

WHY DO FIRMS BOTH MAKE AND BUY? AN INVESTIGATION OF CONCURRENT SOURCING

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Transaction cost economics, neoclassical economics, and the firm capabilities literatures propose theories of the firm that typically depict firm boundaries determined by a dichotomous choice: the make or buy decision. However, none of these theories presents a satisfying explanation as to why firms would concurrently source, i.e., simultaneously make and buy the same good. This study combines these organizational economics theories and compares when firms make, buy, and concurrently source through surveying small manufacturing firms. Support was shown for aspects of all three theories, with evidence indicating that concurrent sourcing is a distinctly different choice, rather existing along a make/buy continuum. Copyright © 2007 John Wiley & Sons, Ltd.

INTRODUCTION

As strategy scholars, we are most interested in the behavior and performance of firms. Despite decades of research on theories of the firm, we still struggle with the fundamental question of how firms determine their boundaries. Firms ostensibly create their boundaries through procurement decisions by choosing which goods to produce internally; therefore most theories of the firm view the sourcing decision as a dichotomous choice: to make or to buy (Williamson, 1975; Perry, 1989; Grant, 1996). However, firms can and do simultaneously make and buy the same good, a phenomenon this paper terms concurrent sourcing.¹ To

institute concurrent sourcing, the firm must incur both the costs of securing capital, allocating plant and equipment capacity, staffing, and coordination that accompany internal production as well as the costs of finding, selecting, negotiating with, and maintaining external suppliers. Once both internal and external sources are in place, managing these simultaneously can be challenging owing to the natural comparisons, suspicions, and shirking that can occur between the two sources (Hennart, 1993). Given that concurrent sourcing is more costly to set up and manage, why would firms select this sourcing mode over solely making or solely buying? This paper attempts to answer that

Keywords: concurrent sourcing; make-or-buy decisions; strategic sourcing; transaction cost theory; firm capabilities; vertical integration

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¹ I use the term 'concurrent sourcing' to specifically refer to only backward, partial vertical integration of a homogeneous good (or

service) by a single firm. The term 'partial integration' can refer to either forward or backward integration or some combination of these (e.g., making, buying, and selling a particular good; Porter, 1980). Likewise, Harrigan's term of 'taper integration' does not specifically refer to backward integration and is applied at a broad and diverse unit of analysis (the strategic business unit; Harrigan, 1984). 'Concurrent sourcing' emphasizes that firms are making and buying the *same* good, in contrast to considering a broader unit of analysis and/or one with more heterogeneity.

question both theoretically, by combining transaction cost theory, neoclassical economics, and the firm capabilities literature, and empirically, by analyzing survey data from small manufacturing firms. As such, this paper contributes to the strategy literature by explicitly incorporating the effects of all three theories in a careful empirical study, demonstrating the firm's desire to simultaneously monitor suppliers, produce efficiently, and improve processes.

A second and related research question that these theories help address is whether concurrent sourcing is better represented as a linear combination of making and buying along a make/buy continuum or as a distinct choice that uses two different sourcing modes simultaneously.² That is, whether the firm's primary decision is its degree of integration or its choice to either make, buy, or concurrently source. The three theories mentioned above do not agree on this decision. Transaction cost economics views the governance choice as placed upon a continuum, with market and hierarchy as the anchors (Williamson, 1985). Neoclassical economics and the capabilities views, however, support a distinct choice view such that a small degree of making (or buying) can provide significant benefits. If along a continuum, then the main decision by the firm is the percentage to produce internally; the forces motivating the firm to produce more would also motivate it to purchase less. However, if concurrent sourcing is a distinct choice, the key firm decision is choosing this option over solely making or solely buying. The forces that motivate the firm toward making may not be the same as those motivating it away from buying. It could be that forces pushing the firm away from making and away from buying motivate it to concurrently source, as the lesser of the three evils. Alternately, forces may push the firm toward making and toward buying, thus motivating it to concurrently source to gain the different benefits of both.

These ideas relate to discussions in the literature on plural forms and the distinctions between

governance modes. Firms that concurrently source simultaneously use the governance modes of market and hierarchy. Bradach and Eccles have termed this a plural governance mode, in which 'distinct organizational control mechanisms operate simultaneously *for the same function by the same firm.*' They offer the following argument as to why firms would use such a mode: 'Contracting is problematic without in-house experience, and the maladies associated with hierarchy are widely recognized. The remedy for these difficulties may be the simultaneous use of the two mechanisms, creating in essence competition between them' (Bradach and Eccles, 1989: 113; emphasis in original). It is the concurrent use of these two mechanisms, not the extent of one or the other, which provides the benefits to the firm. This connects to findings from Poppo and Zenger (1998), who proposed two different cost functions for making and for buying and found that 'these two governance forms possess distinctly different capacities to cope with or exploit various exchange attributes.' Answering the question of whether concurrent sourcing is a continuous or a discrete choice contributes to the field by enabling a deeper understanding of the differences between various hybrid governance modes and by clarifying different theoretical viewpoints.

Economists have provided some explanations why firms would concurrently source. Early work by Adelman suggested that firms concurrently source in times of demand uncertainty, pushing the fluctuations in volume onto suppliers in order to ensure full internal capacity and stable production (Adelman, 1949). Later economic scholars concurred with this view and posited that firms will also concurrently source to gain an increased understanding of the production process and thus better monitor suppliers (Cannon, 1968; Harris and Wiens, 1980; Porter, 1980). Harrigan conducted empirical work investigating relationships among strategic business units and found evidence that successful units concurrently sourced when uncertainty was high and the potential for synergies was significant (Harrigan, 1986).

More recently, marketing scholars have investigated dual distribution, in which firms simultaneously use in-house and independent sales channels, analogous to concurrent sourcing. They have found firms use dual distribution in the presence of performance uncertainty (Dutta *et al.*, 1995),

² A related issue involves how to define concurrent sourcing. An absolute approach would consider producing 1 percent of the firm's requirements while outsourcing the rest as being concurrent sourcing. However, if one is interested in the typical mode of sourcing a good, a less stringent definition is preferable. Following prior research, this study uses a threshold of 10 percent for both conceptual and empirical reasons. While some information may be lost by using this threshold, that which remains is more accurate and robust. For more details, see the dependent variable section.

market heterogeneity (Sa Vinhas, 2002), and information asymmetries (Heide, 2003). Franchising scholars have also positioned the choice to both own and franchise units as a decision to use dual distribution in order to balance incentive and control issues, as well as facilitate learning (Bradach, 1997; Lafontaine and Shaw, 2005). Similar findings have been shown in the trucking industry (Nickerson and Silverman, 2003; He and Nickerson, 2006).

These explanations do not fully take into account attributes of the good being sourced or characteristics of the buying and supplying firms, all of which affect the sourcing choice. Theories that address these factors and thus could be included when investigating this question are transaction cost economics, neoclassical economics, and the firm capabilities view. Although an influential theory for investigating strategic issues and a quintessential theory of vertical integration, transaction cost economics has been intriguingly silent on the question of concurrent sourcing. This is curious, especially given the scores of papers exploring hybrid forms and investigating the make/buy decision that generally have supported transaction cost logic (for reviews see Crocker and Masten, 1996; Rindfleisch and Heide, 1997; Boerner and Macher, 2002; and David and Han, 2004). Although transaction cost theory views the sourcing modes on a continuum, many of these empirical studies depict a dichotomous choice to make or to buy, sometimes forcing the issue and combining concurrent sourcing with one of these two choices. For example, in the classic work by Monteverde and Teece (1982), they define 'make' as when the firm produces 80 percent or more of its requirements and 'buy' as when the firm produces less than this amount; thus, many of their goods were actually concurrently sourced (Bradach and Eccles, 1989). Likewise, firm capability theories have neglected concurrent sourcing. These theories suggest that firms will conduct competence-related activities internally and outsource other activities (Pralhad and Hamel, 1990), thus addressing firm boundaries, but they do not explicitly address when firms may both make and buy.

Investigating the nature of the concurrent sourcing decision assists in our understanding of hybrid modes of organizing. Many theoretical lenses, including transaction cost economics and the capabilities view, have been used to explore hybrid governance modes, which combine aspects of

both market and hierarchy. But confusion exists given the myriad of hybrid forms which includes alliances, joint ventures, supply chain networks, relational contracting, and franchising, among others (Hodgson, 2002). Concurrent sourcing represents a simple and clean hybrid sourcing mode, involving a single firm and a single good, so its study can help resolve some of this confusion.³ Supporting the need for a study that would distinguish between the continuum and dual views, Dutta and colleagues suggested that a 'congenial context for such a study (of sourcing modes) would be an industrial purchasing decision where buyers engage in buy-only, make-only, and make-plus-buy choices ... (since) data including all three forms would thus afford a clearer separation of hybrid form (continuum) effects from dual form effects' (Dutta *et al.*, 1995: 203). Steensma and Corley concur with this position, advocating for 'discrete analyses of governance mode decisions ... conducted between the use of market and hybrid and between hybrid and hierarchy' (Steensma and Corley, 2001: 288).

This study answers these calls and, through a holistic approach, integrates several theoretical perspectives and builds on work that has combined theories but has assumed a dichotomous sourcing choice (e.g., Argyres, 1996; Poppo and Zenger, 1998; Combs and Ketchen, 1999; Steensma and Corley, 2001; Leiblein and Miller, 2003). Through this approach, the effects of both production and transaction costs can be better understood, as firms simultaneously strive to produce efficiently, improve their processes, and monitor suppliers. This approach also allows a comparison of theories that imply a continuum view (transaction cost economics) with those that imply a discrete choice view (neoclassical economics and capabilities). As suggested above, this study employs an industrial purchasing context by analyzing survey data from small manufacturing firms regarding their sourcing decisions for production tooling and services. This unique and fine-grained dataset of over 800 observations includes occurrences of all three sourcing modes as well as the percentage of internal production where applicable. The continuous vs. discrete choices can therefore be empirically examined using different modeling techniques. Aspects

³ While alliances and other more complex hybrid modes are important, this study focuses on concurrent sourcing since it is a mode available to nearly all firms in most industries, including small firms in mature environments.

from all three theoretical perspectives were shown to affect the sourcing choice, with greater support shown for the discrete over the continuum view.

The next section of this paper provides the theoretical background and hypotheses for sourcing choices, describing how transaction cost economics, neoclassical economics, and the capabilities view explain why or under what circumstances firms would concurrently source. An empirical section follows that describes the research design, context, and methodology. The results segment discusses the findings of several models and how these relate to the hypotheses. A final section presents a summary, practical implications, and suggestions for future work.

THEORIES AND HYPOTHESES

All of the literature used in this paper is rooted in economics but each stream proposes distinct arguments as to why a firm would concurrently source. The theoretical background and hypotheses in this section will suggest specific relationships between this sourcing strategy and attributes of the good, the environment, suppliers, and the sourcing firm. Each theory and its associated predictions also implies either a continuous or discrete view, addressing the related research question of whether concurrent sourcing is a mid-point on the make-or-buy continuum or whether it is a distinct and discrete choice. For a given variable, if the firm can gain the benefit of concurrent sourcing even with a slight percentage of its requirements outsourced (or insourced), then the discrete view is supported over the continuum view. This view is also less stringent than a strict continuum, which positions concurrent sourcing in between making and buying, thereby intermediate levels of explanatory factors lead to this result. The arguments below, along with empirical modeling techniques, strive to unravel these issues.

Transaction cost economics and concurrent sourcing

Transaction cost economics (TCE) has been established as a dominant lens to view firm boundary decisions. In this theory, the firm considers the *ex ante* and *ex post* costs of exchange as the primary determinant of whether to conduct an activity internally or externally, as these are distinct

governance structures (Coase, 1937; Williamson, 1975). Due to opportunism and bounded rationality, asset specificity and uncertainty are key transaction cost drivers, as they increase the costs of market exchange, motivating the firm to produce internally (Williamson, 1975, 1985). TCE has been applied broadly in the strategy, management, and organization theory literatures, as well as in non-business disciplines. Boerner and Macher offer an extensive review of over 600 papers based upon TCE principles demonstrating the wide range of questions investigated, from international entry modes for multinational corporations, to rock band membership and prenuptial agreements (Boerner and Macher, 2002). They, along with other scholars, find the tenets of TCE to be generally supported empirically, particularly the influence of asset specificity (see also Rindfleisch and Heide, 1997). David and Han's review of 63 empirical papers was less sanguine in supporting TCE, but still find considerable explanatory power for this theory in answering its canonical question and most frequently examined dependent variable: the make-or-buy decision (David and Han, 2004). Various forms of hybrid arrangements have been also studied using TCE, including alliances and joint ventures (e.g., Oxley, 1997, 1999), franchising (e.g., Minkler and Park, 1994), relational contracting (e.g., Heide and John, 1990; Dyer, 1997), and network forms (e.g., Eccles, 1981).

Given the wealth of contexts and questions that TCE has addressed, it is surprising that scholars have not investigated the rather obvious question of why firms would concurrently source. One reason for this neglect could be the assumption of a make-or-buy continuum, such that the key variable of interest is the percentage produced internally. Williamson describes this continuum as 'discrete market exchange at the one extreme to centralized hierarchical organization at the other, with myriad of mixed or intermediate modes filling the range in between' (Williamson, 1985: 16). Given the key dependent variables in TCE, this suggests a fairly linear relationship, such that the greater the degree of asset specificity (or uncertainty), the greater the percentage of the firm's requirements it would produce internally. This view also sets up market and hierarchy as mutually exclusive, with forces pushing it toward one form pulling it away from the other, and thus not considering why a firm may choose to use both of these governance forms simultaneously (Dutta *et al.*, 1995).

TCE does consider the possibility of a firm sourcing both internally and externally whereby a firm produces more custom goods internally and outsources the more generic ones. As described by Williamson, 'where firms are observed to both make and buy an identical good or service, the internal technology will be characterized by higher asset specificity than will be external technology, *ceteris paribus*' (Williamson, 1985: 96). But these goods aren't truly identical if produced by different technologies. Suppose the good is homogeneous and the firm is purposefully splitting the volume requirements between their internal facility and outside suppliers. The TCE/continuum view does not address this possibility and, moreover, cannot distinguish this case of using market and hierarchy simultaneously from the case of using these two governance modes for two related goods.

Another reason why TCE may have neglected concurrent sourcing is its emphasis on transaction characteristics. As such, TCE implies that concurrent sourcing would result in cases of intermediate asset specificity. In this situation, Williamson suggests that we will observe 'mixed governance, in which some firms will be observed to buy, others to make, and all expressing "dissatisfaction" with their current procurement solution' (Williamson, 1985: 94). As in the continuum case above, this theory doesn't address the possibility of the *same* firm both making and buying the *same* good, which may lead to less dissatisfaction. TCE stresses transaction costs as the driver for vertical integration and suggests the firm would 'never integrate for production cost reasons alone' (Williamson, 1985: 94). This may be true for full integration, but the case of partial integration, i.e., concurrent sourcing, is not as clear.

Perhaps aspects of production costs, such as economies of scale, are influential in this decision. It is important to consider these factors and either control for them or incorporate them into the theoretical framework. In this paper, hypotheses presented in later sections predict the effects of firm and supplier scope economies, as well as firm and supplier expertise, all of which will affect production costs. While not hypothesized but later controlled for, goods with a high minimum efficient scale and high volume requirements would be unlikely candidates for concurrent sourcing since it would be inefficient to split production over multiple suppliers.

As one of the key determinants of transaction costs, asset specificity should affect the choice to concurrently source. Asset specificity refers to the degree of idiosyncrasy of an investment required to produce the good for the sourcing firm; the more idiosyncratic the investments required, the more likely the firm will prefer to produce the good itself since the costs of protecting against potentially opportunistic suppliers is greater than the cost of producing internally (Williamson, 1975). TCE theory suggests a continuum view such that for higher degrees of asset specificity the percentage of requirements insourced would increase up to the point of full integration. This positive relationship has been supported empirically in scores of studies (see Crocker and Masten, 1996; Rindfleisch and Heide, 1997; Boerner and Macher, 2002; and David and Han, 2004; for reviews). What has not been investigated is the prediction that concurrently sourced goods would be moderate in their degree of specific investment. This logic leads to the first hypothesis:⁴

Hypothesis 1_{tce}: The greater the asset specificity of the good, the higher the percentage of its requirements the firm will produce internally. Therefore, moderately asset-specific goods will be concurrently sourced.

Uncertainty also affects the firm's sourcing choice. Uncertainty includes both the potential for environmental change and the unpredictability of a partner's behavior (Williamson, 1985). Greater uncertainty can lead to adaptation problems and to difficulties in evaluating performance, both of which may motivate the firm to internalize the activity, since hierarchical authority enables better coordination and monitoring, as well as protection against supplier opportunism. Transaction cost theory suggests that greater uncertainty in conjunction with a non-trivial level of asset specificity will lead to increased vertical integration, but empirically the findings have been mixed (Rindfleisch and Heide, 1997). One reason for this may be

⁴ Each hypothesis number includes a subscript representing its theoretical connection ('tce' for TCE, 'neo' for neoclassical economics, and 'cap' for capabilities). When the same variable is employed by different theories, the hypothesis number is the same, but the subscript differs. For example, the volume uncertainty hypothesis connected to TCE logic is Hypothesis 2_{tce}, while the volume uncertainty hypothesis connected to neoclassical economics is Hypothesis 2_{neo}.

that uncertainty consists of a number of distinct constructs, such as demand unpredictability, environmental volatility, and measurement difficulty (Sutcliffe and Zaheer, 1998; Leiblein and Miller, 2003; David and Han, 2004). A better understanding of how each of these types of uncertainty affects the sourcing decision can be reached by exploring separate hypotheses for each.

Volume uncertainty is one type of environmental uncertainty that should affect the sourcing decision. This uncertainty refers to unpredictability of demand and an accompanying inability to accurately forecast and schedule production. Volume uncertainty will make it more difficult to contract with suppliers since volume requirements will directly affect their costs, which will generally be lower when volume is smooth and predictable (Pindyck and Rubinfeld, 1995). Volume uncertainty will also lead to more misunderstandings and inventory coordination problems, increasing the need to communicate and impede adaptation (Williamson, 1985); thus, firms will produce more of their requirements internally in this situation. In addition, suppliers will be less likely to invest in process improvements since fluctuating volumes will complicate the pay-offs from such investments. Following this logic, concurrently sourced goods will be characterized by moderate levels of volume uncertainty. Restated, this is the next hypothesis:

Hypothesis 2_{ice}: The greater the good's volume uncertainty, the higher the percentage of its requirements the firm will produce internally. Therefore, goods with moderate levels of volume uncertainty will be concurrently sourced.

Another type of environmental uncertainty that can affect a firm's sourcing decision is when the technological future is uncertain. The TCE literature is split on whether greater technological uncertainty will promote internalization or outsourcing (Mahoney, 1992). On one hand, greater technological change will result in more significant adaptation and coordination challenges, leading to a higher degree of internalization (Williamson, 1985). However, significant technological uncertainty will also raise the risk of obsolescence and therefore firms would prefer to not invest, letting suppliers take this risk instead (Balakrishnan and

Wernerfelt, 1986). Moreover, technological uncertainty can drive the firm away from internalization and away from outsourcing, complicating a TCE prediction which is based upon a continuum (Poppo and Zenger, 1998). Empirical findings have also been mixed (Rindfleisch and Heide, 1997). Therefore, no TCE hypothesis will be made for this variable.

Performance uncertainty, or measurement difficulty, also affects a firm's sourcing decision. This uncertainty refers to the difficulty in predicting how a good will perform in the firm's subsequent production processes. The firm will have an information disadvantage relative to its potentially opportunistic suppliers if it knows little about upstream processes (Alchian and Demsetz, 1972; Barzel, 1982). Performance uncertainty will be greater for more complex goods, especially those that involve multiple components and technologies, since complexity increases the difficulty in evaluating quality through inspection prior to use (Coles and Hesterly, 1998; Bensaou and Anderson, 1999; Novak and Eppinger, 2001). If quality is difficult to evaluate, then monitoring a supplier's compliance will be problematic, as will determining when to enforce sanctions. TCE logic suggests that greater internalization will solve these monitoring problems and remove the potential for supplier opportunism, since the firm's hierarchical structure will improve information flows and coordinate incentives. Thus, concurrently sourced goods would have a moderate level of performance uncertainty. These arguments support the final TCE-based hypothesis:

Hypothesis 3_{ice}: The greater the performance uncertainty of the good, the higher the percentage of its requirements the firm will produce internally. Goods with a moderate level of performance uncertainty will be concurrently sourced.

Neoclassical economics and concurrent sourcing

The standard neoclassical economic explanation for concurrent sourcing involves hedging against demand uncertainty. In this case, a firm can keep its internal plant at full production by using suppliers to handle fluctuating additional volumes, thereby running more efficiently due to having this flexibility in capacity (Adelman, 1949; Carlton, 1979; Porter, 1980). This position assumes a

robust spot market, consisting of a large number of qualified external suppliers vying for the firm's business, although these suppliers will have higher base costs (Adelman, 1949). The actual prices they charge the firm may be even higher, due to the risk they are bearing by having unused capacity during slack times and by not knowing when the 'low probability' demand will occur (Carlton, 1979). Indeed, suppliers may charge premiums for lower volumes and short lead times since they know they are merely 'overflow outlets' for the firm (Harrigan, 1984; Hill, 1994). Firms may be willing to pay these premiums rather than invest in additional, and potentially underutilized, capacity.

The percentage of a firm's requirements that would be satisfied by its internal production may not necessarily depend upon volume uncertainty per se, but perhaps upon other aspects of the firm's production processes and equipment, such as the minimum efficient scale or demand for other products that share these resources. In the overflow case above, when firms are making the good and are near capacity at the usual demand levels, then volume uncertainty would result in a small degree of taper or a relatively small amount of outsourcing relative to internal production. But, more generally, the target internal production percentage could be great or small, since this depends upon other aspects of the production process. The key is that neither completely making nor completely buying will sufficiently resolve the uncertainty. In contrast to the TCE argument that proposes the firm is motivated toward greater making in cases of volume uncertainty to protect against supplier opportunism, this line of reasoning suggests that the firm is motivated both toward making, to fully utilize capacity, and toward buying, for flexibility in meeting demand. This implies a discrete choice rather than a continuum view. Restated, these arguments suggest the next hypothesis:

Hypothesis 2_{neo}: The greater the good's volume uncertainty, the more likely the firm will concurrently source.

Neoclassical economists also suggest that firms would use concurrent sourcing to reduce information asymmetry, such as that caused by performance uncertainty. By using both internal and external suppliers, the sourcing firm will learn more about production technology and have greater access to cost-saving measures (Adelman, 1949;

Harris and Wiens, 1980; Porter, 1980; Dutta *et al.*, 1995). The firm will gain an enhanced understanding of the production process in terms of quality and be in a better position to spur both internal and external suppliers to improve their offerings (Canon, 1968; Harrigan, 1984; Heide, 2003). Firms can also use concurrent sourcing as a sanctioning device since it enables the firm to credibly threaten to switch suppliers by either totally vertically integrating or completely outsourcing its requirements, thus disciplining both internal and external suppliers (Hennart, 1993). The firm does not need to produce a majority of its requirements in order to gain this understanding and be well positioned to monitor suppliers; a pilot plant producing small quantities can suffice (Oster, 1994). Therefore, as in the case of volume uncertainty and again contrary to TCE, there is not a continuous relationship between the degree of performance uncertainty and the percentage of internalization. In this case, the firm is motivated both to make, to better understand the good, and to buy, to be able to benchmark. Thus, another hypothesis results:

Hypothesis 3_{neo}: The greater the performance uncertainty of the good, the more likely the firm will concurrently source.

Neoclassical economics emphasizes the production function and its associated costs as the motivator for a firm's sourcing decision (Perry, 1989). One relevant characteristic of this function is the potential for scope economies, which involve a reduction in overall production costs from producing two goods simultaneously, leading to a fuller utilization of sharable upstream inputs (Panzar and Willig, 1981). These sharable inputs include specialized equipment and human capital, neither of which is sufficiently fungible to easily sell excess capacity in established markets, due to a lack of potential customers (Teece, 1982). The greater the scope economies for the firm, the less the marginal cost of production of a particular good, since producing this good in concert with its usual portfolio of products reduces the firm's total costs. Therefore, a firm would be motivated to produce such goods internally. This also suggests a continuous and linear relationship between a firm's scope economies and its percentage of internalization. Likewise, if suppliers can enjoy significant scope economies, this will be reflected in lower prices that will motivate the firm to outsource.

In other words, there will be a continuous and negative relationship between the suppliers' scope economies and the firm's internal production.

However, the firm considers both its and its supplier's scope economies in sourcing decisions. The firm and supplier may experience different levels of scope economies, since these depend upon the other goods each one produces. They may use dissimilar production processes and thus each has a different type of excess sharable input that they wish to more fully utilize (Barney, 1991; Helfat and Eisenhardt, 2004). For example, a supplier may have excess capacity on a particular machine while the firm may have slack internal engineering resources, both of which could be better utilized by the firm and the supplier producing the good. In this way, scope economies can provide symmetric incentives for the firm and supplier. Therefore, if both the firm and the supplier could reduce their production costs through scope economies, the firm would be motivated to make and to buy in order to enjoy both lower internal costs and relatively low supplier prices. This leads to the next hypothesis:

Hypothesis 4_{neo}: The greater scope economies for both the firm and its suppliers to produce the good, the more likely the firm will concurrently source.

Capabilities and concurrent sourcing

The capabilities view (e.g., Teece, Pisano, and Shuen, 1997; Eisenhardt and Martin, 2000), incorporating the resource- and knowledge-based views of the firm, complements the above two literatures by considering how attributes of the firm and its suppliers affect the sourcing decision. A firm will produce goods that are close to its area of expertise, core to its business, and related to items it already produces, as it uses past experience and resources as 'stepping stones' into related areas (Wernerfelt, 1984; Barney, 1986; Prahalad and Hamel, 1990). This expertise is broader and deeper than just the sum of the firm's prior experience in production as it incorporates its understanding of the base technology and the firm's related skills. Every firm is different, so some goods will be a better fit with its resource or knowledge base than others. If the good is a poor fit, it will be more efficient to outsource (Rubin, 1973; Kogut and Zander, 1992; Conner and Prahalad, 1996; Grant,

1996). Suppliers' costs will depend upon their relative expertise, resources, and capabilities and thus each individual supplier will offer a somewhat different blend of price, delivery, quality, and other attributes for the sourcing firm to consider (Penrose, 1959; Barney, 1991). This suggests a continuum such that the greater a firm's expertise about a good, the greater its degree of internalization and the greater the supplier's expertise, the greater the degree of outsourcing. If either the firm or the supplier has relatively greater expertise, then internalization or outsourcing, respectively, will result (Jacobides, 2004). However, if both the firm and the supplier have significant expertise, the firm will be motivated both to make, to take advantage of its own expertise, and to buy, to learn from suppliers. This case is analogous to the neoclassical case of combined scope economies with concurrent sourcing being a logical choice, since the firm is motivated to both make and buy. This logic supports the next hypothesis:

Hypothesis 5_{cap}: The greater the expertise of both the firm and its suppliers, the more likely the firm will concurrently source.

When a firm concurrently sources, learning will be enhanced, since it gains both the deep tacit knowledge of internal production and the broader, more diverse understanding from external supply relationships. Making the good improves the firm's understanding, since it gains a deeper tacit knowledge of the good and its processes (Kogut and Zander, 1992; Darr, Argote, and Epple, 1995; Grant, 1996). The knowledge and skills the firm accumulates through this 'learning by doing' cannot be replicated through outside supply relationships (Pisano, 1994). Buying the good provides vicarious learning from the outside suppliers who are connected through customer relationships to the firm's competitors and to firms in other industries. Since suppliers may not necessarily provide their goods at lower prices, a key benefit of concurrent sourcing is the 'net gain in the know-how and the trade connections' (Adelman, 1949: 116). This sourcing mode allows the firm access to both external suppliers' research and technology developments and to its own internal knowledge of the good and its related production processes (Porter, 1980; Harrigan, 1984; Cassiman and Veugelers, 2006).

While it is clear how concurrent sourcing benefits the buying firm, it is not as obvious why suppliers would choose to be part of this relationship. In some cases, the buyer may be large, powerful, and nearly a monopsonist, forcing the supplier to participate. This is the base case for much of the neo-classical economics literature, since it implicitly assumes robust markets, such that the larger firm can always find suppliers upon which to offload their fluctuations in demand (Porter, 1980). But many commercial markets are relatively thin, with buyers and suppliers having more equal power. Suppliers may not necessarily view the buyer's internal production as threatening, but rather as a signal that it is trying to gain a tacit understanding of the good. This is knowledge that the supplier already possesses. Suppliers could view the buyer's internal production unit as an attempt to create competition, since it could not obtain the desired quality and cost levels through pitting existing suppliers against each other (Harrigan, 1985). This can give suppliers a sense of reassurance and an indication of their significant bargaining power, especially if they are fairly well established in the market and the buyer is just beginning its own production of the good.

Moreover, suppliers benefit by having knowledgeable customers who are better positioned to evaluate supplier offerings (Lincoln, Ahmadjian, and Mason, 1998). Just as suppliers are a useful source of knowledge for customers, so too are customers for their suppliers (von Hippel, 1988). This motivates suppliers to participate in this bilateral relationship, since they can learn vicariously from the firm's internal production unit. Their shared understanding provides a foundation upon which the firms can learn from each other (Tunisi and Zanfei, 1998). It also provides a depth of understanding and facilitates knowledge transfer between the firm and its suppliers due to the increased similarity of the firms' knowledge bases (Lane and Lubatkin, 1998). Since the firm and suppliers both can gain from complementary knowledge, their incentives are aligned, suggesting that learning could drive the firm to choose concurrent sourcing and the supplier to participate. Firms can also swap managerial and technical innovations between internal manufacturing units and suppliers, improving both (Bradach and Eccles, 1989).

Learning is imperative when the progress of technology is difficult to predict. Firms will need to both gather a broad range of knowledge about

the technology and have the capacity to understand, interpret, and act upon whatever changes occur (Cohen and Levinthal, 1990). By concurrently sourcing internally and externally, firms will have a wider range of knowledge sources and adaptive responses, enabling them to exploit their cumulative knowledge and explore a broader set of technologies from suppliers (March, 1991). The firm's knowledge base will become more diverse, potentially overcoming inertia and relying solely on one technological approach (Sorensen and Stuart, 2000). If a firm cannot accurately predict the type of change forthcoming, having both types of sourcing available will improve the firm's likelihood to succeed by being 'ambidextrous' and able to deal with both suppliers and internal development groups in the face of technological change (Afuah, 2001). Since suppliers also face these changes, they too will want to be connected to the sourcing firm, making the incentives symmetric.

Another way to consider the value of learning from internal and external sources is through a real options framework (Bowman and Hurry 1993; Trigeorgis, 1995; Mahoney, 2005). By having both internal and external suppliers, the firm gains the option to switch between them, resulting in greater process flexibility (Kulatilaka and Marks, 1988). In times of greater technological change and uncertainty, these options become more valuable and therefore concurrent sourcing should be more likely (Sa Vinhas, 2002). However, the firm can gain these options and understand the environment sufficiently by outsourcing (or insourcing) a small amount of its requirements, implying a discrete rather than a continuous view. Thus, the benefits of learning from having two streams of knowledge provide the basis for the final hypothesis:

Hypothesis 6_{cap}: The greater the good's technological uncertainty, the more likely the firm will concurrently source.

Taken together, these hypotheses advance organizational economic theory by providing a more realistic and holistic approach to how firms make sourcing decisions. These predictions incorporate transaction cost and production cost effects by including aspects of asset specificity, various types of uncertainty, qualities of the good's technological production process, and the expertise of both the firm and its suppliers. Some of these

Table 1. Summary of predictions and results

Hypothesis and variable	Prediction (if high)	Logic	Models	Results ^a
H1 _{ice} Asset specificity	Produce greater % internally	Make to protect against supplier opportunism	1, 2, 3, 4	Not supported Models 5, 6 support Make > Buy and CS > Buy
H2 _{ice} Volume uncertainty	Produce greater % internally	Make to better able to coordinate and adapt	1, 2, 3, 4	Not supported
H3 _{ice} Performance uncertainty	Produce greater % internally	Make to align incentives by using authority	1, 2, 3, 4	Supported Models 5, 6 support Make > Buy and Make > CS
H2 _{neo} Volume uncertainty	Concurrently source	Make to fully utilize capacity Buy to gain flexibility	5, 6	Not supported
H3 _{neo} Performance uncertainty	Concurrently source	Make to better specify and evaluate Buy to benchmark	5, 6	Supported
H4 _{neo} Firm and supplier scope economies	Concurrently source	Make to enjoy lower costs Buy to gain lower prices	5, 6	Firm: Make > CS > Buy Supplier: Make < CS < Buy Combined: Make > Buy and CS > Buy
H5 _{cap} Firm & supplier expertise	Concurrently Source	Make to leverage competencies Buy to learn from suppliers	5, 6	Supported Firm: Make > CS > Buy Combined: Make < Buy and CS > Make
H6 _{cap} Technological uncertainty	Concurrently Source	Make to understand and interpret Buy to gain diverse views	5, 6	Supported CS > Make

^a CS, concurrently source.

hypotheses suggest a continuum, while others propose a discrete choice, with concurrent sourcing not necessarily in between making and buying. Table 1 summarizes the predictions and previews the results. The following empirical study along with ordinal and discrete modeling techniques assist in providing evidence both about when firms would concurrently source and about the nature of this decision.

RESEARCH DESIGN

The context for this study involves the sourcing decisions of metal stamping and powder metal

firms for production tooling and services. These two sectors of the metal forming industry consist of numerous, independent, mature, small firms. The attributes of these firms help to rule out alternative explanations for concurrent sourcing, such as inertia, corporate parent influence, or slack resources (Penrose, 1959). Both the firms and their suppliers are relatively small, which assists in controlling for explanations of sourcing strategy based upon a power differential, such as a large, powerful buyer that can act without considering a supplier's response, since it knows the supplier will comply (Porter, 1980). These firms rarely use buyer/supplier alliances or other more sophisticated mechanisms, simplifying the

sourcing choice. These firms are predominantly non-union, which controls for labor contracts that can restrict a firm's sourcing options (Argyres and Liebeskind, 1999). Both of these sectors share fairly homogeneous production processes and the technology involved is relatively mature, enabling better identification and characterization of the goods and a more conservative test of the hypotheses.

After on-site interviews with managers from 11 metal forming firms, a mail survey was created to collect data on the sourcing decisions of five production-related goods: die design, die building, die maintenance, end-part machining, and end-part surface coating. These goods were common to all firms, covered all three sourcing modes, were strategically significant, and were sourced relatively often. The 24-page survey booklet contained six sections, one for data on each good and one for overall firm information, with most items using a seven-point 'true/untrue' scale (Fowler, 1995). Four stages of pre-testing included evaluations by academic colleagues, managerial interviews which incorporated cognitive interviewing techniques (Campanelli, 1997), reviews by industry association executives, and a pilot test with managers which replicated final survey conditions (Babbie, 1990). In all, 10 survey revisions were made from its initial development through the final mailing in fall 2002. Initial lists of firms were obtained from the respective industry associations (Precision Metalforming Association and Metal Powder Industry Federation). Screening calls were made to verify address information and to identify the best respondent, typically the plant or general manager. After these calls, a viable mailing list of 453 firms, 366 in stamping and 87 in powder metal, was established. The survey packet included customized cover letters co-signed by the industry association executive and a window decal incentive. Follow-up messages were made by fax, electronic mail, and phone, reflecting a mixed mode design, with between two and six contacts per firm (Dillman, 2000).

Variable operationalization

Dependent variable: Sourcing mode choice

This variable reflects the firm's procurement choice for the good over the last year. For questions that seek to understand behavior, including a time

period is essential (Fowler, 1995). Prior work has often asked respondents to nominate goods; this can result in a selection bias because respondents tend to mention the most recent, important, or otherwise memorable decision (e.g., Bottum, 1992; Heriot and Kulkarni, 2001). By asking all firms about the same five goods, this bias is eliminated. The dependent variable was measured using one item that asked if the firm sourced this item internally, externally, or concurrently (both internally and externally; see the Appendix for the item used). For this last option, the percentage of internal production was obtained; rather than relying entirely on a respondent's ability to remember this percentage, six choices were provided. This improves accuracy by cueing the respondent's memory, pushing him or her to consider the different options and choosing the best one, thus reducing response distortion (Fowler, 1995).

For the analysis, the answer to this dependent variable item was interpreted in two ways. To test the continuum view, each of the eight options was placed in order from 0 to 100 percent produced internally and an ordered logit model was used. For the discrete view, three categories were created for goods that were made, bought, and concurrently sourced and a multinomial logit model was used. Consistent with prior work (e.g., Harrigan, 1986; Sa Vinhas, 2002), a 10 percent cutoff was used such that items that were produced internally 90 percent or more often were considered 'made,' those that were outsourced 90 percent or more often were considered 'bought,' with the rest considered concurrently sourced. While perhaps intuitively pleasing to assign the cases of 1 to 99 percent internally sourced into the concurrent sourcing category, there are several problems with this approach. First, respondents may have been hesitant to classify a good as being completely insourced or outsourced since they may have recalled those few unusual cases in which the other mode was used. Since we are interested in the typical mode of sourcing, it makes sense to ignore these odd cases and assign the overall choice to the usual mode (make or buy). Moreover, respondents may have had trouble recalling whether absolutely all requirements were produced internally or outsourced, and so chose the concurrent sourcing option with a very small (or large) percentage to compensate for their memory and appease the researcher (Fowler, 1995). A third problem is econometric because the data were not

well balanced by type of good and sourcing mode. For example, only three of the 169 cases of part coating were produced 100 percent internally and only seven of the 164 cases of die maintenance were 100 percent outsourced. This is termed a sparse cell count problem and, if left uncorrected, can bias parameter estimates in multinomial logit models (Agresti, 1996). By using the 90 percent cut-off and reclassifying a relatively small number of the observations (82 out of 805), we can have more confidence in the multinomial logit models that compare making, buying, and concurrent sourcing.

Independent variables

All of the independent variable items were measured on a seven-point Likert-type scale. Items for each variable are listed in the Appendix.

Asset specificity. This variable was operationalized as market thinness, since goods requiring highly specific assets often result in a small number of willing suppliers (Williamson, 1985). When there are few capable suppliers, switching is difficult and costly. Three items relating to this concept were adapted from prior work and included in the survey (Walker and Weber, 1984; Heide and Weiss, 1995; Poppo and Zenger, 1998).

Volume uncertainty. Volume uncertainty was measured by asking respondents about forecast inaccuracies and unpredictability in volume patterns. Two items adapted from prior work were included on the survey to measure this attribute (John and Weitz, 1988).

Technological uncertainty. This variable measures the likelihood that technological change will occur. This industry is fairly mature, so measuring the likelihood of change was more relevant than measuring its magnitude. Goods based upon mature technologies and stable processes will be less prone to this form of uncertainty as they are unlikely to change significantly in the future. The likelihood of technological change can refer to the innovation potential for either the good or the processes used in its production. Three items from prior work were adapted to measure this variable (Heide and Weiss, 1995; Bensaou and Anderson, 1999).

Performance uncertainty. While difficulties in estimating downstream performance have sometimes been operationalized in terms of complexity, this is not as relevant in this context. Dies may consist of scores of components and seemingly be quite complex, but if the die can be easily described to suppliers and accurately evaluated for quality, then downstream performance can be assured. A better operationalization for this context measures information asymmetry, such as when simple inspection techniques are not adequate to evaluate quality, when production problems occur that cannot be traced to a specific cause, and when it is difficult to compare goods from different suppliers. Five items were developed to measure this attribute, some of which were adapted from prior work (Anderson and Schmittlein, 1984; Anderson, Glenn and Sedatole, 2000; Bottum, 1992; Dutta *et al.*, 1995).

Firm and supplier scope economies. Scope economies for the firm will be independent from those of its suppliers since each has its own established product mix and resource base. Two distinct variables were created to estimate firm and supplier scope economies. Measures reflected the extent to which overall costs were reduced by producing the good along with its other products (Dutta *et al.*, 1995). Firm scope economies were measured by two items, while supplier scope economies were measured by one item.

Firm and supplier expertise. Variables were created for both firm and supplier expertise, reflecting the extent to which either has considerable skills and capabilities for producing the good and an understanding of the underlying technology. Due to different experience bases, firm and supplier expertise will be independent. Four items were used for firm expertise and five for supplier expertise; some of these items were borrowed or adapted from prior work (Walker and Weber, 1984; Noordewier, John, and Nevin, 1990) and others were original.

Controls

Firm control variables included the number of employees and firm age since these have often been related to greater internalization (Perry, 1989). A binary variable for unionization was also included, as unionized firms may be more likely to

produce internally due to contractual commitments or may be less likely to do so due to higher costs. A binary variable for firm type, powder metal or not, was included, as were dummy variables for four of the goods. Controls were also included for volume requirements and scale economies as these can affect production costs, typically toward greater outsourcing (Pindyck and Rubinfeld, 1995). A measure for similarity was included to address the potential for more custom goods being produced simultaneously with more generic ones, which is at odds with this paper's definition of concurrent sourcing but is consistent with transaction cost logic (Williamson, 1985).

Survey response

Nearly half of the firms replied (218), delivering 193 usable surveys. This equates to a 43 percent usable response rate, significantly higher than the typical rate for firm-level studies of about 20 percent (Paxson, Dillman, and Tarnai, 1995). The demographics for the respondent firms were rather unique as compared to those found in a typical organizational survey. Respondent firms were small (95% employed fewer than 500 people), non-union (86%), and fairly old (average age: 44 years). No indication of non-response bias was found when comparing respondents to non-respondents by firm type and size (Armstrong and Overton, 1977). Since the sample is based upon industry association listings that represent the overall firm populations, sample selection bias is unlikely (Tomaskovic-Devey, Leiter, and Thompson, 1994).

A key informant single-respondent approach was used for the survey. While in some cases it is preferable to have multiple survey respondents, the small size of these firms and the technical and specialized nature of the survey made it preferable to request information from one very knowledgeable respondent. The key informant approach is appropriate when one can identify respondents who, by virtue of their positions in an organization's hierarchy, are able to provide opinions and perceptions that are valid reflections of those of other key decision-makers in the firm (Li and Atuahene-Gima, 2002; Phillips, 1981). Due to the fact that these firms are relatively small, that screening calls were made to determine the most appropriate respondent, and that 95 percent of the respondents were professionals, with 53 percent being

executives, it is likely that these key informants were the most appropriate respondents.

Consistency artifacts and a common method variance bias can result from collecting dependent and independent variables from the same respondent. While this is a significant drawback of this type of survey design, efforts were made to avoid consistency artifacts by placing more subjective items (e.g., supplier expertise) before objective ones (e.g., firm size) (Salancik and Pfeffer, 1977). Common method variance was investigated by conducting the Harman one-factor test, which involves entering all the independent and dependent variable items into a factor analysis (Podsakoff and Organ 1986). A principal component factor analysis of all measurement items yielded seven factors with eigenvalue exceeding one. These factors accounted for 57 percent of the variance. The factor with the greatest eigenvalue accounted for 15 percent of the variance. Because no single factor emerged as a dominant factor accounting for most of the variance, common method variance is unlikely to be a serious problem in the data.

METHODOLOGY

In order to statistically relate the survey items to the sourcing mode decisions, two types of analysis were conducted. First, a measurement model was created to assess validity and determine item weights so a composite variable score could be computed. Then, these independent variable scores were related to the sourcing decision in two different ways. An ordered logit model was used to investigate the continuous, transaction cost-based hypotheses. This model is preferred over OLS regression, since the data are ordinal rather than interval in nature; this method better reflects the dependent variable data as they were collected as eight discrete choices (Agresti, 2002). The ordered logit model is also more appropriate for the data than a Tobit model, since the data do not necessarily reflect an underlying but censored construct, are not strictly continuous, and require some incorporation of firm effects (Kennedy, 1998). The analyses used to test the other hypotheses, which were discrete choice in nature, are multinomial logit models that relate the independent variables to the three distinct sourcing options: make, buy, and concurrently source. By comparing the exploratory

power of the ordered and multinomial logit models, we can infer whether concurrent sourcing can better be depicted as a point along a make/buy continuum or as a separate and distinct alternative.

Since multiple items were used for the variables, exploratory factor analysis (EFA) and then confirmatory factor analysis (CFA) were employed to investigate the relationships between the items and the variables (Anderson and Gerbing, 1988). The EFA results indicated that each of the variables were unidimensional and distinct. CFA submodels for each individual variable were created and then aggregated into a final, full model. All of the CFA models were estimated using full information maximum likelihood and were evaluated using six different indices (Hu and Bentler, 1998). The final model sufficiently fit the data ($\chi^2 = 1521.642$, 421 degrees of freedom, $p < 0.001$, $\chi^2/\text{d.o.f.} = 3.614$, TLI = 0.972, CFI = 0.976, RMSEA = 0.057). All parameter estimates were significant ($p < 0.02$), supporting convergent validity, and none of the covariances was significantly close to 1, supporting divergent validity (Bollen, 1989; Bagozzi, 1994). Reliability estimates for the hypothesized variables, other than supplier expertise, were all over 0.60, suggesting adequate consistency among the items (Nunnally, 1967). The loadings from this final CFA model were used as item weighting factors to construct aggregate scores for each variable (Pedazhur and Schmelkin, 1991); these scores were used in the subsequent analysis.

Since the dataset of 805 sourcing choices originates from 193 firms, each of which provided data on one to five goods, it is possible that the observations will not be independent, a clustering phenomenon common in survey research (Hosmer and Lemeshow, 2000). Due to the relatively small number of inputs vs. the larger number of firms, a fixed-effects model could not be used because of the problem of perfect prediction (Greene, 1997). However, incorporating robust standard errors adjusted for repeat observations by firm does address this problem, and this technique has been used by other scholars for similarly structured data (e.g., Mizruchi and Stearns, 2001).

RESULTS AND DISCUSSION

Descriptive statistics provide an initial indication of the nature of sourcing decisions in this setting.

Table 2. Sourcing modes: overall, by firm, and by input type

	Make	Buy	Concurrent Source	Total
<i>Overall</i>	292 36.3%	287 35.7%	226 28.0%	805
<i>By firm type</i>				
Stamping	227 36.5%	226 36.3%	169 27.2%	622
Powder metal	65 35.5%	61 33.3%	57 31.1%	183
<i>By input type</i>				
Die design	71 41.5%	38 22.2%	62 36.3%	171
Die build	43 24.9%	69 39.9%	61 35.3%	173
Die maintenance	110 67.9%	12 7.4%	40 24.7%	162
Part machining	62 47.3%	19 14.5%	50 38.2%	131
Part coating	6 3.6%	149 88.7%	13 7.7%	168

Table 2 presents the distribution of each sourcing mode in the entire dataset, by firm type, and by good sourced. All three modes are present in the data, with little difference between firm types, but considerable difference among goods. Analysis indicated a fairly even distribution of observations in the middle categories, suggesting that the data will be amenable to both ordered and unordered analysis. Table 3 provides correlations and descriptive statistics. Firm expertise and scope economies were significantly positively correlated with the percentage produced internally (0.704 and 0.514, respectively) whereas supplier expertise and supplier scope economies were significantly negatively correlated with this dependent variable (-0.494 and -0.387). This supports both the neoclassical and capabilities views that firms will be more likely to produce goods which they can produce efficiently and effectively. Supporting capabilities logic, firm and supplier expertise were significantly negatively correlated (-0.536), suggesting that firms find suppliers that have skills unlike their own.

One potential issue with the sourcing mode of concurrent sourcing is its stability. Critics may assume that this mode of sourcing is transitory, used for a time while moving between making and buying (Nickerson and Zenger, 2002). To test for this, an item measuring longevity

Table 3. Descriptive statistics and correlations^a

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Concurrent (1/0)	0.281	0.450	1														
2 Percent internal	0.519	0.438	0.057	1													
3 Asset specificity	4.070	1.266	0.028	0.042	1												
4 Volume uncertainty	3.814	1.448	0.026	0.012	0.013	1											
5 Tech uncertainty	4.464	1.232	0.049	-0.055	0.040	0.088*	1										
6 Perform uncertainty	2.949	0.928	-0.051	0.024	0.066	0.297‡	-0.017	1									
7 Scale economies	3.475	1.664	-0.011	-0.022	-0.014	0.011	-0.039	0.020	1								
8 Volume required	2.643	1.474	-0.090*	-0.034	-0.000	-0.192‡	-0.044	-0.053	-0.029	1							
9 Firm scope econ.	4.214	1.571	0.082*	0.514‡	0.032	0.042	-0.039	0.013	0.009	0.050	1						
10 Supplier scope econ.	4.703	1.361	-0.052	-0.387‡	-0.083*	-0.001	-0.008	0.066	0.054	0.001	-0.200‡	1					
11 Firm expertise	4.722	1.742	0.268‡	0.704‡	-0.026	0.001	-0.016	-0.012	-0.032	-0.037	0.544‡	-0.325‡	1				
12 Supplier expertise	3.723	1.060	-0.115†	-0.494‡	0.010	-0.032	0.056	0.063	0.039	-0.010	-0.401‡	0.396‡	-0.536‡	1			
13 Firm size	2.501	1.100	0.026	0.045	0.061	-0.093*	0.052	-0.127‡	-0.075*	0.280‡	0.042	-0.041	0.055	-0.105†	1		
14 Union (1/0)	0.140	0.347	0.042	-0.024	-0.134‡	0.064	0.037	0.058	-0.005	0.016	0.022	0.057	0.014	0.048	0.024	1	
15 Input similarity	3.509	1.804	0.025	-0.009	-0.177‡	-0.180‡	-0.180‡	0.070*	0.026	0.065	-0.041	-0.023	0.009	-0.034	-0.063	-0.051	1

^a n = 805

* p < 0.05; † p < 0.01; ‡ p < 0.001.

Table 4. Ordered logit models, with percentage produced internally as the dependent variable; Models 1 and 2 use eight categories; Models 3 and 4 use three categories^a

	Model 1	Model 2	Model 3	Model 4
Asset specificity	0.053 (0.071)	0.057 (0.071)	0.058 (0.075)	0.058 (0.075)
Volume uncertainty	-0.046 (0.056)	-0.047 (0.056)	-0.021 (0.065)	-0.022 (0.064)
Technological uncertainty	-0.059 (0.069)	-0.062 (0.070)	-0.065 (0.077)	-0.065 (0.077)
Performance uncertainty	0.198** (0.097)	0.205** (0.098)	0.178** (0.106)	0.184** (0.106)
Firm scope economies	0.326*** (0.065)	0.009 (0.168)	0.327*** (0.069)	0.090 (0.190)
Supplier scope economies	-0.263*** (0.062)	-0.573*** (0.165)	-0.370*** (0.076)	-0.601*** (0.180)
Firm × Supplier scope economies		0.070** (0.035)		0.052* (0.038)
Firm expertise	0.882*** (0.088)	0.880*** (0.313)	0.848*** (0.087)	0.931*** (0.309)
Supplier expertise	-0.132 (0.125)	-0.116 (0.454)	-0.179** (0.123)	-0.046 (0.451)
Firm expertise × Supplier expertise		-0.001 (0.081)		-0.023 (0.080)
Firm age	0.007** (0.004)	0.008** (0.004)	0.007* (0.005)	0.007* (0.005)
Firm size (employees)	0.042 (0.074)	0.040 (0.073)	0.084 (0.083)	0.085 (0.083)
Union	-0.129 (0.229)	-0.138 (0.229)	-0.031 (0.248)	-0.035 (0.247)
Powder metal	0.074 (0.212)	0.071 (0.211)	0.102 (0.232)	0.104 (0.232)
Scale economies	-0.039 (0.061)	-0.034 (0.061)	-0.030 (0.066)	-0.027 (0.066)
Volume required	-0.067* (0.051)	-0.061 (0.053)	-0.069 (0.057)	-0.066 (0.059)
Input similarity	0.005 (0.048)	0.009 (0.048)	0.041 (0.052)	0.044 (0.053)
Likelihood ratio	755.75(19)	759.62(21)	690.30(19)	691.90(21)
Pseudo R^2	0.266	0.267	0.393	0.394
Adjusted Count R^2	0.375	0.374	0.513	0.517
χ^2 (-2 log likelihood)	0.000 (Ctrl)	0.021 (Mod 1)	0.000 (Ctrl)	0.201 (Mod 3)

^a $n = 805$ for both models; parameter estimates for input controls and constants are omitted. Robust standard errors are in parentheses below the parameter estimates. All tests are one-tailed since the hypotheses are directional, with * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

was included and was compared across modes. For concurrently sourced inputs, 60 percent had always been sourced in this way, as compared to 54 percent for inputs made, a difference that is not statistically significant. Firms were also asked whether they plan to change modes; for concurrently sourced inputs, 11.9 percent plan to change, as compared to 10.3 percent for inputs made. The difference was not significant, supporting concurrent sourcing as a stable, equilibrium sourcing mode.

Model 1, presented in Table 4, depicts an ordered logit model that included all eight choices for the dependent variable.^{5,6} This model has reasonably good explanatory power, as shown by

⁵ As a robustness check, Tobit models were run to replicate the ordered logit Models 1 and 2. The substantive results relating to the hypothesized variables were identical.

⁶ In some cases, scholars include interaction terms between asset specificity and uncertainty variables (e.g., Coles and Hesterly, 1998, who studied hospital procurement decisions for 15 different services). This technique is appropriate when the goods being

its pseudo R^2 value of 0.266.⁷ Note that positive parameter estimates for the explanatory variables suggest that greater amounts of these variables lead to a higher percentage of the good produced internally. Interestingly, it shows no significance for the asset specificity variable, contrary to Hypothesis 1_{tce}. Volume uncertainty had no effect on the percentage produced internally, indicating no support for Hypothesis 2_{tce}. Goods with greater uncertainty in performance were likely to be produced internally at higher rates, supporting Hypothesis 3_{tce}. Greater firm scope economies resulted in higher percentages of internalization, while greater supplier scope economies resulted in lower percentages, following the logic of Hypothesis 4_{neo}. Greater firm expertise resulted in higher percentages of internalization, following the logic of Hypothesis 5_{cap}. The parameter estimate for technological uncertainty was not significant, which supports Hypothesis 6_{cap}. Since we expect greater technological uncertainty to result in concurrent sourcing, the coefficient for this variable will not be directly related to the percentage produced internally, and therefore an insignificant estimate is expected. To more directly test Hypotheses 4_{neo} and 5_{cap}, Model 2 incorporates interaction terms between the firm and supplier scope economies and between firm and supplier expertise. There is a positive relationship between greater combined firm and supplier scope economies with greater internalization, potentially conflicting with Hypothesis 4_{neo}. No significant results were found for the interaction of firm and supplier expertise, which is consistent with Hypothesis 5_{cap}.

The modest explanatory power plus the lack of significance for the asset specificity variable suggest that this model could be improved. Perhaps the distinctions between the eight categories are too fine and fewer categories will lead to a better model. The next two models are ordered logit models with three categories representing make,

concurrent source, and buy; concurrent sourcing is always the middle option. Model 3 has better explanatory power than Model 1 or 2, with a pseudo R^2 value of 0.393.⁸ The substantive results of Model 3 were identical to Model 1, with the exception of supplier expertise being negatively and significantly associated with the percentage produced internally, which follows the logic of Hypothesis 5_{cap}. Hypotheses 1_{tce} and 2_{tce} were not supported, while Hypothesis 3_{tce} was supported, and the logic underlying Hypotheses 4_{neo}, 5_{cap}, and 6_{cap} was supported. Model 4, which includes the interaction terms for scope economies and expertise, produced the same substantive results as Model 2, but does have greater explanatory power.

Based upon the fit statistics, the models with three categories better represent the data. However, many of the hypotheses do not require the rigid specification of ordering concurrent sourcing between making and buying. The hypotheses that relate explanatory variables toward a greater likelihood of concurrent sourcing are better tested using a multinomial logit model which compares concurrent sourcing with making and with buying. Table 5 displays Model 5, a multinomial logit model that was significant with very good explanatory power, predicting 71 percent of the sourcing mode choices correctly.⁹ The Wald combine test indicated that sourcing mode of concurrent sourcing was statistically distinct from that of make and of buy. Both the Hausman and the Small-Hsiao tests confirmed the independence of irrelevant alternatives (IIA) assumption, further supporting the distinction between the three sourcing modes. Most of the key independent variables had explanatory power; Wald tests indicated that asset specificity ($p = 0.017$), performance uncertainty ($p = 0.094$), firm scope economies ($p = 0.000$), supplier scope economies ($p = 0.000$), and

studied have widely varying levels of asset specificity (e.g., landscaping and respiratory services) and binary variables are used. In this study, all the goods have some non-trivial degree of asset specificity above the threshold where it affects uncertainty and this variable was measured continuously. Interactions were not included in the models since the effects on uncertainty variables could be interpreted directly.

⁷ Model 1 was run with only the control variables, resulting in a pseudo R^2 of 0.14, an adjusted count R^2 of 0.29, and a likelihood ratio of 392.87 (11). Likelihood ratio significance tests indicated that the model incorporating the explanatory variables was considerably better.

⁸ Model 3 was run with only the control variables, resulting in a pseudo R^2 of 0.21, an adjusted count R^2 of 0.33, and a likelihood ratio of 361.80 (11). Likelihood ratio significance tests indicated that the model incorporating the explanatory variables was considerably better.

⁹ Model 5 was run with only the control variables, resulting in a pseudo R^2 of 0.22, an adjusted count R^2 of 0.36, and a likelihood ratio of 379.03 (22). Likelihood ratio significance tests indicated that the model incorporating the explanatory variables was considerably better.

Table 5. Multinomial logit models^a

	Model 5			Model 6		
	Make vs. CS	Buy vs. CS	Make vs. Buy	Make vs. CS	Buy vs. CS	Make vs. Buy
Asset specificity	-0.089 (0.094)	-0.344*** (0.120)	0.255** (0.124)	-0.091 (0.94)	-0.349*** (0.120)	0.258** (0.122)
Volume uncertainty	-0.070 (0.083)	-0.115 (0.105)	0.045 (0.109)	-0.069 (0.083)	-0.109 (0.104)	0.041 (0.109)
Technological uncertainty	-0.113* (0.082)	-0.060 (0.131)	-0.053 (0.146)	-0.118* (0.083)	-0.069 (0.130)	-0.049 (0.145)
Performance uncertainty	0.265** (0.123)	0.017 (0.159)	0.249* (0.182)	0.267** (0.124)	-0.002 (0.161)	0.269* (0.183)
Firm scope economies	0.266*** (0.081)	-0.253** (0.111)	0.520*** (0.119)	0.259* (0.201)	0.205 (0.300)	0.055 (0.351)
Supplier scope economies	-0.265*** (0.088)	0.431*** (0.119)	-0.695*** (0.131)	-0.291* (0.219)	0.791*** (0.264)	-1.083*** (0.322)
Firm × Supplier scope				0.003 (0.043)	-0.093* (0.058)	0.096* (0.068)
Firm expertise	0.278*** (0.110)	-1.095*** (0.128)	1.373*** (0.148)	0.772** (0.370)	-1.575*** (0.527)	2.346*** (0.586)
Supplier expertise	-0.119 (0.142)	0.053 (0.171)	-0.171 (0.206)	0.682 (0.584)	-0.471 (0.615)	1.153** (0.695)
Firm expertise × Supplier expertise				-0.139* (0.099)	0.119 (0.129)	-0.259** (0.137)
Firm age	0.009** (0.005)	0.000 (0.007)	0.009 (0.008)	0.009** (0.005)	0.000 (0.007)	0.009 (0.008)
Firm size (employees)	-0.010 (0.094)	-0.218* (0.133)	0.207* (0.147)	-0.005 (0.095)	-0.229** (0.133)	0.223* (0.147)
Union	-0.357* (0.260)	-0.567* (0.390)	0.210 (0.448)	-0.379* (0.261)	-0.538* (0.393)	0.159 (0.439)
Powder metal	-0.079 (0.247)	-0.356 (0.367)	0.277 (0.409)	-0.067 (0.251)	-0.334 (0.373)	0.267 (0.417)
Scale economies	-0.023 (0.066)	0.034 (0.088)	-0.057 (0.113)	-0.023 (0.066)	0.034 (0.089)	-0.057 (0.114)
Volume required	0.064 (0.064)	0.248*** (0.099)	-0.184** (0.105)	0.056 (0.065)	0.257*** (0.100)	-0.201** (0.105)
Input similarity	-0.059 (0.059)	-0.193** (0.086)	0.134* (0.092)	-0.056 (0.058)	-0.193** (0.087)	0.137* (0.093)
Likelihood ratio		733.68(38)			738.70(42)	
Pseudo R^2		0.417			0.420	
Adjusted Count R^2		0.550			0.556	
χ^2 (-2 log likelihood)		0.000 (vs. controls)			0.040 (vs. Model 5)	

^a CS, concurrent source; $n = 805$ for both models. A positive coefficient indicates that the first choice is more likely than the second. Parameter estimates for input controls and constants are omitted. Robust standard errors are in parentheses below the parameter estimates. All tests are one-tailed since the hypotheses are directional, with * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

firm expertise ($p = 0.000$) coefficients were significant for the overall model.¹⁰

¹⁰ The Wald tests indicate that variables associated with both production and transaction costs were significant in determining the sourcing mode. As an exploratory exercise, Model 5 was run with controls and only production cost variables (firm and supplier scope, firm and supplier expertise) and again with controls and only transaction cost variables (asset specificity, volume uncertainty, performance uncertainty, and technological uncertainty). Likelihood ratio tests indicated that these exploratory

Model 5 computes the likelihood of each of the three modes vs. the others: it compares concurrent sourcing vs. making, concurrent sourcing vs. buying, and making vs. buying. Hypothesis 1_{tee} is supported since firms would be more likely to concurrently source rather than buy goods with greater asset specificity; they also would be more

models were inferior to Model 5. This supports the importance of both production and transaction costs in the sourcing decision.

likely to make vs. buy, which supports the usual TCE prediction. Neither Hypothesis 2_{tce} nor 2_{neo} is supported, since volume uncertainty does not appear to affect the sourcing choice. Hypothesis 3_{neo} is not supported, as greater performance uncertainty will motivate firms to choose making over concurrent sourcing and making over buying; this finding does support Hypothesis 3_{tce}. The logic of Hypothesis 4_{neo} is supported, since greater firm scope economies will lead to making over concurrent sourcing, concurrent sourcing over buying, and making over buying, with similar results found for supplier scope economies. Likewise, the logic of Hypothesis 5_{cap} is supported, since greater firm expertise was associated with making over concurrent sourcing, concurrent sourcing over buying, and making over buying; supplier expertise was not significant but was signed appropriately. Hypothesis 6_{cap} is moderately supported since concurrent sourcing is more likely than solely making, although not necessarily favored over solely buying.

Model 6, also shown in Table 5, was created to test Hypotheses 4_{neo} and 5_{cap} directly by including interaction terms for the scope economy and expertise variables. Greater scope economies for both the firm and the supplier led to concurrent sourcing over buying, supporting Hypothesis 4_{neo}. Likewise, greater expertise for both the firm and the supplier led to concurrent sourcing over making, supporting Hypothesis 5_{cap}. Interaction terms are difficult to interpret, especially in nonlinear models. To verify that the expertise and scope economy interactions were indeed significant, the model was converted into a dichotomous model (concurrent source or not) and the algorithm of Norton, Wang, and Ai was used. This program

computes the correct marginal effect of a change in two interacted variables by calculating the cross-derivative. It provides both tabular and graphical output, which can be interpreted to determine the true interaction effect since this is conditional upon the value of the variables (Norton, Wang, and Ai, 2004). These findings supported the significance of both of these interaction variables toward concurrent sourcing; they also supported Hypothesis 6_{cap}. While the multinomial logit model suggested partial support for this technological uncertainty hypothesis (concurrent sourcing over making but not concurrent sourcing over buying), the dichotomous model indicated that concurrent sourcing was more likely for goods high in technological uncertainty.

An overriding question that these empirical analyses can address is whether or not sourcing choices lie on a continuum. If a continuum exists, then the ordered logit model should fit better than the multinomial logit model, which does not restrict concurrent sourcing always to be the middle choice. Comparing Model 3 and Model 5 through goodness of fit and nested model tests indicated a violation of the parallel regression assumption and that the ordering constraint was too severe; thus the multinomial logit was the better model (Long and Freese, 2001). The explanatory power of Model 5 was also superior. A graphical depiction of Model 5, shown in Figure 1, also assists in answering this question as it presents the marginal effect of the variables on each of the three options: make, buy, and concurrently source. If the marginal effects are small, then the options will be very close together, suggesting that the variable does not affect the choice between them. The greater the effect, the farther the option will be from zero, as indicated

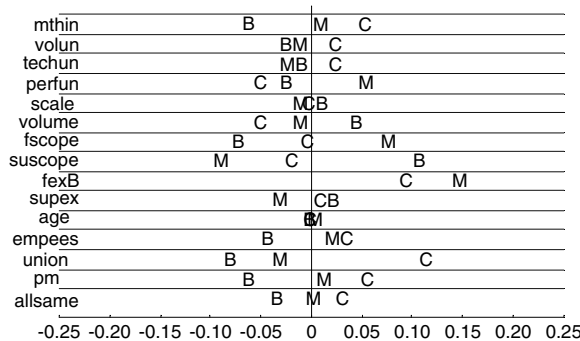


Figure 1. Marginal probabilities for making (M), buying (B), and concurrent sourcing (C) per standard deviation change in each independent variable (based on Model 5)

by the y -axis. The figure indicates that concurrent sourcing is sometimes the middle choice, such as with firm expertise, while other times it is not, such as with technological uncertainty. It appears that some variables may indeed act continuously, with concurrent sourcing associated with an intermediate level of the attribute, while others do not.

Concurrent sourcing appears to be a distinct choice over making or buying, rather than a linear combination of the two sourcing modes. Perhaps concurrent sourcing is chosen first, with the secondary decision being the extent of internal production. As an exploratory exercise, models were created to relate the percentage of internal production for only the concurrently sourced goods with the variables used in the other models. These models are not displayed owing to relatively poor explanatory power (pseudo $R^2 = 0.093$), but some interesting results did occur. Asset specificity did not affect the percentage made. While performance uncertainty was positively and directly related to internalization, the other uncertainty variables were not significant. Firm scope economies were related to the percentage produced internally, while the scope interaction was not. Firm and supplier expertise affected this percentage, but the interaction did not. These findings suggest that the percentage produced internally could be affected by different variables from those that influence the initial decision to source internally, externally, or concurrently.

Several control variables also deserve mentioning. Unionized firms were more likely to concurrently source; it may be difficult for them to completely outsource due to contractual commitments or they desire outside suppliers as a benchmark. Higher-volume goods were less likely to be concurrently sourced and more likely to be outsourced, following economies of scale logic. More homogeneous goods were also more likely to be concurrently sourced, perhaps because this facilitates the comparison between internal and external offerings. This contradicts the TCE assumption of heterogeneity among concurrently sourced goods (i.e., more customized goods produced internally and more generic ones outsourced).

In summary, all three theories assisted in explaining the sourcing choice. TCE logic was supported as firms were less likely to buy when markets were thin and more likely to make if performance uncertainty was great. The neoclassical economics prediction of greater firm and

supplier scope economies leading to concurrent sourcing was confirmed. The capabilities view was supported as greater combined firm and supplier expertise led to concurrent sourcing, as did greater technological uncertainty that may motivate firms to search for knowledge both internally and externally. Moreover, support was shown for a discrete choice between making, buying, and concurrent sourcing over a continuum view. This suggests that firms that concurrently source may only need to buy or make a minor percentage of their requirements and still get the governance benefits of both market and hierarchy.

CONCLUSION AND IMPLICATIONS

This study assists in clarifying the confusion surrounding firm boundaries and hybrid governance modes through investigating why firms would concurrently source, simultaneously making and buying. By incorporating transaction cost, neoclassical economics, and capabilities theories, a holistic view of why firms would use this sourcing mode is presented, revealing aspects of each theory motivating the sourcing choice. Finding that all three theories contribute to the choice of sourcing mode illustrates the firm's desire to simultaneously monitor suppliers, produce efficiently, and improve processes.

In addition to understanding why firms concurrently source, this study addressed the question of whether concurrent sourcing was a midpoint along the make/buy continuum or whether it was a discrete and distinct choice. The superiority of the multinomial over the ordered logit models and the findings summarized in Figure 1 support the discrete choice perspective. This suggests that firms benefit from the concurrent use of the two governance modes of market and hierarchy, not the extent of one or the other. This supports concurrent sourcing as a plural governance mode (Bradach and Eccles, 1989).

By separating plural modes from other types of governance modes, we can better understand hybrid modes. Some modes do use two mechanisms simultaneously and thus are considered plural, such as dual distribution channels in which firms simultaneously use inside salespeople and outside representatives, and franchising in which a franchisor simultaneously operates some units and enlists franchisees to run others. Other modes,

like technical alliances or supply chain networks, may be better thought of as intermediate modes which are market-based at their core, but have some overlay of relational or coordinative elements (Hodgson, 2002; Dyer, 1997). Still other modes, like joint ventures or internal transfer markets, may be primarily firm-based, but have some mechanism to invoke higher powered incentives (Walker and Poppo, 1991). In this way, we can follow Foss's advice, proposing that we 'keep the traditional firm-market distinction but supplement it with a more refined taxonomy of the many different coordination mechanisms that may be implemented inside the traditional governance structures' (Foss, 2002: 5). In doing this, we may also wish to adapt Harrigan's dimensions of vertical integration, distinguishing between ownership, vertical vs. horizontal relationships, the number of firms involved, and the number of modes simultaneously employed in describing hybrid modes (Harrigan, 1984).

In addition to clarifying hybrid governance modes, another contribution of this study is a better understanding of how some factors may motivate a firm toward one mode of organizing but not necessarily away from another. For example, thin markets motivated firms not to buy, preferring to make or concurrently source over this option, while performance uncertainties motivated firms to make rather than to concurrently source or to buy. By looking at the comparisons between the three sourcing modes separately, we can untangle the effects pushing the firm away from outsourcing vs. pulling it toward internalization and then begin to create theoretical frameworks to support these effects and choices. These findings echo other scholars who have found differing influences on the costs of organizing internally vs. externally (Poppo and Zenger, 1998). They also help in explaining the potential existence of thresholds over which one form of organizing may be preferred, as suggested by Park and Russo, 'to argue that governance structures and their hazards lie on a continuum, running from market-like to fully internal exchange, may be to overstate the case . . . once an exchange is moved away from a fully internal operation, a major transactional threshold has been breached' (Park and Russo, 1996: 888).

Some limitations to this study involve its context and research method. It may be that these findings are unique to small manufacturing firms and fairly

low levels of technological change; thus it would be informative to investigate concurrent sourcing among larger firms in more volatile environments. This study did not include buyer/supplier alliances or other more complicated forms of organizing; it would be interesting to understand how concurrent sourcing fits into these relationships. The types of goods studied, those directly related to the production process, could be more likely to be concurrently sourced than other goods. This study used a cross-sectional survey method; although items were included to investigate the evolution and potential change in sourcing mode choices, it does provide a one-time snapshot of sourcing decisions. Single respondents were used for both the dependent and independent variables, which may have led to some common respondent bias. Ideally, a separate source, perhaps archival, would have been used for one set of the variables. Although not possible in metal forming, in other industry settings, such as government contracting, this may be feasible and would be a fruitful extension. Moreover, the only respondents in this survey were from the sourcing firms, and therefore the replies regarding supplier-related characteristics such as supplier expertise may not be as accurate as those from a dyadic survey that directly obtains information from both the firm and its suppliers. While preferable, this was not feasible in this context due to the difficulty in locating suppliers; in metal forming, suppliers for these production-related inputs are quite small, often just a handful of people operating in a garage.

The findings from this study generate several practical implications for managers. When considering their sourcing options, they should include concurrent sourcing along with solely making or solely buying. If faced with thin markets and few alternative suppliers, they may want to consider producing internally to increase competition. In times of technological change, concurrent sourcing may offer increased learning by combining internal and external knowledge streams. For goods that are difficult to describe or evaluate, internal production may be the best option, while goods that are required in high volumes may be best outsourced. For unionized firms, concurrent sourcing may provide an attractive option, since the internal production unit can be benchmarked against outside suppliers who may be more attuned to market conditions. Concurrent sourcing can also

be a way to employ underutilized equipment or personnel for both firms and their suppliers. If both the firm and its suppliers do have sufficient expertise and/or overlap with other products, concurrent sourcing can be beneficial, particularly if the inputs are homogeneous. The choice of both making and buying may be more important than the precise percentage produced internally, so managers may be able to allow this percentage to fluctuate without losing the benefits of this sourcing mode. However, caution should be taken when interpreting the results of this study in terms of cost minimization. The advice above holds in the theoretical case, such that firms making decisions consistent with the aforementioned predictions should enjoy lower sourcing costs; in actuality, however, difficulty in implementation, such as selecting suppliers or managing logistics, can offset some of the potential savings.

Many extensions of this research could build on its findings. This research supports David and Han's (2004) observation that TCE does not adequately predict between hybrid and hierarchical modes, but that multiple theories should be used. One key question that scholars could examine using TCE logic along with other theories is the determinants of the mix of internal vs. external sourcing as a second-order decision. Firms may select a percentage to produce internally as a decision variable, analogous to franchisors that may first determine to use franchising and then select the proportion of outlets to operate internally (Lafontaine and Shaw, 2005). The findings of this franchising work, prior research in dual distribution (Sa Vinhas, 2002), and the current study suggest there could be different antecedents to the decisions of sourcing mode choice vs. percentage of internal production. The data in this paper left much of the variation in the percentage produced internally unexplained and this percentage was evenly distributed, suggesting no clear optimal percentage.

One could also investigate the performance implications of choosing concurrent sourcing. All of the organizational economics theories used in this paper assume that firms typically select the most efficient sourcing mode. If governance form matters, then we would expect misaligned sourcing transactions to have negative performance implications. But since performance is multidimensional,

including price, delivery, quality, and other criteria, a sourcing mode superior in all of these areas may not exist. Furthermore, firm-specific attributes such as unionization appear to be important in the sourcing decision. The ability to manage suppliers could be investigated as firms likely have varied skills in this area, as suggested by the relational contracting literature (e.g., Dyer, 1997), but scarce research has been conducted to empirically tie these skills to measures, sourcing mode choice, and performance results. Leiblein, Reuer, and Dalsace (2002) have used multistage models to link the make-or-buy decision to subsequent performance, but extending this to incorporate three sourcing modes would be econometrically challenging as the standard Heckman correction could not be used, particularly if the performance variable was not continuous. Cassiman and Veugelers (2006) employed several different models for innovation performance and compared the differences in the coefficients on the sourcing dummy variables, but they were investigating the sourcing of just one activity (research and development). Gulati, Lawrence, and Puranam (2005) used a switching regression to connect sourcing modes (make, buy, or ally) with performance, but since their data originated from two firms it is not clear whether this method can be applied when many more firms and different types of goods are involved.

In conclusion, two contributions emanate from this research. First, firm boundaries are best investigated using a multi-theoretic approach, as aspects of the environment, firms, and the good all affect the sourcing choice. Even small, relatively simple firms in this mature industry used at least three options, suggesting that firm boundary choices for large, multinational firms in rapidly changing industries will be considerably more complex. We can deepen our understanding of 'make-or-buy' decisions by also considering the concurrent sourcing choice. Second, this choice does not appear to be a simple weighted average along a make/buy continuum, but rather a distinct choice with unique advantages and disadvantages, chosen by firms when conditions warrant. Other scholars have shown that diverse types of supply arrangements within and between inputs can be complementary. This paper goes a step further and posits that internal and external sourcing can be synergistic when used concurrently, clarifying this simple hybrid mode of organizing.

ACKNOWLEDGEMENTS

I appreciate financial support from the Institute for Supply Management, the American Production and Inventory Control Society, the University of Michigan Business School, and the Lundquist College of Business of the University of Oregon. Intellectual guidance and support from Associate Editor Will Mitchell, Joanne Oxley, Allan Afuah, Rich Gonzalez, and Francine Lafontaine are also gratefully acknowledged. Valuable feedback from Mike Russo and Alan Meyer greatly improved this paper. Thanks as well to the seminar participants at the University of Michigan, CCC, the Strategic Management Society, the INFORMS/Organization Science Winter Conference, and the Academy of Management for their comments and suggestions. I am also grateful for the feedback from the two anonymous *SMJ* reviewers.

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APPENDIX: SURVEY ITEMS

Dependent variable

1. For the past fiscal year, which best describes how you source progressive stamping dies?

- All done internally (either within your plant or from a division with which your firm shares a common corporate parent)
- All purchased from external suppliers
- Both done internally and purchased from external suppliers

(i) If you marked this response, what % of your requirements did you produce internally (please mark one)?

- 0–10% 26–49% 75–90%
- 11–25% 50–74% Over 90%

Don't use this input

Independent variables

Each item included a response scale of 1 to 7, indicating totally true to totally untrue. Items were edited to reflect each different good (e.g., 'dies' was replaced with 'surface coating'). This resulted in five similar four-page sections, one section for each good. (Items adapted from prior work are designated by citations; other items are original.)

Asset specificity

1. The skills needed to create dies are generic and widely available (reversed).
2. Numerous capable die suppliers exist in the market (Walker and Weber, 1984; reversed).
3. Switching die suppliers would be quick and easy to do (Poppo and Zenger, 1998; reversed).

Volume uncertainty

1. Our forecasts for dies are very accurate (Anderson and Weitz, 1986; reversed).
2. There are predictable patterns to our requirements (Anderson and Weitz, 1986; reversed).

Technological uncertainty

1. The processes and skills required to create dies are mature and unlikely to change in the future (Heide and Weiss, 1995; reversed).
2. Major die innovations are very likely within the next few years (Bensaou and Anderson, 1999).
3. Major innovations in how dies are produced are very likely within the next few years (Bensaou and Anderson, 1999).

Performance uncertainty

1. We can easily describe dies to our suppliers through printed/electronic descriptions and/or drawings (reversed).
2. Through a simple inspection, we can predict how well the die will function in our downstream production processes (Bottum, 1992; reversed).
3. We use several forms of inspection and several different metrics to evaluate die quality (Anderson *et al.*, 2000).
4. When there is a problem with a die, we usually can determine its cause (reversed).

5. It is difficult to equitably measure one supplier's die vs. another supplier's (Anderson and Schmittlein, 1984).

Firm scope economies

1. By making our own dies, we do/could reduce our overall production costs of other products.
2. We do/could better utilize our labor and equipment by making dies in addition to our other products.

Supplier scope economies

1. By making dies for us, our suppliers can reduce their overall production costs since they can make better use of their labor and equipment.

Firm expertise

1. Our manufacturing staff can/could easily produce dies.

2. Making dies requires a deep expertise that our firm understands (Walker and Weber, 1984).
3. We have internally produced dies for years.
4. The skills used to make dies are closely related to those that we use to make other similar products.

Supplier expertise

1. The leading die suppliers have proprietary knowledge that gives them an advantage over other firms (Walker and Weber, 1984).
2. We rely on our suppliers to help us keep up with die technology (Stump and Heide, 1996).
3. There is very little difference between the process we would use to make dies and that used by a supplier (reversed).
4. As compared to suppliers, our internal production of dies is/would be higher in price (Anderson, 1985; reversed).
5. As compared to our suppliers, our internal production of dies is/would be lower in quality (Anderson, 1985; reversed).