate one-time and occasional exchanges, but as frequency increases, the need to anticipate future market conditions increases the costs of negotiating contracts and of resolving disputes (Masters & Miles, 2002).

Although there are disagreements regarding whether uncertainty and transaction frequency will shape transaction costs when asset specificity is negligible (David & Han, 2004), Williamson (1985) asserted that overall, as asset specificity, uncertainty, and transaction frequency increase, so too do exchange hazards. To combat such hazards and reduce resulting transaction costs, the appropriate managerial response, according to TCE, is to move transactions toward hybrid and hierarchy, where greater authority is available for parties to conduct cooperative adaptation (Williamson, 1991).

CORE TCE PREDICTIONS AND NEWER THEORIES

Williamson (1985) offered several core predictions involving relationships among the attributes of transactions and organizing decisions. Later, Williamson (1991) predicted that when transactions are organized in ways that "match" the transaction to the appropriate structural alternative, the firm will enjoy higher performance. We now develop hypotheses based on these predictions.

Core TCE Predictions

Under conditions of asset specificity, uncertainty (i.e., volume, technological, and behavioral), and frequency, firms are exposed to potentially costly exchange hazards in markets because there are few authoritative controls, and disputes might be expensive and time consuming to resolve (Williamson, 1985). Hybrids have more controls (e.g., mutual monitoring or information disclosure requirements) and more expeditious dispute resolution mechanisms (e.g., mediators instead of courts) than markets but fewer than hierarchies (Williamson, 1991). Accordingly, as the attributes of a transaction increase the potential for costly exchange hazards, firms will trade off autonomous adaptation and the higher-powered incentives of markets and move toward hybrids, and eventually hierarchies, where greater authority permits coordinated adaptation.

We use the term *degree of integration* to describe a transaction's position along the range of structural alternatives from market to hybrid to hierarchy. In short, as firms increase the degree of integration surrounding a transaction, they move away from markets toward hierarchical governance, where greater managerial authority is available to resolve disputes and control how assets are deployed. Accordingly, greater integration reduces the costs of coordinating transactions involving asset specificity, uncertainty, and/or frequency (Williamson, 1985). Further, the cost of finding exchange partners and negotiating, writing, and amending contracts is reduced or eliminated. Thus, several of TCE's core predictions can be stated formally as:

> *Hypothesis 1a–e: The transaction attributes that create transaction costs are positively related to the degree of integration. Specifically, the more a transaction is surrounded by (a) asset specificity, (b) volume uncertainty, (c) technological uncertainty, (d) behavioral uncertainty, and (e) transaction frequency, the greater the degree of integration.*

An implication from these predictions is that when managers match transactions to the structural alternative that, according to TCE, lowers transaction costs, efficiency increases and firm performance is enhanced (Gibbons, 2010; Williamson, 1985). Williamson (1991) refers to this as the "discriminating alignment" hypothesis and posits that matching transactions to the appropriate structure creates efficient boundaries and, hence, improved firm performance. This relationship is stated formally as:

Hypothesis 2: Matching transactions to the degree of integration as identified by researchers is positively related to firm performance.

Newer Theories That Offer Competing Explanations

In the years since Williamson (1985) described how transaction attributes affect integration, at least two important theories have emerged that challenge the theoretical boundaries of TCE. First, real options theory asserts that managers value flexibility in the face of uncertainty. Managers will often defer making irreversible investments until uncertainty is reduced, even if such investments should yield a positive net present value (Folta & O'Brien, 2004). An exception is when managers take a "growth option" by making early investments in uncertain markets when they perceive opportunities to build new capabilities or to deter potential competitors, both of which increase the probability of future success (Folta & O'Brien, 2004; Kulatilaka & Perotti, 1998). When such strategic advantages are present, uncertainty actually increases the value of growth options because uncertainty lowers first movers' costs and creates reputation gains (Kulatilaka & Perotti, 1998).

However, managers are more likely to take growth options when they can minimize the size of irreversible investments (Folta & O'Brien, 2004). One way to take advantage of potential first-mover advantages while minimizing irreversible investments is to organize using flexible arrangements, such as market contracts and hybrids, even when doing so might involve higher transaction costs (Kogut, 1991; Schilling & Steensma, 2002). Whereas using hierarchy might safeguard the firm from potential opportunism and facilitate coordinated adaptation, it also increases the firm's level of difficult-to-reverse investment (Folta, 1998; O'Brien & Folta, 2009). Accordingly, real options theory challenges TCE's predictions regarding volume and technological uncertainty. These sources of uncertainty come from unpredictability in the environment, where unforeseen changes in market

conditions or technology can significantly reduce the value of the type of fixed investments that define hierarchies (Krychowski & Quélin, 2010).

Thus, in the face of environmentally driven uncertainties, real options theory predicts the opposite of TCE (i.e., that firms will avoid hierarchy) (Folta, 1998). Hybrids, in contrast, permit managers to make limited commitments when transactions are uncertain. Hybrids also allow managers to avoid the risks associated with volume fluctuations (e.g., unused production capacity when demand falls), and to let partners suffer the consequences should a particular technological approach fail. Finally, managers can use hybrids to learn about new technologies from their partners while avoiding fixed hierarchical investments until key uncertainties are resolved (Kogut, 1991). Thus, at least with respect to volume and technological uncertainty, real options theory predicts the following alternative hypothesis[1]:

Hypothesis 3a, b: In the face of environmental uncertainty, managers prefer hybrids over hierarchies. Specifically, the relationship between (a) volume uncertainty and (b) technological uncertainty on the degree of integration is stronger among studies that investigate the choice between market and hybrid than for studies that investigate hierarchy.

Resource-based theory is a second theory that has emerged after TCE with implications for how managers organize economic activity (Conner & Prahalad, 1996). According to resource-based theory, firms can create advantages over rivals by assembling "strategic assets" (Amit & Schoemaker, 1993): resources that are value-enhancing, limited in supply, and costly for competitors to duplicate or purchase (Barney, 1991). Although much resource-based research is focused on describing the nature of strategic assets and how they create competitive advantages, there is a theory-of-the-firm branch of resource-based theory that explains how strategic assets affect how economic activity is organized (e.g., Argyres, 1996; Conner & Prahalad, 1996; Leiblein, 2003; Madhok, 2002). The central prediction

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[1] TCE can be adjusted to make the same prediction. Specifically, if we speculate that managers view volume and technological uncertainty as transaction attributes that require autonomous adaptation (e.g., the ability to quickly change suppliers) as much as coordinated adaptation (e.g., the ability to redesign integrated components), one could argue that hybrids might be chosen because they offer a mix of both kinds of adaptation (Williamson, 1991).

is that managers can often create more value by integrating certain strategic assets into the hierarchy—even when there are no TCE-type exchange hazards (Conner & Prahalad, 1996). The reason is that some resources are most valuable when they are tightly bundled within a set of hierarchical routines (Combs & Ketchen, 1999; Conner & Prahalad, 1996), social relationships (Kogut & Zander, 1996), and managerial processes (Sirmon, Hitt, & Ireland, 2007) that further enhance these resources' value.

In many ways, TCE and resource-based theory view specific/strategic assets from opposite directions (Carter & Hodgson, 2006). Because of bounded rationality, the threat of opportunism, and the potential loss of an asset's value outside the focal transaction, TCE predicts that markets fail when asset-specific investments are present (Williamson, 1985). TCE, therefore, takes a market failures approach, wherein managers move toward hierarchy to reduce the exchange hazards that come with markets (Madhok, 2002). Resource-based theory, in contrast, takes what might be called an organizational advantages approach, wherein managers move to hierarchy because they can add value by bundling strategic assets and managing them in creative ways (Conner & Prahalad, 1996; Sirmon et al., 2007). Because these theories approach the same problem from opposite directions (Carter & Hodgson, 2006), it is difficult to know whether a transaction is being integrated into the hierarchy because the assets involved are specific and managers fear opportunism or maladaptation, or whether the assets involved are "strategic" in that their value is enhanced by the hierarchy. More to the point, strategic assets are also specific, which makes it difficult to separate the impact of an asset's specificity from its strategic value (Chi, 1994).

The reverse, however, is not necessarily true. Specific assets create value because they are specialized to a transaction (Klein et al., 1978), and economic theory dating back to Adam Smith's description of the pin factory has long recognized that assets that are specialized to their purpose (people, in the case of the pin factory) are more productive than general assets. Thus, specific assets as described by TCE are inherently valuable, which is one of the three criteria that define strategic assets (Barney, 1991; Chi, 1994). In order for a specific asset to also be a strategic asset, however, it must meet two additional criteria—criteria that keep competitors from gaining the same advantage. A strategic asset must be rare enough that competitors cannot easily purchase a similar asset at the same price, and it must be difficult for competitors to either create or gain the same advantage through other means (Barney, 1991). Thus, whereas a robot that performs a complex weld in a factory and a narrowly specialized history professor are both highly specific assets, they are not strategically valuable as described by resource-based theory if there is a plentiful supply of similar welding equipment or similarly trained professors. In this way, strategic assets are a subset of specific assets; a strategic asset is, by definition, specific, but there are many specific assets that are not necessarily rare or difficult to imitate or substitute.

Accordingly, we might expect that the impact of strategic assets on managers' integration decisions might differ from decisions involving specific assets that do not also meet the rare and difficult-to-imitate criteria. TCE points toward integrating specific assets because doing so reduces transaction costs by limiting exchange hazards; resource-based theory points toward additional value creation opportunities for specific assets that are also strategic. Thus, integrating assets that are specific but not also strategic might reduce transaction costs as TCE anticipates, but integrating such assets will not also offer managers an opportunity to create advantages.[2] If managers can find ways to protect these specific-but-not-strategic assets while keeping the incentive and flexibility advantages of markets and/or hybrids, they might be inclined to do so.

Despite the large body of empirical findings linking asset specificity to structural choices (e.g., Geyskens et al., 2006; Gibbons, 2010), there has not been a systematic examination into whether strategic assets are more strongly related to structural choices than assets that are specific but not rare or difficult to imitate/substitute. Accordingly, we submit that strategic assets will have a greater impact on hierarchical integration than assets that are only specific. In particular, support for TCE, we predict, is weaker among studies that measure only assets' specificity, whereas studies that co-mingle assets' strategic and specific components will find stronger effects because they are taking advantage of two reinforcing theoretical mechanisms. Given this:

Hypothesis 4: When asset-specific investments are also strategic, they will be more strongly related to the degree of integration than will asset-specific investments that are less rare and easier to copy or substitute.

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[2] As an anonymous reviewer noted, Porter (1996) offered a complementary insight when drawing a distinction between competitive advantage and operational effectiveness. In particular, there are assets that may contribute to performance, and a firm needs to have them to stay alive and be competitive, but these assets will not lead to superior performance.

WHAT WE HAVE LEARNED
SO FAR ABOUT TCE

Our goal was to aggregate what others have found to offer a synthesis about what we have collectively learned about TCE's core predictions and its theoretical boundaries. To accomplish this goal, we tried to collect all the studies that examine one or more of the hypothesized relationships and that reported the necessary effect size estimates (e.g., correlation coefficients) for inclusion in the meta-analysis. We began by conducting a keyword search for the words "transaction cost," "asset specificity," "uncertainty," "frequency," and "opportunism" in ABI Inform, Business Source Premier, Dissertation Abstracts, EconLit, and JSTOR. We used 1975, the year of Williamson's seminal book, as the start date. We also examined reference sections of reviews of extant TCE-based inquiry (e.g., David & Han, 2004; Geyskens et al., 2006; Rindfleisch & Heide, 1997) and sent e-mails seeking effect size estimates from authors whose studies reported empirical results but did not include such estimates. To be included, a study had to report one or more effects between our constructs of interest (Hunter & Schmidt, 2004). Our search yielded 143 usable studies that investigated 101,937 transaction relationships. The studies are listed in Appendix A.

We then used meta-analysis (a methodological approach that statistically aggregates findings from prior studies) to establish whether a relationship exists, the size of this relationship, and factors that explain the variability of this relationship across studies (Hunter & Schmidt, 2004). The "size" of a relationship is called its effect size, and the most popular effect size in management research is the correlation coefficient (Aguinis et al., 2011), which ranges between negative one (-1) and positive one ($+1$). Effect size estimates were calculated as the mean of the sample-size-weighted effects from all prior studies (for more detail, see Hunter &

Schmidt, 2004). Weighting effect sizes by each study's sample size improves the accuracy of the estimated population parameter because this procedure controls for the artifactual impact of sampling error (Hunter & Schmidt, 2004). Measurement errors also produce a biasing effect on primary study-based effect size estimates. Because no study includes perfectly reliable measures (see list of example measures in Appendix B), observed effect sizes are downwardly biased (Hunter & Schmidt, 2004). In Appendix C, we outline our step-by-step method, which includes how we estimated how much measurement error reduced the effects reported in the original studies, and how we added this back to create more accurate effect size estimates of the relationships of interest.

Table 1 reports the evidence surrounding TCE's core predictions. Hypothesis 1a–e predicted that (1a) asset specificity, (1b) volume uncertainty, (1c) technological uncertainty, (1d) behavioral uncertainty, and (1e) frequency are positively related to the degree of integration. Hypothesis 2 predicted that matching transaction attributes to the degree of integration enhances performance. Collectively, prior research offers support for several of TCE's core predictions. The effects of asset specificity ($r_c = .12$), behavioral uncertainty ($r_c = .24$), and transaction frequency ($r_c = .14$) are positively and significantly related to the degree of integration. Studies to date collectively reveal no significant relationships among the transaction attributes of volume uncertainty ($r_c = .02$) or technological uncertainty ($r_c = .02$) and the degree of integration. We found that matching transaction attributes to the degree of integration enhances performance ($r_c = .13$).

Table 2 reports the evidence surrounding Hypotheses 3a,b and 4. Hypothesis 3 predicted that the effects of (a) volume uncertainty and (b) technological uncertainty on the degree of integration are stronger for studies that investigate the choice

TABLE 1
Results for TCE's Core Predictions

	Hypothesis	*N*	*K*	Corrected Effect (r_c)	Observed Variance	Confidence Interval
1a	Asset specificity	85,166	109	.12*	.01	.08, .11
1b	Volume uncertainty	4,442	17	.02	.03	−.06, .09
1c	Technological uncertainty	8,448	17	.02	.02	−.05, .07
1d	Behavioral uncertainty	19,586	38	.24*	.03	.14, .24
1e	Transaction frequency	19,526	27	.14*	.02	.07, .15
2	Matching transactions	4,662	5	.13*	.01	.02, .19

Notes: *N* is the number of observations reported across *K* number of primary-level studies; corrected effects are sample-size weighted and corrected for measurement error; *effect differs from zero at $p < .05$; confidence interval lists the 95% confidence interval for the lower and upper limits of the effects.

TABLE 2
Results for Moderators

	Hypothesis	N	K	Corrected Effect (r_c)	Observed Variance	Confidence Interval	*p* Value
3a	Volume uncertainty to hybrid	1,238	3	.22	.03	.10, .24	
	Volume uncertainty to hierarchy	3,204	14	-.05	.02	−.08, .01	<.01
3b	Technological uncertainty to hybrid	1,209	4	.06	.03	−.03, .12	
	Technological uncertainty to hierarchy	7,279	13	.01	.02	−.02, .04	*ns*
4	Asset specificity to degree of integration	52,273	49	.10	.01	.05, .10	
	Strategic assets to degree of integration	26,096	47	.19	.01	.12, .18	<.05

Notes: *N* is the number of observations reported across *K* number of primary-level studies; corrected effects are sample-size weighted and corrected for measurement error; confidence interval lists the 95% confidence interval for the lower and upper limits of the effects; *p*-values indicate whether there are significant differences between the effects.

between market and hybrid than for studies that investigate hierarchy. Hypothesis 3a was supported; volume uncertainty relates more to hybrid than hierarchy (r_c = .22 versus −.05, *p* < .01). Hypothesis 3b was not supported; the effects of technological uncertainty on hybrids and hierarchies are r_c = .06 versus .01 (*ns*). Finally, Hypothesis 4 predicted that when specific assets are also strategic they will be more strongly related to degree of integration than when assets are specific but not rare and difficult to copy or substitute. This hypothesis was supported with r_c = .19 versus .10 (*p* < .05).

WHAT OUR KNOWLEDGE MEANS AND WHERE WE GO FROM HERE

Meta-analysis allows researchers to estimate the size of relationships found in a body of prior research by calculating the average of the prior studies' results and by correcting for the biasing effects of sampling and measurement error. By applying meta-analysis to prior tests of TCE, we can make statements about the amount of support that exists for each of TCE's core predictions. Overall, the evidence shows that most of the transaction attributes described by Williamson (1985) relate to the degree of integration as predicted and that matching transaction attributes to the degree of integration enhances firm performance. We also estimated the degree to which findings in TCE studies are challenged by competing theories, and found that real options and resource-based theories highlight boundary conditions for TCE. Taken together, this suggests that managers look at multiple factors—not just transaction costs—in their organization decisions.

What Does Our Knowledge Mean?
Core Predictions

Asset specificity. We found that prior research supports TCE's core prediction about the effect of

asset specificity (r_c = .12) on the degree of integration. Overall, Williamson (1985) appears correct in that the exchange hazards surrounding transactions characterized by asset specificity raise transaction costs, and managers seek to lower such costs via greater integration. However, the size of the relationship suggests the presence of other important factors.

Frequency. This is the first study to synthesize prior research regarding frequency. Consistent with TCE, when firms undertake frequent transactions, managers attempt to lower transaction costs by increasing the degree of integration (r_c = .14). It makes sense that managers will want to exercise greater authority over frequent transactions because such transactions are likely to be important (Masters & Miles, 2002). It also makes sense because any transaction costs—for example, the cost of finding, evaluating, and building a relationship with a hybrid partner—can be spread across more transactions. Considering the size of the effect of frequency (i.e., r_c = .14), managers do seem to care about frequency and consistently respond to it with greater integration and control.

Uncertainty. Researchers have described three types of uncertainty (Sutcliffe & Zaheer, 1998; Walker & Weber, 1984), but only one—behavioral uncertainty—relates to the degree of integration as predicted by TCE. The two types of uncertainty that are caused by the unpredictability in the environment—volume and technological—show no relationship with degree of integration decisions (i.e., r_c = .02 for volume uncertainty and r_c = .02 for technological uncertainty). Behavioral uncertainty, in contrast, comes from the type of work that is being performed (Williamson, 1985). When the tasks being performed are hidden from view or complex and thus difficult to evaluate, managers prefer more integration (r_c = .24). The magnitude of this relationship is almost twice as big as for asset specificity or frequency, suggesting that managers' concerns about exchange hazards are highest when

they cannot see or evaluate what partners are being asked to do (Williamson, 1985). Overall, managers appear to increase integration so they can better see, understand, and exercise authority over the activity in question.

Matching. We found evidence supporting Williamson's discriminating alignment—that "transactions, which differ in their attributes, are aligned with governance structures, which differ in their costs and competencies, in a discriminating (mainly transaction cost economizing) way" (Williamson, 1991, p. 277). Consistent with this hypothesis, matching transaction attributes to the structural alternatives predicted by TCE enhances performance ($r_c = .13$). As with the effects of asset specificity and frequency, the size of the effect is non-trivial but not large. One potential reason for the size of the effect is that most firms likely match transactions to structural alternatives in a discriminating way because doing so is critical to survival (Masten, 1993). Thus, we might not have been able to empirically detect large differences between the firms in the studies. Despite this, the size of the effect suggests that matching is one among many factors that affect performance.

Overall, what we know about TCE is that asset specificity, frequency, and behavioral uncertainty act just as Williamson (1985) predicted. These factors appear to raise managers' costs of using markets because the potential for and the costs of exchange hazards are higher in their presence. Importantly, protecting the firm by using an appropriate level of integration (i.e., discriminating alignment) improves firm performance. Accordingly, TCE appears to merit much of the importance that researchers, practitioners, and the Nobel committee have attached to it.

What this means for students and practitioners of management is that managers need to be aware of the factors that raise exchange hazards and take actions to reduce these threats. This will likely involve greater integration, such as making partners invest so that they too have much to lose (Dyer & Singh, 1998). Such investments create the credible commitments that characterize hybrid forms, and insisting on such investments at the right time improves performance (Williamson, 1991). Despite the size of the effects, the results also tell us that there are probably other important factors that managers need to consider when comparing alternative ways to organize a transaction. TCE gives us one set of factors—transaction attributes that increase exchange hazards—but managers also care about other factors that are not part of TCE reasoning.

What Does Our Knowledge Mean? Newer Theories

Real options theory. Real options theory predicts that in the presence of environmental uncertainty, hierarchy can reduce value by limiting a firm's flexibility and adaptability (Folta, 1998). Accordingly, we expected that as volume and technological uncertainty increased, so too would managers' preferences for hybrids over hierarchy. As expected, studies of volume uncertainty show a strong positive relationship with hybrids (i.e., $r_c = .22$), and the relationship is much stronger than for hierarchy (i.e., $r_c = -.05$). The pattern for technological uncertainty is in the expected direction (i.e., $r_c = .06$ for hybrids versus $r_c = .01$ for hierarchies), but the difference is not significant. What these results mean is that when volume uncertainty is considered in isolation from other factors, managers prefer not to lock themselves into hierarchical arrangements that typically require investments that would be inefficient should demand drop unexpectedly (e.g., Walker & Weber, 1984).

Because most real options research has focused on technological uncertainty, we were surprised that managers' preferences for hybrids under technological uncertainty were not materially greater than for hierarchy. What we can say now is that technological uncertainty alone is not an important factor in managers' integration decisions. Managers and students will need to look elsewhere—possibly at multiple factors—to determine the best course of action with respect to any given technology.

Resource-based theory. Consistent with resource-based theory, when firms undertake transactions that involve assets that are both specific (i.e., valuable and difficult to redeploy) *and* strategic (i.e., valuable, rare, and hard to duplicate or substitute), managers are even more inclined to move toward greater integration ($r_c = .10$ versus .19). We submit that the causal sequences described by TCE and resource-based theory reinforce one another to make integration even more likely than if only one causal sequence is at work. According to TCE, asset specificity exposes firms to exchange hazards, so managers integrate to protect themselves (Williamson, 1985). According to resource-based theory, integrating strategic assets can help firms develop advantages over competitors (Conner & Prahalad, 1996; Leiblein, 2003). Some studies have empirically tested this logic. In their analysis of restaurant chains, for example, Combs and Ketchen (1999) found that concerns about exchange hazards and the possibility of attaining advantages both shape integration decisions. However, they also found that building strategic assets

affected managers' decisions more than did concerns about exchange hazards surrounding such assets.

What this means for managers and students is that exchange hazards and the potential for value creation are both important considerations in integration decisions (Williamson, 1999). Indeed, it might be helpful to think of these as opposite sides of the same coin. Strategic assets have the potential to generate competitive advantage, but the structural arrangement that is selected affects how much value is created (Madhok, 2002) and how much profit is captured by the firm (Crook, Ketchen, Combs, & Todd, 2008). Sometimes strategic assets need to be combined with partners' resources to maximize competitive advantage (Dyer & Singh, 1998); other times, such assets need to be tightly coordinated within the hierarchy (Conner & Prahalad, 1996).

Strategic assets are also specific (Chi, 1994), however, so managers also need to ensure that they maintain sufficient leverage over partners and/or direct managerial control, which TCE asserts can best be attained through hybrid and hierarchical structures. Perhaps one effective way for managers to approach integration decisions is to first think about what kind of structure will maximize the firm's competitive advantage, and then ensure that the selected structure can be designed so the strategic/specific assets are protected from exchange hazards (e.g., David, O'Brien, & Yoshikawa, 2008; Kochhar, 1996; Simerly & Li, 2000). If the structure that maximizes competitive advantage cannot protect from opportunism and maladaptation, perhaps a bit more integration is needed.

Where Do We Go From Here?
Broad Implications for TCE Research

We set out to leverage extant evidence to describe what has been learned about organizing around transaction costs and where inquiry in this area needs to go. Our results show that most of TCE's predictions are supported by extant evidence. Although the effect sizes are non-trivial, the absolute size of the relationships (1) among TCE's transaction attributes and the degree of integration and (2) between "matching" (transactions to the proper degree of integration) and firm performance suggests that there is still much to explain.

Accordingly, we believe that there are two broad questions future researchers need to address. The first pertains to the size of the relationships we see. What other factors might shape the extent to which managers respond to TCE's transaction attributes and the transaction costs they theoretically create?

The second question pertains to the theoretical boundaries surrounding TCE. Where does TCE work and not work, and how can it be integrated with newer theories to offer a more complete explanation for managers' organizing decisions?

What factors would make the relationships larger (or smaller)? Of the transaction attributes described by Williamson (1985), behavioral uncertainty has the largest relationship with the degree of integration. Managers also appear to prefer the flexibility of hybrids in the face of volume uncertainty, and integrate more in the face of asset specificity and frequency, but these relationships are not large. Williamson (1985, p. 56) calls asset specificity the "big locomotive" of TCE, so while there is strong evidence that the relationship exists, an important question for future inquiry is to understand why the relationship between asset specificity and the degree of integration is not larger than for other transaction attributes.

One possibility is that these effects, while meaningful, are simply smaller than the theory anticipates. Each firm has a unique history that creates cultural and institutional (Brouthers, 2002), financial (David et al., 2008), and/or strategic constraints (Simerly & Li, 2000) on managers' ability to act as TCE predicts. These constraints on managerial discretion suggest that the small effects that we found might reflect the upper bound of TCE's predictive power.

By contrast, there are likely other transaction costs that are not captured in most studies, which implies that most studies underreport the size of TCE's effects. For example, organizing decisions about specific transactions are rarely made in isolation; there are transaction costs tied to related transactions that are inseparable from the focal transaction (Argyres & Liebeskind, 1999).[3] Further, whereas each transaction attribute might have only small effects on organizing decisions, there are likely multiplicative effects among the transaction attributes that we are unable to capture using meta-analysis (Mayer, 2009). To know the extent to which unmeasured transaction costs or multiplicative effects are limiting effect sizes, researchers need to seek out and measure "governance inseparabilities" (Argyres & Liebeskind, 1999). Further, researchers will need to report interactions among transaction attributes, so that a future meta-analysis might yield evidence about the extent to which our results are negatively affected by unmeasured transaction costs or unreported multiplicative interactions, or whether our reported estimates re-

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[3] We thank an anonymous reviewer for these insights.

flect managers' constrained ability to respond to transaction costs as TCE anticipates.

Another possibility is that managers have found innovative ways to reduce the transaction costs involved in identifying and working with partners, and that these innovations allow for greater control without increasing the degree of integration (Dyer, 1996, 1997; Zenger & Hesterly, 1997). Two categories of innovations are particularly noteworthy. First, managers increasingly use "relational governance" in their interactions with exchange partners (Dyer & Singh, 1998). Relational governance refers to the use of non-contractual means—such as trust (e.g., keeping promises) (Zaheer, McEvily, & Perrone, 1998) and cross-equity holdings (Blodgett, 1992)—that allow managers to create stable relationships. Such relationships allow managers to combine resources into highly specific bundles that create more value than any one firm could create on its own (Dyer & Singh, 1998). Dyer (1996, 1997), for example, found that some auto companies use relational governance to lower transaction costs while simultaneously increasing each firm's specific asset investments. By encouraging more specialized investments while keeping the incentive benefits of hybrids (over hierarchies), these firms kept costs low and innovation high and outperformed rivals that used more integration.

Overall, researchers will likely discover that the impact of the transaction attributes is smaller than expected because they did not investigate other sources of transaction costs that are inseparable from related transactions, and because new innovations, such as relational governance and complex contracting, allow managers to invest in greater levels of asset specificity at lower degrees of integration.

What are the theoretical boundaries surrounding TCE? The second promising direction for future inquiry is to further explore the predictive boundaries of TCE and to investigate ways that TCE can be integrated with other theoretical perspectives to better explain managers' organizing decisions. Obviously, real options and resource-based theories are important starting points. Real options theory suggests that managers organize to maximize value in uncertain environments, but what do managers do when environmental uncertainty, asset specificity, and frequency are all high? Which theory predicts best? What moderators explain when managers respond to the need for flexibility versus the need to protect against exchange hazards? Perhaps some managers find creative ways to do both. With respect to resource-based theory, untangling the impact of an asset's specificity from its impact as a strategic asset seems like a very impor-

tant yet daunting challenge. Another important question involves whether TCE's predictions involving actual transaction costs—not governance structure decisions—are shaped by the attributes of transactions, and whether other factors, such as various forms of trust, shape these predicted relationships.

CONCLUSION

Broadly speaking, the results of our meta-analysis of 143 studies show that most of TCE's core predictions are supported by extant evidence, suggesting that TCE's enormous influence is justified. Specifically, asset specificity, behavioral uncertainty, and frequency have significant relationships with the degree of integration. Further, managers who align transactions with structural alternatives in a discriminating way enjoy enhanced firm performance. Despite these findings, there is still much to learn about organizing decisions. For researchers, our results make clear that TCE possesses a real yet modest ability to explain how firms organize economic activity. As such, future inquiry will need to augment TCE with alternative perspectives such as real options and resource-based theories. For managers, one key implication of our findings is that transaction costs explain only a fraction of their peers' behavior. Given that some potentially large component of the small effects we found are due to maladaptation risks (which do not require opportunism), perhaps Ghoshal's (2005) warning that educators overemphasized opportunism has merit. The evidence to date suggests that managers should focus on how to maximize value from available resources before considering how to minimize the transaction costs involved in protecting them.

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APPENDIX A

List of Primary Studies

Author(s), Year, Source
Afuah, 2001, AE
Ahmadjian & Oxley, 2005, JLEO
Anderson, 1988, JEBO
Anderson, 1985, MKTS
Anderson & Coughlan, 1987, JMKT
Anderson, Glenn, & Sedatole, 2000, AOS
Anderson & Schmittlein, 1984, RAND
Anderson & Weitz, 1992, JMR
Andersson & Fredriksson, 1996, JIBS
Ang & Cummings, 1997, OS
Argyres & Silverman, 2004, SMJ
Armour & Teece, 1980, RES
Balakrishnan & Wernerfelt, 1986, SMJ

Barney, Edwards, & Ringleb, 1992, AMJ
Belderbos, 2003, SMJ
Bello & Lohtia, 1995, JMKT
Bergh & Lawless, 1998, OS
Bigelow, 2004, WP
Bradley & Gannon, 2000, JIM
Brouthers, 2002, JIBS
Brouthers & Brouthers, 2003, JOMS
Brouthers, Brouthers, & Nakos, 2002, TIBR
Brouthers, Brouthers, & Werner, 2003, SMJ
Buvik & Reve, 2001, JBR
Campa & Guillen, 1999, MS
Caves & Bradburn, 1988, JEBO
Coles & Hesterly, 1998, JCF
Combs & Ketchen, 1999, SMJ
Crocker & Masten, 1988, RAND
D'Aveni & Illinitch, 1992, AMJ
D'Aveni & Ravenscraft, 1994, AMJ
Delios & Beamish, 1999, SMJ
Delios & Henisz, 2000, AMJ
Delmas, 1999, ICC
Dhanaraj & Beamish, 2004, SMJ
Dragonetti, Dalsace, & Cool, 2003, WP
Dunbar & Phillips, 2001, JATA
Dutta, Bergen, Heide, & John, 1995, JLEO
Dutta, Heide, & Bergen, 1999, JMKT
Erramilli, Agarwal, & Seong-Soo, 1997, JIBS
Fan, 1996, D-Pitt
Fladmoe-Lindquist & Jacque, 1995, MS
Gebelt, 1992, D-UCLA
Girlea, 2001, D-Conc.
Gomes-Casserres, 1989, JEBO
Gonzalez-Diaz, Arrunada, & Fernandez, 2000, JEBO
Gulati, Lawrence, & Puranam, 2005, SMJ
Gulati & Singh, 1998, ASQ
Heide & John, 1992, JMR
Hoetker & Mellewigt, 2009, SMJ
Hughes, 1999, D-Temple
Ingham & Thompson, 1994, SMJ
James, 1998, JEBO
Jensen & Rothwell, 1998, JEBO
John & Weitz, 1988, JLEO
John & Weitz, 1989, JMR
Johnson, 1988, D-UNL
Jones, 1987, AMJ
Kaleveld, 2011, D-Utrecht
Kerkvliet & Shogren, 2001, JITE
Kim & Daniels, 1991, MIR
Klaas, McClendon, & Gainey, 1999, PPsych
Klein & Roth, 1993, JAMKTS
Klein, Frazier, & Roth, 1990, JMR
Kogut & Chang, 1991, RES
Krafft, 1999, JMKT
Lecraw, 1984, JIE
Lee, 1998, D-OhioSt
Leffler & Rucker, 1991, JPE
Leiblein & Macher, 2004, WP
Leiblein & Miller, 2003, SMJ
Leiblein, Reuer, & Dalsace, 2002, SMJ
Levy, 1985, RES
Li, 1995, SMJ

Lieberman, 1991, JIE
Lu, 2002, JIBS
Luo, 2007, SMJ
Lyons, 1995, JEBO
MacDonald, 1985, RES
Majumdar & Ramaswamy, 1994, JITE
Majumdar & Ramaswamy, 1995, SMJ
Maltz, 1994, LTR
Mang, 1998, JEBO
Masten, 1984, JLE
Masten, Meehan, & Snyder, 1989, JEBO
Masten, Meehan, & Snyder, 1991, JEBO
Masters & Miles, 2002, AMJ
Mayer, 1999, D-UCB
Mayer & Nickerson, 2005, OS
McGee, Dowling, & Megginson, 1995, SMJ
McInnes, 1999, D-SFU
McNally & Griffin, 2004, JSCM
McNaughton, 2002, IMR
Minkler & Park, 1994, RAND
Monteverde, 1995, MS
Monteverde & Teece, 1982, BJE
Mulherin, 1986, JLEO
Murray & Kotabe, 1999, SMJ
Mutinelli & Piscatello, 1998, RP
Nelson, 1997, EI
Nicholls-Nixon & Woo, 2003, SMJ
Nickerson, Hamilton, & Wada, 2001, SMJ
Nickerson & Silverman, 2000, WP
Nickerson & Silverman, 2003, JEMS
Ohanian, 1994, RES
Oxley, 1997, JEBO
Pan, 1996, JIBS
Pisano, 1989, JLEO
Pisano, 1990, ASQ
Poppo, 1995, MS
Pouder, 1993, D-UConn
Rasheed & Geiger, 2001, JBS
Ravenscraft, 1983, RES
Regan, 1997, JRI
Reuer, 2001, SMJ
Reuer & Ariño, 2007, SMJ
Robinson, 1996, JLE
Robertson & Gatignon, 1998, SMJ
Sako & Helper, 1998, JEBO
Sass & Gisser, 1989, JLE
Schilling & Steensma, 2002, OS
Shane, 1996, SMJ
Shervani, Frazier, & Challagalla, 2007, SMJ
Shrader, 2001, SMJ
Silverman, 1999, MS

Silverman, Nickerson, & Freeman, 1997, SMJ
Smith & Schnucker, 1994, JCF
Stapleton & Hanna, 2002, TJ
Steensma & Corley, 2000, AMJ
Steensma & Corley, 2001, AMJ
Steensma, Marino, Weaver, & Dickson, 2000, AMJ
Sutcliffe & Zaheer, 1998, SMJ
Takeishi, 2001, SMJ
Tan & Vertinsky, 1996, JIBS
Tremblay, Cote, & Balkin, 2003, JOMS
Walker, 1994, OS
Walker & Weber, 1984, AMJ
Walker & Weber, 1987, ASQ
Weiss & Anderson, 1992, JMR
Whyte, 1994, JEBO
Widener & Selto, 1999, JMAR
Zaheer & Venkatraman, 1994, SMJ
Zahra & Nielsen, 2002, SMJ

Sources are abbreviated as follows: *Applied Economics* (AE); *Academy of Management Journal* (AMJ); *Accounting, Organizations and Society* (AOS); *Administrative Science Quarterly* (ASQ); *Bell Journal of Economics* (BJE); Dissertation (D); *Economic Inquiry* (EI); *Industrial and Corporate Change* (ICC); *International Marketing Review* (IMR); *Journal of the Academy of Marketing Science* (JAMKTS); *Journal of the American Taxation Association* (JATA); *Journal of Business Research* (JBR); *Journal of Business Strategies* (JBS); *Journal of Corporate Finance* (JCF); *Journal of Economic Behavior and Organization* (JEBO); *Journal of Economics and Management Strategy* (JEMS); *Journal of International Business Studies* (JIBS); *Journal of Industrial Economics* (JIE); *Journal of International Marketing* (JIM); *Journal of Institutional and Theoretical Economics* (JITE); *Journal of Law and Economics* (JLE); *Journal of Law, Economics, and Organization* (JLEO); *Journal of Managerial Accounting Research* (JMAR); *Journal of Marketing* (JMKT); *Journal of Marketing Research* (JMR); *Journal of Management Studies* (JOMS); *Journal of Political Economy* (JPE); *Journal of Risk and Insurance* (JRI); *Journal of Supply Chain Management* (JSCM); *Logistics and Transportation Review* (LTR); *Management International Review* (MIR); *Marketing Science* (MKTS); *Management Science* (MS); *Organization Science* (OS); *Personnel Psychology* (PPsych); *Rand Journal of Economics* (RAND); *Review of Economics and Statistics* (RES); *Research Policy* (RP); *Strategic Management Journal* (SMJ); *Thunderbird International Business Review* (TIBR); *Transportation Journal* (TJ); Working Paper (WP)

APPENDIX B

Definitions and Sample Measures of Transaction Cost Economics Constructs

Construct	Definition	Sample Measures
Asset specificity	Level of unique investment supporting a transaction (Williamson, 1985)	• Difficulty redeploying equipment (Combs & Ketchen, 1999) • Firm-specific training time (Coles & Hesterly, 1998)
Technological uncertainty	Level of technological predictability (Walker & Weber, 1984)	• Level of confidence that a new technology would meet customer demands (Steensma & Corley, 2000) • Frequency of changes in specifications (Walker & Weber, 1984)
Volume uncertainty	Level of demand predictability (Walker & Weber, 1984)	• Industry net sales variability (Bergh & Lawless, 1998) • Extent to which volume is uncertain (Walker & Weber, 1984)
Behavioral uncertainty	Performance measurement difficulties (Williamson, 1985)	• Difficulties monitoring quality (Brouthers et al., 2003) • Extent that performance could be assessed (Masters & Miles, 2003)
Frequency	How often a transaction occurs (Williamson, 1985)	• Are purchases small, medium, or large (Leffler & Rucker, 1991)? • Number of annual transactions between firms (Parkhe, 1993)
Degree of integration	Degree to which a transaction is managed or controlled using hierarchy-like governance mechanisms (e.g., market vs. hybrid or hierarchy, or hybrid vs. hierarchy)	• Market versus close collaborative ties with supplier (toward hybrid—Sriram, Krapfel, & Spekman, 1992) • Licensing versus acquisitions (toward hierarchy—Schilling & Steensma, 2002)
Matching	The degree to which managers align transactions in the way prescribed by TCE (Williamson, 1991)	• Assigned probabilities for transactions that are integrated or outside hierarchy to come up with a fit/misfit measure (Leiblein, Reuer, & Dalsace, 2002)
Performance	The outcomes of a firm's activities	• Returns on sales and assets (ROS/ROA—Silverman, Nickerson, & Freeman, 1997)
Strategic assets	Assets that are valuable, rare, and hard to copy or duplicate (Barney, 1991; Crook et al., 2011, found strong performance effects for specific skills and abilities)	• The degree to which skills are specific to a transaction (Masten, Meehan, & Snyder, 1991)

APPENDIX C

Description of Meta-Analytic Method

Meta-analysis was used to synthesize the accumulated data on the relationships of interest. Meta-analysis allows researchers to synthesize the available evidence to obtain the best possible estimate of the direction and strength of a relationship between variables (Crook et al., 2011; Dalton & Dalton, 2005). Our meta-analysis followed the analytic procedures of the Hunter and Schmidt (2004) random-effects model. This was an appropriate model because it is likely that the relationships in the body of TCE research are not constant across contexts (Aguinis, Gottfredson, & Wright, 2011). First, we obtained effects, such as a bivariate correlation between transaction attributes and structural alternative decisions, from the primary studies. Second, we obtained the sample size (i.e., number of transactions/firms) from each study. Third, we corrected each correlation for mea-

surement error. Because the reliabilities of resource and performance measures are rarely reported, we used a correction factor of .80, which is a recommended conservative value for meta-analyses in the strategic management field (Dalton & Dalton, 2005, p. 55) and has been validated by a review of almost 6,000 effect sizes reported in management journals (Aguinis et al., 2011). Fourth, we computed a mean weighted (by sample size) and corrected (by measurement error) correlation for each relationship (i.e., r_c). Fifth, we examined whether effects differed from zero or whether effects differed from each other by computing confidence intervals around each mean weighted and corrected effect using equations offered by Hunter and Schmidt (2004, p. 205–207). Computing a confidence interval assumes that all effects estimating a particular relationship across studies estimate a common (and fixed) population correlation. Thus, a confidence interval refers to the distribution of a single parameter value (for more detail, see Aguinis and colleagues, 2011).

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