

COMPLEMENTARITY & CONSTRAINTS:
WHY FIRMS BOTH MAKE AND BUY THE SAME THING¹

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Abstract

While many theories of the firm seek to explain why firm make or buy, in practice firms often make and buy the same input. We use both verbal and formal reasoning to present an integrated theory of plural sourcing- instances of firms using multiple governance modes simultaneously to procure the same input. Firms are more likely to make *and* buy rather than make *or* buy in the presence of complementarities between procurement modes and constraints on the use of individual modes. The extent of plural sourcing increases with complementarities and constraints, but decreases with factors that create an advantage for one of the modes over the other. Finally, complementarities weaken the effects of constraints on the extent of plural sourcing and vice versa.

The make-or-buy problem has become central to theories that attempt to explain the nature, origin and boundaries of the firm (Coase, 1937). Transaction cost economics, a leading theoretical perspective on these issues, specifies whether firms choose to make or buy a key input as a function of the need for investments specific to the transaction, uncertainty about contract parameters, and frequency of transactions (Williamson, 1991a). Other theorists, while offering different explanations for the choices between make and buy, such as superior coordination and knowledge transfer within firms (Conner & Prahalad, 1996; Grant, 1996; Kogut & Zander, 1996), or information asymmetry and measurement costs (Barzel, 1982; Demsetz, 1988), nonetheless retain the discrete make-or-buy choice as the central empirical phenomenon to be explained (Poppo & Zenger, 1998).

Yet, firms often make *and* buy *the same thing*. If firms were making and buying different things, there is little to explain. Given the extensive development of the theory of the firm in economics and management, it no longer surprises any one (except perhaps a devotee of vertical integration for its own sake) to learn that a firm may prefer to develop its own products but buy its stationary. However, what is intriguing is that firms often make and buy the exact same input simultaneously (Bradach & Eccles, 1989; Harrigan, 1986; Jacobides & Billinger, 2006; Parmigiani, 2006). Indeed, empirical work in transaction cost economics often forces a dichotomous characterization of a procurement decision as make or buy based on some arbitrary cut-off (e.g. more than 80% bought is defined as buy in the classic study of outsourcing in the auto industry by Monteverde and Teece, 1982), reflecting the empirical reality that firms can and do choose both modes of transacting simultaneously. Bradach and Eccles noted that ignoring such anomalies amounts to

ignoring “the obvious and fascinating issue of why companies so often both make and buy” (1989; pg 100).

Following the extremely productive research trajectory sparked by Coase’s original insights, there is general consensus today that the boundaries of the firm matter- that making and buying are qualitatively distinct forms of governance and organization (Grossman & Hart, 1986; Klein, Crawford & Alchian, 1978; Williamson, 1975, 1985). However, the distinct nature of these modes of procurement does not automatically imply that they are mutually exclusive, as is implicitly asserted by the phrase “make or buy”. In this research, we scrutinize the traditional assumption of make and buy as mutually exclusive choices to understand why plural sourcing may occur, and in what proportion of internal and external procurement it is likely to occur.

We define plural sourcing as instances where a firm may elect to simultaneously make and buy the same input. We argue that any theory (including transaction cost economics) that is based on a set of arguments about when one governance mode is superior to another provides at best a partial account for plural sourcing. Instead, to explain plural sourcing requires a model that links the differential advantages of making and buying to the proportion produced in either mode. In the next section, we first explain in detail why extant make-or-buy theories do not provide an adequate explanation for plural sourcing. In the following section, we lay out a theory of plural sourcing based on the concepts of complementarity and constraints. The last section concludes with a discussion of implications for theory, empirical research and practice.

It is useful to clarify at the outset the distinction between plural sourcing and what are often known as “hybrids”- organizational forms that are distinct from in-

house procurement and arms-length market relationships (Hennart, 1993; Powell, 1990; Williamson, 1991b). Hybrids are a mode of procurement that are different from either make or buy – they may not complete ownership, but yet be characterized by a degree of cooperation and coordination that is unusual in market relationships (Gulati, Lawrence and Puranam, 2005). They often embody greater authority and continuity of association than is found in market relationships, but also more reliance on prices than is typical for firms (Bradach and Eccles, 1989; Williamson, 1991). Hybrids are “mixed modes” of procurement in the sense that they display governance characteristics that appear to combine price and authority (Bradach and Eccles, 1989; Hennart, 1993).

However, plural sourcing refers to a different phenomenon- a mixing of modes in the sense that firms may simultaneously rely on pure hierarchy (internal procurement) as well as price (market contracts) for the same input. Thus, whereas hybrids refer to procurement of the *entire* volume from a single mode that exhibits mixed governance characteristics, plural sourcing refers to the splitting up of total volume being procured across multiple modes, each of which may be a pure governance mode. As we will argue in this paper, the rationale that motivates plural sourcing is quite distinct from that underlying the preference for hybrids over either making or buying. To keep our theorizing parsimonious, we will focus on plural forms that include simultaneously making and buying- but we also discuss how our approach can be extended to include plural forms where firms simultaneously choose three modes of procurement- make, buy and ally (hybrids) (Williamson, 1991b).

Our analysis draws on and also extends work by other scholars who have explored closely related issues. For instance, prior work on the use of plural forms in franchising has explored the benefits of the simultaneous use of different models of

asset ownership – company owned vs. franchised operations - to exploit intangible assets such as brands and standard operating procedures (Bradach, 1997). Jacobides and Billinger (2006) use qualitative evidence to document the benefits of plural sourcing in the context of a garment design and manufacturing company. Parmigiani (2006) tests a variety of hypotheses drawn from different theoretical perspectives that might explain why plural sourcing occurs. Our analysis builds on these prior contributions and also extends them by analysing the forces that determine the optimal mix of sourcing the same input from internal and external modes, and not only on the benefits of doing both per se. As we will show through both verbal and formal arguments, the optimal mix depends on scale constraints to internal and external procurement as well as benefits (complementarities) from sourcing through multiple modes simultaneously. Further, we show how complementarities and constraints interact to shape the optimal mix of procurement, and how they weaken the link between transactional characteristics and governance choices as posited in traditional make or buy theories.

WHY MAKE-OR-BUY THEORIES DO NOT PROVIDE AN ADEQUATE EXPLANATION OF PLURAL SOURCING

Consider a canonical representation of transaction cost arguments found in Williamson's work (1991). Figure 1 (based on Figure 1 pg 284 in Williamson's 1991 paper) shows governance costs for a transaction when it is conducted within markets and hierarchies respectively as a function of the extent of asset specificity involved. This is a visual representation of the "comparative cost/benefit" analysis first indicated by Coase (1937), and developed subsequently by Williamson (1985; 1991). The figure shows that the governance costs are lower for markets than hierarchies at

low levels of asset specificity, but higher in markets than hierarchies for high levels of asset specificity, implicitly holding the benefits from the exchange constant.

Insert Figure 1 Here

What is noteworthy is that the governance costs shown in Figure 1 are volume independent- they describe the relative costs of markets, hierarchies and hybrids whether a single unit of a good is being exchanged or a million units. Put differently, if it is cheaper to use markets for the first unit of a good being procured, so it is for the millionth unit- within the logical framework represented by the figure, there is no reason why firms should procure some fraction of their requirement for a good (with a certain level of asset specificity) from the market and make the rest internally. Thus the traditional comparative cost/benefit analysis of transaction cost economics cannot offer an explanation for plural sourcing.

Indeed, transaction cost theorists who seek to explain plural sourcing have sometimes done so by denying its existence – through uncovering heterogeneity in transaction attributes, it is claimed that what appears at first sight to be instances of firms making and buying the same thing, turns out in fact to be quite different things being procured through different modes. For instance, Williamson (1985, pg 96) argues that when firms appear to be both making and buying the same good, a closer examination should reveal that the internally produced good actually involves higher asset specificity – what appear identical are in fact heterogeneous transactions. The claim therefore is that what appears on the surface to be a case of a firm procuring the same component through make and buy is actually the firm procuring two distinct components each being procured by the appropriate means.

An empirical illustration of this “transactional heterogeneity” argument can be found in a recent paper by He and Nickerson (2006) that examines why many

interstate trucking companies engage in hiring their own drivers as well as relying on external drivers often for trips of comparable mileage and loads. The answer they suggest is that not all load-miles are equal, thus suggesting that maybe firms are not necessarily simultaneously making and buying the exact same thing. In the trucking industry a key profitability driver is the avoidance of empty backhauls. Orders that originate and terminate at company depots are economically different from orders that do not- even if the weight and distance are identical. Trucking companies therefore use their own drivers for orders of the former type, while outsourcing those of the latter type. Thus, once transactional heterogeneity is correctly accounted for, the “anomaly” of plural sourcing disappears (He & Nickerson, 2006).

Yet the documented instances of firms procuring identical inputs from internal and external sources simultaneously are too numerous to be dismissed offhand (Harrigan, 1986; Bradach and Eccles, 1989; Parmigiani, 2006; Gulati, Lawrence and Puranam, 2005; Jacobides and Billinger, 2006). Put differently, how frequently plural sourcing occurs is an empirical question; what cannot be disputed is that it does occur, and that even the theoretical possibility of its occurrence is effectively ignored in traditional transaction cost analysis (Bradach & Eccles, 1989).

The theoretical neglect of plural sourcing is not restricted only to transaction cost theorizing. Indeed, most theories of economic organization that rely on a comparison of costs or benefits per transaction to explain the organization of economic activity have typically ignored the possibility of plural sourcing. Whether the theory is based on concepts of competitive advantage (Conner and Prahalad, 1996), comparative advantage (Jacobides & Winter, 2005) or coordination/knowledge transfer efficiencies within firms (Kogut and Zander, 1996; Grant, 1996)- in the

absence of auxiliary assumptions, none provides a convincing account of plural sourcing.

An implication of our arguments above is that “straightforward” extensions of a logic that explains if a service or good is either made or bought, to the question of *how much* is made and *how much* is bought is not so obvious. For instance, it is not possible to predict the extent of vertical integration into producing a good on the basis of the extent of the transactional hazard within the standard comparative cost logic (eg. Poppo and Zenger, 1998; Jacobides and Hitt, 2005; Parmigiani, 2006) because that logic cannot explain why some proportion of a good is made and some proportion simultaneously bought; it only allows for a prediction of the conditions under which all or none of it is bought (or made). Nor is it possible to invoke measurement/judgement errors to justify such a hypothesis. Some researchers have assumed that when a firm makes 75% or 80% of its requirement for an input it can be interpreted to mean that the firm is in fact making 100% internally and the 20% represents errors of measurement or judgement on the part of management (Monteverde & Teece, 1982; Popper & Zenger, 1998). However this leaves unanswered the question of why the extent of the error should be correlated inversely with transactional hazards.

Another approach sometimes taken by scholars to explain plural sourcing is to suggest that plural sourcing occurs when firms are just indifferent between making and buying (Parmigiani, 2006). This situation occurs in Figure 1 at asset specificity level of k^* at which point firms are likely to be indifferent between the two discrete choices of make or buy. One can also imagine scenarios where the effects of different transactional attributes cancel out the advantages of both market and hierarchical procurement so that a situation of indifference prevails. For instance, the level of asset

specificity may be high but so may be the cost of bureaucracy borne if the transaction is integrated, making firms indifferent between their discrete choices. The “indifference hypothesis” can explain why in a cross section of firms engaging in identical transactions, some choose to make and other to buy. Further, this indifference hypothesis may also help explain hybrids- if the hybrid offers a governance-cost advantage over either market or hierarchy when transactional hazards and costs of bureaucracy are finely balanced. However, it cannot explain why any given firm should do both, nor the proportion it may source from each mode.

How then do we explain plural sourcing – instances of firms making and buying the same thing? In the next section we develop a theoretical framework to explain under what conditions firms may choose to engage in plural sourcing and also provide an explanation for how the proportion of each mode used may vary systematically.

THE RATIONALE FOR PLURAL SOURCING: COMPLEMENTARITIES AND CONSTRAINTS

To clarify our discussion, it is helpful to refer to Figure 2 in which we visualize the tradeoffs firms may face in making their procurement choices. This figure shows the various possible combinations of proportions that a firm may choose to make (produce within itself) and buy (procure from another firm i.e. the market). At the extreme left is the case where a firm buys its entire requirement for a particular input. At the extreme right is the case where a firm makes its entire requirements internally for a particular input.

Insert Figure 2 Here

Standard formulations of theories that explain make-or-buy decision by invoking the comparative cost/benefit logic can explain which of the two corner solutions (all make or all buy) would be adopted – the logic is one of forces that “push towards the corners”. For instance, a net advantage in terms of governance costs in favour of make (for instance because of asset specificity) would imply that $x=1$; a net disadvantage (for instance due to extremely high costs of bureaucracy) implies that $x=0$. As we have noted, however, this comparative cost/benefit approach cannot explain why a firm would ever optimally chose a value of $0 < x < 1$ – i.e. engage in plural sourcing. Our goal is to describe conditions under which such an intermediate value of x (with some proportion being made as well as some proportion being bought) may be optimal, as well as the forces that may increase or decrease x . Figure 2 also suggests a simple metric for the extent of plural sourcing: $x(1-x)$. As can be seen, this is maximized at $x=1/2$, when the firm splits its procurement volume equally between internal and external procurement.

We outline two distinct factors that arise from complementarities and constraints respectively, which push firms towards simultaneously making *and* buying. Table 1 summarizes the key features of complementarities and constraints, as well as how and why they encourage plural sourcing. Constraints push the optimal value of x “away from the corners”, whereas complementarities “pull towards the middle”. In conjunction with the basic logic of comparative cost outlined in theories like transaction costs economics, constraints and complementarities can help explain not only why firms engage in plural sourcing but also the optimal mix of making and buying that may arise in specific situations.

Complementarities in plural sourcing

Complementarities refer to a situation in which the performance consequences of a choice depend on other choices (Milgrom & Roberts, 1990; Milgrom & Roberts, 1995). In formal terms, this is often expressed as the marginal value of one variable depending on the value of another variable (Siggelkow, 2002). The notion of complementarity recurs under various guises as “interdependence” (Thompson, 1967), “fit” (Drazin & van de Ven, 1985) or “synergies” (Markides & Williamson, 1996) in the literature on organizations and strategy (Milgrom and Roberts, 1995). Complementarities have implications for the choice of organizational form because of the potential value of coordinating complementary choices (Siggelkow, 2002). In the context of procurement, complementarity refers to the condition in which the marginal benefit of procuring a good from the market depends on the level of in-house production, and vice versa. In the words of Bradach and Eccles (1989), “transactions controlled by one mechanism are profoundly affected by the simultaneous use of an alternative mechanism”.

By their nature, complementarities are systemic- the gains from coordinating complementary choices are most accurately assessed at the level of the “system” defined by the choices, rather at the level of each individual choice (Milgrom and Roberts, 1995). Thus complementarities between procurement modes should enhance the performance of the firm that engages in plural sourcing. Second, complementarities are by definition symmetric; “If doing more of activity a raises the value of increases in activity b, then increasing b also raises the value of increasing a”(Milgrom and Roberts, 1995; pg 83). Therefore if making enhances the marginal value of buying, it should also be true that buying enhances the marginal value of making. We argue below that these two properties imply that in the presence of

complementarities between procurement modes, a mix of making and buying outperforms pure make or buy.

We discuss complementarity between procurement modes in terms of two basic forms that are known in the literature- in terms of enhanced knowledge and understanding of the production process (knowledge complementarities) or through superior monitoring and incentives for the supplying units (incentive complementarity). While incentive complementarity leads to superior monitoring and measurement of both kinds of suppliers, knowledge complementarity leads to the enhanced competence of internal and external suppliers.

Incentive complementarities

One of the earliest explanations for plural sourcing hinged on the argument that if firms both made and bought an input, it gave them the ability to credibly threaten backward integration to their suppliers (Porter, 1980). This form of sourcing has been referred to as “tapered integration”, as the focal firm maintains a small level of in-house production of an input, while outsourcing the rest. Harrigan’s work (1985; 1986) documented specific instances of this form of plural sourcing, adding texture to the concept described by Porter (1980). In addition to bargaining power, a related advantage for firms engaging in tapered integration is that internal production gave firms superior insight into performance measurement and costs enabling enhanced monitoring and measurement of their external suppliers (Dutta, Bergen & Heide, 1995; Harrigan, 1985, 1986; Heide, 2003). Much of this discussion of tapered integration has been asymmetric in the sense that the emphasis was on the benefits of some internal production for managing external suppliers. More recently, researchers have emphasized that the complementarity works both ways- participation in the external markets also helps to discipline the internal provider - “ Placing an outside order, over

and above the transactional and cost considerations can be seen as an investment that infuses the firm with discipline through its active participation in intermediate markets” (Jacobides and Billinger, 2005: pg 256). Indeed the same argument can be made for the threat of backward integration- just as an internal supplier threaten vendors with backward integration, an external supplier can be the basis for a firm providing a credible threat to its internal unit with divestment and outsourcing in the event of poor performance.

Incentive complementarity is thus both symmetric and systemic in effect, as both internal and external supplier can experience incentives for improvements and the procuring firm becomes better off through using a combination of procurement modes rather than either one alone. The common mechanism underlying incentive complementarities is competition. By creating implicit or even explicit competition between internal and external units, the procuring firm enjoys the benefits of stronger incentives acting on both kinds of suppliers.

Knowledge Complementarities

In contrast with incentive complementarities, knowledge complementarities refer to improvements in the competence of internal suppliers because of procurement from external suppliers and vice versa. Knowledge complementarities arise from collaboration (not competition) between internal and external suppliers in order to create value for the procuring firm. As a result, in this instance firms can benefit by their internal and external suppliers sharing knowledge of improvements in production processes and technologies, thus enabling each other to enhance their efficacy and effectiveness (Dyer & Hatch, 2006; Dyer & Singh, 1998; Hatch & Dyer, 2004; Helper, MacDuffie& Sabel, 2000).ⁱ

Knowledge complementarities rest on the distinctive knowledge and nature of innovations that characterize internal and external suppliers. The nature of innovations that arise within internal and external suppliers may be qualitatively different, but having once occurred may be useful in either mode (Sorenson & Sorensen, 2001). For instance, in-house production is advantageous in generating innovations in manufacturing that are systemic in nature- that involve the focal component and other parts of a product. This is because hierarchies have an advantage at forms of innovation entailing significant interdependence across components because of the presence of sophisticated coordination and control mechanisms that are unavailable in market transactions (Afuah, 2001; Chesbrough & Teece, 1996; Teece, 1996). However, once the process or product improvement has been achieved within in-house production, it could potentially be leveraged in the external procurement mode as well, if the innovation can be transferred effectively from one unit to the other. The improvements in production process or product features can then be used to educate external suppliers, and measure them against the performance standards obtained by the internal supplier (Bradach, 1997).

Conversely, when firms choose to buy an input through a market transaction, the sharp, high-powered incentives available to external suppliers may result in autonomous innovations (eg, cost reductions in manufacturing or R&D), which can then be applied in internal supplying units as well through a process of knowledge transfer. A related form of complementarity between the knowledge available from internal and external suppliers may pertain to the depth vs. breadth of knowledge. Internal production allows for the creation and retention of deep tacit knowledge that is specific to and internalized within the organization (Nelson & Winter, 1982) (Kogut & Zander, 1992; Nelson & Winter, 1982; Pisano, 1990); in contrast, external

suppliers represent an entry channel for a broad variety of information from outside the firm, which may make up in breadth what it lacks in depth.

The distinctive knowledge bases of internal and external suppliers can be particularly useful under conditions of technological uncertainty (Sorenson and Sorensen, 2001). Given a production technology subject to rapid developments and uncertainty about its trajectory of development, the procuring firm benefits by both making as well as buying, since it increases its chances of becoming aware of the latest technological developments in the component technology (Parmigiani, 2006). Further, under conditions of technological uncertainty, plural sourcing may be a “hedging” strategy that creates options to either make or buy as uncertainty about optimal procurement mode is resolved (Afuah, 2001).

Thus, knowledge complementarities can arise whenever the knowledge generated in each mode of procurement is distinct from the knowledge generated in the other mode, but is usable in both. Under such conditions, plural sourcing can outperform pure sourcing, as long as the knowledge is transferable effectively across modes. Bradach’s analysis of plural forms in franchising underlines the importance of mutual learning processes, which involve the sharing of knowledge across modes, for knowledge complementarities to be exploited (Bradach, 1997). A combination of opportunities for complementary knowledge generation and mechanisms for transferring knowledge between modes can effectively create an “open innovation” regime such that the firm benefits from innovation regardless of whether it is in house or from external sources (Chesbrough, 2003; Jacobides & Billinger, 2006).

A more subtle form of complementarity that mixes incentives and knowledge occurs through a process that has been described as “ratcheting” (Bradach, 1997). In situations where a firm engages in plural sourcing, it is often possible for it to use the

performance achieved in one mode as the standard for the other. For instance, franchisee and company owned fast food restaurants frequently benchmark their performance against each other. The effect goes beyond just the maintenance of current standards, to include a virtuous cycle of continuous improvement as internal and external supplier compete against the performance benchmarks established by the other (and inevitably overshoot).

We have argued so far that both knowledge and incentive complementarities have systemic effects in that they enhance the procuring firms performance for those inputs when plural sourcing rather than a pure procurement mode is used for them. We have also argued that incentive and knowledge complementarities are symmetric – competition enhances incentives for both internal and external suppliers, just as collaboration and knowledge transfer can enhance the competence of both (see Table 1 for a summary of incentive and knowledge complementarities). Complementarities thus create a force that “pulls towards the middle” in Figure 2 and away from a corner solution where a firm uses one or the other way of sourcing an input.

Yet, it seems unlikely that plural sourcing will always involve an even split between internal and external procurement. For instance while making 10% of the requirement of a product internally may enhance the value of the 90% bought from the market (by transferring best practice to the supplier and/or monitoring the supplier better), it seems less clear that firms would make 50% internally in order to obtain these benefits. It seems much more likely that there may be internal optimal points for the mix between make and buy, which are unlikely to be at the midpoint, but more likely to be closer to the two ends of the make-buy- spectrum (eg. x_1^* or x_2^* in Figure 3).

Insert Figure 3 Here

How do we reconcile the forces pulling towards the centre created by complementarities that symmetrically improve the performance of both internal and external suppliers, with internal optima that are close to the corners such as x_1^* or x_2^* ? This apparent conundrum is resolved once we factor in the basic comparative cost/benefit logic. Assume that on a per unit basis, buying is superior to making because production assets are not specific, and costs of bureaucracy are significant. Then, even if there are complementarities between making and buying arising from either knowledge or incentive considerations, there is a natural limit to how much the firm will make to leverage these complementarities, because the gain from complementarities must be offset against the costs of procuring more volume from the less efficient mode (on a per unit basis). In more technical terms, while making and buying may be complementary, the marginal rate of technical substitution between the two may not be equal to one.

In sum, complementarities between internal and external procurement can arise through the processes of competition and collaboration between modes, generating incentive and knowledge complementarities respectively. Such complementarities are symmetric, in that they benefit both modes of procurement, and systemic, in that they enhance the performance of the procuring firm relative to that of firms that choose only make or only buy. Complementarities should therefore encourage plural sourcing.

In contrast factors that create a comparative cost or benefit advantage for one of the modes (eg. transactional hazards) should discourage plural sourcing, as they create pressures towards adopting one of the pure modes. Further, complementarities should weaken the link between transactional hazards and internal procurement. In the presence of complementarities, the marginal effect of transactional hazards on the

extent of internal procurement depends on the magnitude of complementarities. This is because an optimal choice will balance the gains from procuring from the more efficient mode on a per unit basis (say make) against the complementarity with external procurement. An increase in the magnitude of complementarity will therefore have to be met by an increase in the magnitude of transactional hazards to maintain the balance at the equilibrium level of internal procurement. Therefore, for higher levels of complementarity, a higher level of transactional hazards is necessary to evoke the same optimal choice of internal procurement levels. Thus, complementarity negatively moderates the effect of transactional hazards on the extent of internal procurement. We formalize these ideas as follows (see Technical Appendix for formal arguments):

P1a: The extent of plural sourcing increases with the magnitude of incentive and knowledge complementarities.

P1b: The extent of plural sourcing decreases with the magnitude of transactional hazards.

P1c: Incentive and knowledge complementarities negatively moderate the relationship between transactional hazards and the extent of internal procurement.

Note that while P1b and c mention transaction hazards, the argument applies to any factors that create a comparative cost or benefit advantage for internal over external procurement (such as interdependence, information asymmetry, or measurement uncertainty).

Constraints on the use of pure models of sourcing-

In contrast to complementarities, which “pull towards the centre”, constraints “push away from the edges”. Figure 4 shows the effects of two general classes of constraints that have been studied in prior literature – limits to scale and barriers to

exit – that can prevent firms from adopting pure models of sourcing which involve either make or buy and push them to plural sourcing. We discuss each in turn.

Insert Figure 4 Here

Limits to Scale

Even when transactional hazard considerations suggest a clear advantage to procuring internally (e.g. a situation of high asset specificity), firms may be limited in their ability to produce at the scale they desire.

A well-known source of diseconomies to scale arises from volume uncertainty coupled with costs of excess capacity (Porter, 1980; Harrigan, 1986). With fluctuations in demand, firms are exposed to periods of excess capacity if they choose to invest in production for peak demand (Pindyck & Rubinfeld, 1995). If the cost of this excess capacity is significant, then the firm may optimally choose to produce at lower scale. A system of external suppliers may evolve who help to “make-up the deficit” when demand peaks. These suppliers may even charge a premium for the volume they provide when internal supply limits are reached, and also to reflect the greater risk they bear of excess capacity in lean periods. Yet firms may prefer paying the premium as it may be small compared to the cost of excess capacity borne by the firm, because the peak-time suppliers enjoy the advantage of aggregating excess demand across buyers. Thus volume uncertainty and the costs of maintaining unused capacity are likely to impose limits on the scale of internal production.

Diseconomies of scale in production are also a standard assumption in neoclassical economics, and underlie the upward sloping portions of long run average cost curves (Pindyck and Rubinfeld, 1995). The source of these diseconomies often lies in the limits of bureaucracy (Coase, 1937). While the costs of bureaucracy are frequently invoked in transaction cost analysis (Williamson, 1985), our argument here

pertains to the increasing costs to bureaucracy with increasing scale. Administrative limits to scale can arise from pure coordination failures as well as from motivation losses.

The costs of coordinating activities can be a significant limit to scale as limited rationality confronts the increased complexity that accompanies scale (Simon, 1945). A dramatic illustration of scale diseconomies that arise purely from coordination complexity is provided in the experimental research on coordination games (Camerer, 2003). In a series of studies, experimental economists have shown that in the weakest link game (a pure coordination game with symmetric equilibria that can be Pareto ranked), coordination failures increase dramatically with the size of the team playing the game (Weber, Camerer, Rottenstreich & Knez, 2001; Weber & Camerer, 2003). This is due to the combinatorial increase in the number of other players with whom one must share convergent expectations in order to select the efficient equilibrium.

Administrative diseconomies to scale can also arise from motivation losses as problems of free-riding and noise aggregation in performance increase with scale. Free riding is the tendency of individuals to shirk group activities, as their marginal returns are not large enough to offset their marginal costs of efforts. The marginal returns decrease with group size, so that free riding problems worsen with increasing group size (Zenger, 1994; Zenger & Marshall, 1995; Zenger & Marshall, 2000). Risk aversion is another well-known constraint on incentive intensity, as it limits the extent to which performance based compensation can be used. With increasing group size, each individual bears greater risk as the outcome is increasingly determined by others whom that individual may have little control over, so that effective incentive intensity is reduced (Baker, 2002). These insights from experimental economics and agency

theory bring into sharp focus the mechanisms that underlie the frequently noted phenomenon that organizational units become harder to manage as they become larger (Nadler & Tushman, 1997).

While volume uncertainty and administrative diseconomies of scale create limits to scale in the form of increasing marginal costs with scale, a fixed supply of resources that underlie production can create an absolute limit to the scale of internal production. Ricardian resources that are in short supply, and are impossible or very costly to expand capacity in, can impose limits to the expansion of production beyond certain points (Peteraf, 1993). Thus, paradoxically, the very resources that confer competitive advantage (such as access to a scarce source of raw materials or expertise embodied in a few key individuals) may also imply limits to scale, a point explored in much detail by Winter (1995). He points out that the resulting limit to scale is not the same as the output restriction that characterizes monopoly power- the firm would make more if it could, but it cannot (Winter, 1995). Under such conditions, the firm may be forced to rely on external suppliers to complete its requirements, assuming that the firm does not have a monopoly on the scarce resources in question and that at least some suppliers possess such resources. Thus when the resources or capabilities that underlie production are in fixed supply, they are likely to impose constraints on the scale of internal production.

Barriers to Exit

The mirror image of limits to scale is the problem of barriers to exit- while the former limit the extent of internal production, the latter force a degree of internal production. Even when transaction hazard considerations suggest a clear advantage to procuring from the market (eg. a situation of low asset specificity coupled with scale

economies), firms may be limited in their ability to cease internal production altogether.

The simplest economic rationale for barriers to exit may arise when fixed costs take on the form of sunk investments, which make variable costs lower than average costs (Jacobides and Hitt, 2005).. Under such circumstances, it may be rational to continue in-house production because the variable costs are lower than that of the average costs associated with procuring externally. Barriers to exit may also exist because of reputation or commitment lock-ins (Ghemawat, 1991). In effect, maintaining uneconomical in-house production may be necessary to sustain reputations or honour commitments made to various stakeholders (or even competitors). Thus employment contracts, public commitments, regulation and pressures from activists may prevent firms from exiting the production of a commodity, which it is clearly more economical to procure from the market. An implication of these arguments is that older in-house production facilities may in general be harder to dispose of.

Finally, the ability to exit depends critically on the existence of an active market for divestiture (Markides, 1992). Unless there are buyers available and willing to pay a sufficiently high salvage price, firms may be unable to divest themselves of in-house production facilities even when procurement from the market is preferable on an average cost basis. Thus, a weak market for the production assets may force firms to retain them, and therefore engage in plural sourcing.

In sum, constraints such as limits to scale and barriers to exit may force firms into plural sourcing, even when producing internally or sourcing externally is a dominant option on the basis of factors that create a comparative cost or benefit advantage for one of the modes (eg. transactional hazards). Further, we expect that

constraints negatively moderate the relationship between transaction hazards and internal procurement. In the presence of constraints, the marginal effect of transactional hazards on the extent of internal procurement depends on the magnitude of constraints. This is because an optimal choice will balance the gains from procuring from the more efficient mode on a per unit basis (say make) against the costs imposed by constraints. An increase in the magnitude of constraints will therefore have to be met by an increase in the magnitude of transactional hazards to maintain the balance at the equilibrium level of internal procurement. Therefore, for higher levels of constraints, a higher level of transactional hazards is necessary to evoke the same optimal choice of internal procurement levels. Thus, constraints negatively moderate the effect of transactional hazards on the extent of internal procurement. We formalize these ideas as follows (see Technical Appendix for formal arguments):

P2a: The extent of plural sourcing increases with the magnitude of constraints imposed by limits to scale and barriers to exit.

P2b: Constraints imposed by limits to scale and barriers to exit negatively moderate the relationship between transactional hazards and the extent of internal procurement.

We reiterate that while P2b mentions transaction hazards, the argument applies to any factors that create a comparative cost or benefit advantage for internal over external procurement.

In sum, complementarity and constraints make plural sourcing more likely (P1a and P2a) while factors that create a comparative cost or benefit advantage for one of the modes (eg. transactional hazards) make it less likely (P1b). Comparative cost/benefit factors, complementarities and constraints together can help to identify

the optimal mix of internal and external procurement (P1c, P2b). For instance, transaction hazards or transaction value (due to asset specificity or production competence) push the mix of activities “towards the edges” – towards a corner solution. Complementarities “pull towards the middle” because of the internal optima they create. In contrast, constraints “push away from the edges” because barriers to exit and limits to scale prevent firms from seeking the corner solutions of make or buy. The optimal mix of make and buy that a firm should choose in any situation will therefore depend on the balance between these forces and how they interact.

The joint effects of Complementarities and Constraints

So far, we have discussed comparative cost/benefit arguments, constraints and complementarities as three distinct aspects of the problem of plural sourcing. We have argued through propositions 1 and 2, that complementarities and constraints weaken the link between transactional hazards and choices of making or buying. In the presence of these factors, firms would make less than 100% (or buy less than 100%) even if transactional hazards indicate that the firm should make (or buy) all its requirements. In this section, we consider how constraints and complementarities interact with each other in determining the mix of procurement from internal and external sources.

Both complementarities and constraints encourage plural sourcing (P1a and P2a). However, complementarities negatively moderate the effect of constraints on the extent of plurality. In the presence of constraints, the marginal effect of complementarity on the extent of plural sourcing depends on the magnitude of constraints. This is because an optimal mix of procurement from internal and external sources will balance the gains from complementarities from splitting procurement volume across governance modes, against the costs imposed by sourcing additional

volume from each mode (constraints). An increase in the magnitude of complementarity will therefore have to be met by an increase in the magnitude of constraints to maintain the equilibrium at the optimal mix of procurement. Therefore, for greater magnitudes of complementarity, constraints of greater magnitude are necessary to evoke the same optimal mix of procurement levels. Thus, complementarity negatively moderates the effect of constraints on the extent of plural sourcing. We formalize this as follows (see Technical Appendix for formal arguments):

P3: Knowledge and Incentive complementarities negatively moderate the effect of constraints due to limits to scale and barriers to exit on the extent of plural sourcing.

While we state the argument in terms of complementarities moderating the effect of constraints, the converse would be an equally valid statement of P3.

CONCLUSIONS

Firms are more likely to make *and* buy rather than make *or* buy in the presence of complementarities and constraints. The tendency towards procuring in comparable volumes from internal and external suppliers is enhanced by complementarities and constraints, but suppressed by the existence of factors that create an advantage for one of the modes over the other. Our analysis goes beyond clarifying the role of constraints and complementarities to examine how these two might interact with transactional hazards and each other. We show that both constraints and complementarities weaken the relationship between transactional hazards and internal procurement. We also show that the joint effect of constraints and complementarities on the extent of plural sourcing is weaker than the sum of their independent effects- they interact as substitutes (a negative moderation effect).

Our analysis offers a closer look at the assumption of mutual exclusivity of procurement modes implicit in the phrase “make or buy”. Building on prior work on plural organizational forms (Bradach, 1997; Bradach & Eccles, 1989) and the benefits of plural sourcing (Porter, 1980; Harrigan, 1986; Parmigiani, 2006; Jacobides & Billinger, 2006) we proposed an integrated framework to explain how complementarities and constraints encourage plural sourcing and shape the optimal mix of internal and external procurement. Our analysis suggests that while factors that confer a cost or benefit advantage to one of the modes of procurement (such as transactional hazards) push towards a pure sourcing model, constraints pushes firms away from corner solutions while complementarities pull towards equal usage of the two procurement modes. The combination of these forces determines the optimal mix of internal and external procurement.

The theory developed in this paper complements traditional transaction cost theorizing, or indeed any other theory that treats make or buy as mutually exclusive options, by specifying the conditions under which firms make and buy as well as how the optimal mix varies. Empirical analysis of transaction cost predictions can also be significantly refined by taking into account the existence of constraints and complementarities, both of which weaken the link between per unit cost/benefit considerations and procurement choices. In addition to correcting for these potential conservative biases, the inclusion of measures of constraints and complementarities help to explain when firms engage in plural sourcing as well as the mix of procurement modes they will adopt, neither of which is possible within the traditional transaction cost framework.

Perhaps the single most important insight to arise from a consideration of plural sourcing is the value of systemic firm level analysis as opposed to transactional

level analysis. Our arguments have been developed from the perspective of a procuring firm that is considering choices about how much to make and buy, rather than a transaction level analysis about whether to make or buy an input. Shifting the level of analysis in this way leads to different predictions about transaction level choices. In the first place, it is possible to specify the extent being procured from each mode. More important, this also leads to predictions about the optimal levels of procurement from each mode that are different from those generated by a consideration of transactional hazards or similar factors alone. As we have noted, in the presence of complementarities and constraints, firms should be optimally less responsive to transactional hazard considerations in choosing the extent of internal procurement. There is an opportunity here to move from transaction level strategy to an analysis of the portfolio of sourcing options, which may also be closer to the realities of managerial practice (Bradach and Eccles, 1989; Jacobides and Billinger, 2006).

Our analysis also suggests several fruitful areas for further research. In the interests of simplicity, our analysis has focused on plural sourcing with only two pure alternatives- make and buy. However, it is relatively easy to extend the logic of our discussion to cases where a third alternative- alliance - is included. The precise mix of procurement volume across make, buy and ally would be somewhat harder to evaluate, as a continuum with two poles now becomes tri-polar; but the basic logic remains similar. For instance, the comparative cost benefit logic might indicate a more hierarchical mode of governance as asset specificity increases. The existence of knowledge or incentive complementarities would however cause firms to “distribute” their procurement across other modes as well, as would constraints.

It is also worth noting that the drivers of plural sourcing are distinct from those that motivate the selection of hybrids (such as alliances) over spot-market relationships and hierarchies. Within the transaction cost framework, hybrids become attractive relative to the poles for intermediate levels of transactional hazards (Williamson, 1991; Gulati et al, 2005). However, plural sourcing does not lie intermediate between making and buying- it instead involves both. Intermediate levels of transactional hazards therefore cannot explain plural sourcing though they may explain the preference for hybrids. Conversely, complementarities or constraints cannot explain the preference for hybrids-which have governance characteristics intermediate between internal and external procurement. The drivers of plural sourcing and of the choice of hybrid governance forms are therefore distinct. This is a proposition that would benefit from empirical investigation.

In theorizing about the possible interactions between procurement modes, we have drawn on prior research to focus on possible complementarities – situations in which procurement in one mode enhances the value of procurement from the other. However, it is theoretically possible that the interaction is one of substitution- where procurement from the internal supplier in fact decreases the marginal value of procurement from the external supplier – though such instances have not yet been systematically studied empirically. The formal analysis we conducted (see Technical Appendix) is however easy to modify for such possibilities. A key insight is that in the case of substitutive interactions between procurement modes (eg. the use of external procurement demotivates internal suppliers instead of spurring competition and enhanced incentives for them), ignoring such interactions can create an upward bias in empirical estimates of the strength of the relationship between transactional hazards and internal procurement.

We believe our research makes an important contribution to the literature on organizational form and procurement modes. By providing a theoretical framework to explain the occurrence and extent of plural sourcing, we extend existing theory and also bring a phenomenon that has often been treated as “noise” surrounding make or buy decisions, into the domain of systematic analysis. In some of the early work on this topic, Bradach and Eccles noted that “Explanations for when and why different mixtures of control mechanisms occur need to be developed. Such explanations may end up consistent with existing theories such as transaction cost economics. Little progress will be made, however, unless we step away from the theoretical baggage which insists that we view markets and hierarchies as mutually exclusive alternatives....” (1989; pg 116). It is heartening to notice that the topic of plural sourcing has begun to attract scholarly attention again (He and Nickerson, 2006; Parmigiani, 2006; Jacobides and Billinger, 2006) after a long hiatus (Porter, 1980; Harrigan, 1985; Bradach and Eccles, 1989). Yet much undoubtedly remains to be done. We hope to have provided a rigorous, integrated theoretical foundation for making further progress on the fascinating question of why firms both make and buy. Further, by considering the interactions between different modes of procurement, a more accurate picture of the boundaries of the firm may emerge, with due recognition that while individual transactions may lie squarely within or between firms, production activity as a whole may be less easy to classify in this dichotomous manner.

Technical Appendix

We present a simple formalization of the key arguments in this paper, to assess the robustness of the verbal reasoning that underlies propositions 1-3. In accordance with Figure 2, let the proportion made (i.e. internally produced) be denoted by x and the proportion bought, by $1-x, x \in [0,1]$. The extent of plural sourcing is given by $\rho \in [0,1/4] = x(1-x)$. The objective function that the procuring firm maximizes (Π) must account for the following:

- Factors that confer comparative costs/benefit advantages to internal or external procurement (eg. transaction hazards).
- Complementarity between making and buying
- Constraints on the extent of making and buying.

We decompose the firm's objective function into a benefit and a cost term $\Pi = B - C$, where

$$B = mx + b(1-x) + \theta x(1-x) \quad (1)$$

$$C = i \frac{x^2}{2} + e \frac{(1-x)^2}{2} \quad (2)$$

The parameter $m(> 0)$ captures the marginal benefit from making each unit, *net* of any governance costs. The parameter $\theta > 0$ captures the magnitude of the ***complementarity*** between making (x) and buying ($1-x$). The condition

$\frac{\partial^2 B}{\partial(x)\partial(1-x)} = \theta > 0$ formally defines complementarity (Millgrom and Roberts, 1990).

Note that the complementarity is symmetric ($\frac{\partial^2 B}{\partial(1-x)\partial(x)} = \theta > 0$). Thus each unit

bought increases the marginal benefit of making by $\theta(1-x)$ over and above m . Similarly, the parameter $b(> 0)$ captures the marginal benefit from buying net of any governance costs. Thus each unit made increases the marginal benefit of buying by θx over and above b . A measure of the *comparative cost/benefit* advantage of internal procurement over external procurement on a per unit basis is given by $\delta = m - b$. The existence of transactional hazards correspond to $\delta > 0$.

The parameter $i(> 0)$ can be interpreted as indicating the strength of the “limits to scale” *constraint*, so that ix is the increasing marginal cost of procuring internally. The larger i is, the more significant the diseconomies of scale that impose constraints on internal production. Similarly, the parameter $e(> 0)$ can be interpreted as indicating the strength of the “barriers to exit” *constraint*, so that ex is the increasing marginal cost of procuring externally. The larger e is, the more expensive it is to procure larger proportions of the company’s requirements externally, thus forcing companies towards greater reliance on internal procurement.

The optimal mix of procurement modes can be found by calculating x^* which maximizes Π . The first and second order conditions are:

$$\frac{\partial \Pi}{\partial x} = \delta + e(1-x) - ix + \theta(1-2x) \quad (3)$$

$$\frac{\partial^2 \Pi}{\partial x^2} = -(e+i+2\theta) \quad (4)$$

where $\delta = m - b$. From (3), it is clear that in the absence of complementarity and constraints (i.e. $e = i = \theta = 0$), x^* is always a corner solution with $x^* = 1$ if $\delta > 0$, and $x^* = 0$ if $\delta < 0$. This corresponds to the basic transaction cost injunction- make in the presence of transactional hazards (which make internal

procurement superior to external procurement i.e. $\delta > 0$), else buy. Since we are not examining the impact of the relative magnitude of the limits to scale and barriers to exit constraints, without loss of generality, we set $i = e = c$.

$$\text{Solving } \frac{\partial \Pi}{\partial x} = 0 \text{ yields } x^* = \frac{c + \delta + \theta}{2c + 2\theta} \quad (5)$$

$$\text{Therefore } \rho^* = \frac{(c - \delta + \theta)(c + \delta + \theta)}{(2c + 2\theta)^2} \quad (6)$$

The parameter restrictions necessary to ensure that $x \in [0,1]$ are

$$c + \theta > \delta > -(c + \theta) \quad (7)$$

Proofs for propositions 1-3:

Given (5) and (6), it is easy to prove Propositions 1-3 by simply examining the signs of the appropriate derivatives.

$$\text{P1a: } \frac{\partial \rho^*}{\partial \theta} = \frac{(\delta)^2}{2(c + \theta)^3} > 0$$

$$\text{P1b: } \frac{\partial \rho^*}{\partial \delta} = -\frac{\delta}{2(c + \theta)^2} < 0 \text{ for } \delta > 0 \text{ (transaction hazards).}$$

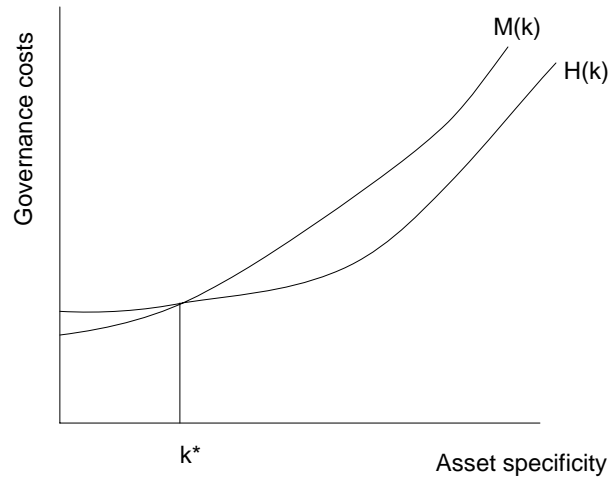
$$\text{P1c: } \frac{\partial^2 x^*}{\partial \delta \partial \theta} = \frac{-1}{2(c + \theta)^2} < 0$$

$$\text{P2a: } \frac{\partial \rho^*}{\partial c} = \frac{(\delta)^2}{2(c + \theta)^3} > 0$$

$$\text{P2b: } \frac{\partial^2 x^*}{\partial \delta \partial c} = \frac{-1}{2(c + \theta)^2} < 0$$

$$\text{P3: } \frac{\partial^2 \rho^*}{\partial c \partial \theta} = \frac{-3\delta^2}{2(c + \theta)^4} < 0$$

Governance costs as a function of asset specificity



=

Figure 1

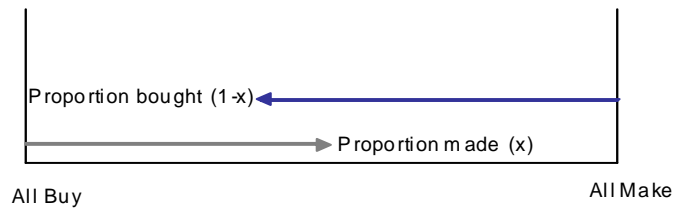


Figure 2

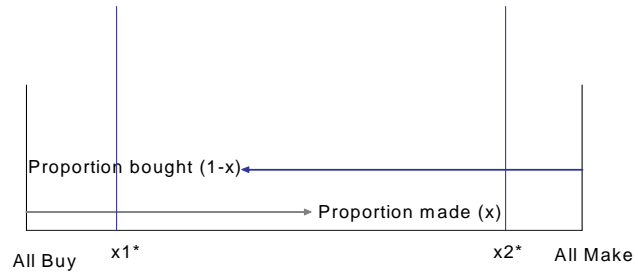


Figure 3

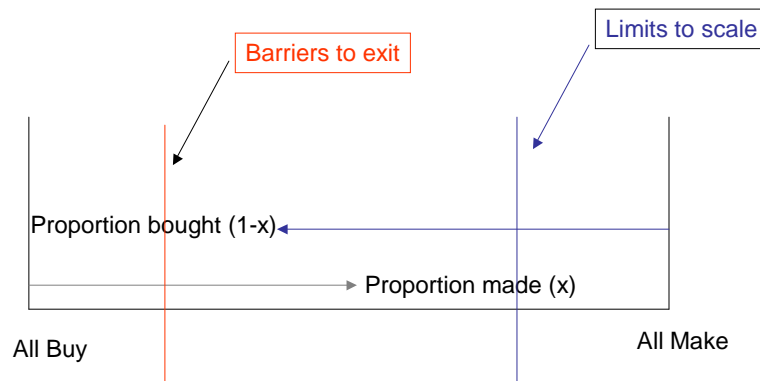


Figure 4

Concept	Key Underlying mechanism	Manifestations	Effect
Incentive Complementarities	Competition	<ul style="list-style-type: none"> • Threat of backward integration/outsourcing • Superior information on costs/prices & performance measurement • Benchmarking and ratcheting 	Improved incentives to perform for both internal and external suppliers
Knowledge Complementarities	Collaboration	<ul style="list-style-type: none"> • Distinct kinds of innovation by internal and external suppliers • Broader exploration under technological uncertainty • Options under technological uncertainty 	Improved competence for both internal and external suppliers
Constraints from Limits to Scale	Scale Diseconomies	<ul style="list-style-type: none"> • Volume uncertainty + cost of excess capacity • Coordination complexity and weakened incentives • Capacity constraints for resources 	Limits to internal procurement
Constraints from Barriers to exit	Lock-ins	<ul style="list-style-type: none"> • Sunk fixed costs • Commitment/reputation lock ins • Weak divestiture market 	Limits to external procurement

Table 1: Complementarities and Constraints: An Overview

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ⁱ Since knowledge based complementarities appear to rely on collaboration, whereas incentive complementarities arise from competition between internal and external suppliers, it is tempting to conclude that the two are mutually exclusive. Yet, there is sufficient evidence that relationships with suppliers tend to have elements of both competition and collaboration, so that it is possible for the two sources of complementarity to co-exist (Helper et al, 2000; Helper and Mudambi, 1996).