

The Horizontal Scope of the Firm: Organizational Tradeoffs versus Buyer-Supplier Relationships

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November 14, 2006

Abstract

Horizontal scope – the set of products and services offered – is an important dimension of firm strategy and a potentially significant source of competitive advantage. On the one hand, the ability to build close buyer-supplier relationships over multiple transactions can give an advantage to broad firms that offer buyers “one-stop-shopping.” On the other hand, the existence of organizational tradeoffs can give an advantage to firms that specialize in a narrower range of products or services. We develop a biform game that incorporates this tension and show how the use of three generic scope strategies – specialist, generalist and hybrid – depends on organizational tradeoffs, client-specific scope economies, barriers to entry, heterogeneity in buyer task requirements and the bargaining power of suppliers relative to buyers. We then use the model to study a variety of issues in supply chain management including the gains to coordinating suppliers, the optimal level of buyer power, and the desirability of subsidizing suppliers.

One of our objectives is to show how biform games, which introduce unstructured negotiations into game theoretic analysis, can be used to develop applied theory relevant to strategy. Generalizing from our stylized model, we identify a class of biform games involving buyers and suppliers that are useful for strategy analysis. Games in this class have the attractive property that each supplier’s share of industry total surplus is the product of its added value and its relative bargaining power.

Key words: added value, biform games, client-specific scope economies, generalists vs. specialists, supply chain management

*Both authors at INSEAD. We would like to thank Ron Adner, Bruce Kogut, Glenn MacDonald, Michael Ryall, Miklos Sarvary, Gus Stuart, Pai-Ling Yin and participants at the ACAC, AOM and SMS conferences and the Séminaire d’Economie Industrielle in Paris for their helpful comments, as well as the Editors and two anonymous reviewers. We also thank INSEAD’s R&D Committee for its research funding.

1. Introduction

In business-to-business markets, one observes a range of horizontal scope strategies. Some firms pursue a “one-stop-shop” strategy and expand their scope of activities to encompass a broad set of products or services. Other firms take a different tack and specialize in a limited array of products, striving to be recognized as the best supplier of a particular type of service. At least two opposing forces are at play in such scope decisions. On the one hand, there are benefits of focus due to organizational tradeoffs. Porter (1996) argues that such organizational tradeoffs require firms to specialize if they are to achieve competitive advantage (see also Siggelkow, 2002). On the other hand, offering a broad set of services allows a supplier to do more business with a particular buyer and hence develop a deeper relationship. Strong ties with buyers provide many possible benefits such as improved cooperation and better sharing of information (Dyer and Singh, 1998; Uzzi, 1999). That is, strong ties may create *client-specific* scope economies that favor broad scope strategies.

Hence, there is a fundamental tension in many markets between specializing to reap the benefits of focus and being more of a generalist to reap the benefits of deeper relationships (Siggelkow, 2003). The environments that are conducive to specialist and generalist organizational forms is an important theme in organizational theory coming out of the population ecology literature (Hannan and Freeman, 1977; Carroll, 1985).

In contrast to the management and organizational literatures discussed above, formal work on horizontal scope has emphasized scope economies in production. In their classic work on the topic, Panzar and Willig (1981) define scope economies as occurring when it is less costly to produce two or more product lines in one firm than to spread the production across specialized firms. The idea that scope economies might arise from interactions with specific buyers is missing from this theory.¹ Prior work on the effect of such supply-side scope economies on firm specialization finds that the number of products places an upper bound on the set of scope strategies (MacDonald and Slivinski, 1987; Eaton and Lemche, 1991). Thus, with two products in a market, there can be at most two scope strategies.

We develop a formal model of scope decisions which is closer to the management and organization theory literatures. We assume that there are organizational tradeoffs that create diseconomies of scope in production. However, we also allow for benefits from building stronger buyer-supplier relationships by offering a broad product range. That is, we allow for client-

¹The formal literature on shopping costs (e.g., Klemperer and Padilla, 1997) addresses a form of client-specific scope economies. However, the focus is quite different from ours: there are no organizational tradeoffs, no distinction between generalists and specialists, and the focus is on social welfare.

specific scope economies. We study how the use of different scope strategies varies with industry structure: When do industries support the use of generalist strategies? When do they support specialists? When do both generalists and specialists coexist? We consider classic elements of industry structure such as barriers to entry and bargaining power, as well as more novel elements such as the size of client-specific scope economies, the extent of organizational trade-offs and the extent to which buyers have heterogeneous task requirements.

Our paper is one of the first to employ the formalism of biform games (Brandenburger and Stuart, 2007) for the formal study of strategy. In a biform game there is an initial stage where players make decisions that affect their ability to create value when working with other players. This stage is analyzed using the standard non-cooperative game theory common in, for example, the modern industrial organization literature. In a second stage, cooperative game theory is used to characterize the outcome of bargaining among the players over how to split the total surplus. A biform game is well suited to problems such as ours where suppliers make initial entry and organizational design decisions and then negotiate with buyers over the fees to be paid on a task by task basis.² The use of cooperative game theory in strategy has been advocated by Brandenburger and Stuart (1996) and Lippman and Rumelt (2003); MacDonald and Ryall (2004) are the first to explicitly develop formal foundations of strategy using cooperative game theory.

1.1. Discussion of the Phenomenon

One often observes a mix of scope strategies in a given industry. For instance, in investment banking, Lazard’s business is mostly M&A advice while Morgan Stanley offers a comprehensive range of services. In the enterprise software industry, Oracle built its success on database management while IBM has had an integrative approach of offering “solutions” to its customers. Some law firms position themselves as generalists while others position themselves as “boutiques” focused on a single area of law. In between these extremes are hybrid strategies. For example, some London law firms with a leading reputation in a very specific field, such as real estate or intellectual property, complement it with a secondary capability in corporate law (see “Bird & Bird Restructures for Corporate Assault,” *Legal Business*, March 2005 issue).

The nature and extent of organizational trade-offs vary across industries. In his classic work on professional service firms, Maister (1993) argues that different service projects are best executed by different types of organizations. For example, complex corporate strategy projects

²See de Fontenay and Gans (2005) for the use of cooperative game theory to study issues of vertical scope.

are best executed by “grey hair” consulting firms such as McKinsey, while IT implementation projects are best executed by “procedural” consulting firms such as Accenture. More generally, firms with a broader scope are often reported to suffer from agency costs (Jensen, 1986) and influence activities (Milgrom, 1988).

We study buyers that seek to outsource two tasks. These tasks could be anything from designing and supplying different types of components, as in the automotive industry, to the delivery of different professional services such as M&A advice and bond placements. We assume that the tasks are not too different so that they can feasibly be offered by the same organization (e.g. both tasks involve financial services or legal advice). We make the simplifying assumption that firms are not capacity constrained. In the case of professional service firms, this would hold if they could hire to staff projects after winning the business. Similarly, this would hold for an automotive supplier that can build capacity after winning a contract to supply a component.

We assume that there may be a benefit from using a single supplier for both tasks. Such client-specific scope economies arise from the more frequent interactions between the buyer and supplier. For example, supplier learning about the buyer from one task could lower costs or improve quality on the other task. The benefit could also arise from improved coordination across the tasks when they are done by the same supplier, which is an argument made, for instance, in the enterprise software market.³

2. An Extended Analytic Example

We introduce our formal treatment of scope strategies with an extended analytic example. Consider a situation where there is a single buyer and three available suppliers. We index the supplying firms by $i = 1, 2, 3$ and refer to the buyer as firm b . The buyer has two tasks, labeled A and B , that it cannot do itself. The buyer negotiates simultaneously with the suppliers to determine the supplier or suppliers to which to outsource the tasks and under what terms. All the firms seek to maximize their share of the surplus created by outsourcing the tasks.

The surplus created by giving a task to a particular supplier is the difference between the buyer’s willingness-to-pay (WTP) for using that supplier and the supplier’s cost of executing the task. All suppliers have a cost of 60 for executing one task and 120 for executing two tasks. The suppliers differ in their competencies in executing each task, which leads to differences in

³See “Enterprise Suites: Makers of ERP, CRM, and Related Software Grapple with a Maturing Market”, *CFO* vol. 19 (15) 2003.

buyer WTP, as given in Table 2.1.

Supplier	Task A	Task B
1	160	120
2	120	160
3	150	150

Table 2.1: How buyer WTP varies across suppliers and tasks

Thus, supplier 1 generates a surplus of $160 - 60 = 100$ when doing task *A* and a surplus of $120 - 60 = 60$ when doing task *B*. In this example, one can think of supplier 1 as a specialist in task *A*, supplier 2 as a specialist in task *B* and supplier 3 as a generalist.

We follow Brandenburger and Stuart (1996, 2007) in using cooperative game theory to analyze the negotiations among the firms. Brandenburger and Stuart (1996) point out that a firm's added value places an upper bound on its payoff from the negotiations. A firm's added value is the surplus that is lost if the firm were to be removed from the negotiations. It requires that one calculates the maximum surplus with all firms and then subtracts the surplus without the focal firm.

With all firms, the surplus is 200, which comes from giving task *A* to supplier 1, task *B* to supplier 2 and no task to supplier 3. The surplus without the buyer is 0 and hence the buyer's added value is 200. The surplus without supplier 1 is 190, which comes from using supplier 3 for task *A* and supplier 2 for task *B*. Hence, the added value of supplier 1 is 10. Similarly, the added value of supplier 2 is also 10. Supplier 3 has no added value as surplus is still 200 if it leaves the negotiations.

Although intuitively appealing, added value is only an upper bound on what a firm can negotiate. Notice that the sum of the added values in the example is 220, which is greater than the total surplus generated. A standard approach in cooperative game theory is to solve for the core. The core satisfies two properties: the maximum surplus is divided up among the firms and no subset of firms can increase its share of surplus by withdrawing and just transacting amongst themselves. Two drawbacks of the core are that it can be empty and that it often yields a range of possible payoffs.

Not having a unique payoff is a problem if one wants to study strategy decisions prior to the negotiations. Brandenburger and Stuart (2007) suggest the following. Solve for the full set of core allocations, which yields a minimum and a maximum allocation for each player. Assume that players expect to get a convex combination of these bounds. That is, firm *i*'s expected surplus from the negotiations is $\alpha_i \pi_i^{\max} + (1 - \alpha_i) \pi_i^{\min}$ where $\alpha_i \in [0, 1]$ is the weighting, $\pi_i^{\max}$ is firm *i*'s maximum core allocation and $\pi_i^{\min}$ is its minimum core allocation. Brandenburger and

Stuart (2007) refer to the α_i as confidence indices that reflect a player's subjective assessment of its bargaining skill.

In this example, we assume that $\alpha_i = 1/2$ for all firms. The set of possible core allocations for each firm and their expected share of surplus is given in Table 2.2.

Firm	$\pi_i^{\min}$	$\pi_i^{\max}$	Surplus
1	0	10	5
2	0	10	5
3	0	0	0
<i>b</i>	180	200	190

Table 2.2: Characterization of bargaining outcomes: the minimum and maximum core allocation for each player with surplus as the mid point

Note that competition among the suppliers drives most of the surplus to the buyer since supplier 3 is a close substitute for the other suppliers. A convenient property of our example is that a supplier's expected share of the surplus is proportional to its added value. That is, with $\pi_i^{\min} = 0$ and $\pi_i^{\max}$ equal to the added value (AV_i), a supplier's expected surplus is just $\alpha_i AV_i$. This is not necessarily the case for biform games in general.⁴

We now consider initial entry decisions by the suppliers. Suppose that there is a fixed cost of $F = 3$ required to serve the buyer that must be incurred prior to the negotiations. While supplier 1 and 2 expect to cover this fixed cost, supplier 3 does not. Hence, all firms entering cannot be a Nash equilibrium of the biform game. What happens if only supplier 1 and 2 enter? Table 2.3 gives the new bargaining outcomes.

Firm	$\pi_i^{\min}$	$\pi_i^{\max}$	Surplus
1	0	40	20
2	0	40	20
<i>b</i>	120	200	160

Table 2.3: Characterization of bargaining outcomes when firm 3 does not enter

The elimination of competition from supplier 3, which was the next best alternative for both tasks, has significantly raised the added value of the remaining suppliers, to the detriment of the buyer's ability to capture surplus.

We now introduce client-specific scope economies to the example. Specifically, suppose that some extra surplus is created when the same supplier does both tasks.⁵ Denote this

⁴The focus on surplus in a biform game shifts attention away from prices. However, the price that a supplier expects to get is just the sum of the supplier's cost and its expected share of the surplus. Thus, with a surplus of 5 and a cost of 60, supplier 1 is expecting a price of 65 for doing task *A*.

⁵The increase in surplus could arise either because there are cost efficiencies so that the cost of providing both tasks is less than 120, or because task execution is improved, generating a higher WTP.

extra surplus by $R > 0$. Thus, using supplier 3 for both tasks now generates a surplus of $(150 - 60) + (150 - 60) + R = 180 + R$. For $R > 20$ this will be greater than the surplus from using the two specialists, which still results in surplus of 200. Not surprisingly, client-specific scope economies favor a generalist strategy.

What is the effect on the buyer of such client-specific scope economies? With $R > 20$, the added value of the specialists will be 0 and hence they cannot expect a share of the surplus. Suppose that anticipating this, the firms do not enter. The bargaining outcomes are given by Table 2.4.

Firm	$\pi_i^{\min}$	$\pi_i^{\max}$	Surplus
3	0	$180 + R$	$90 + R/2$
b	0	$180 + R$	$90 + R/2$

Table 2.4: Characterization of bargaining outcomes when firm 1 and 2 do not enter and there are scope economies of R

The buyer can actually be worse off now that it has a strong relationship with the generalist! Unless $R > 140$, the reduction in competition leaves the buyer with a smaller share of the pie and this more than offsets the fact that the pie is now bigger. Notice that with this configuration of firms, increases in R make both the buyer and supplier 3 better off.

What happens if $0 < R < 20$? Then, surplus is maximized by splitting the tasks between supplier 1 and supplier 2, which leaves supplier 3 without added value. If supplier 3 does not enter, bargaining outcomes are given by Table 2.5.

Firm	$\pi_i^{\min}$	$\pi_i^{\max}$	Surplus
1	0	$40 - R$	$20 - R/2$
2	0	$40 - R$	$20 - R/2$
b	$120 + 2R$	200	$160 + R$

Table 2.5: Characterization of bargaining outcomes when firm 3 does not enter and there are scope economies of R

Within this scenario, R is bad for suppliers. The added value of each supplier is constrained by the buyer's threat to source both tasks from the other supplier. The greater is the benefit R from shifting to sole sourcing, the greater the leverage the buyer gets from this threat. Hence, the negative effect of R for the suppliers and the positive effect for the buyer. Thus, the possibility of building strong relationships can matter even when such close ties are not actually observed. Suppose that the buyer can take prior actions to develop its "relational capabilities" and thereby increase R . How do its incentives to do so depend on its supplier base? Comparing the buyer's surplus in Table 2.4 with Table 2.5, the incentive is greater when

it expects to face the two specialists than when it actually has a strong relationship with the generalist.⁶

The example suggests that the interaction between client-specific scope economies and the use of different scope strategies can have a significant impact on the performance of buyers and suppliers. The rest of the paper seeks to flesh out the theory.

The example had the convenient property that each supplier's expected surplus in the biform game is proportional to its added value. Section 3 identifies a general class of biform games involving buyers and suppliers where this property holds. It also addresses whether the α_i can be interpreted as reflecting the bargaining power of suppliers relative to buyers.

In Section 4, we move from the example to a more general model of scope decisions with client-specific scope economies. In the example, the surplus generated by each supplier is exogenously given. In the full model, we let suppliers choose an organizational design that determines the surplus they create for different tasks. In the example, there is only one buyer and this buyer needs both types of task. In the full model, we allow for multiple buyers, some of whom may only need one type of task. Despite these generalizations, we note that the model remains highly stylized.

3. Added Value as the Objective in a Biform Game

When Brandenburger and Stuart (1996) first proposed cooperative game theory as a tool for strategy research, they highlighted the intuitively appealing concept of added value. Unfortunately, in general settings, added value is only an upper bound on a firm's payoff. It is not necessarily true that a firm's payoff depends in a simple way on its added value (MacDonald and Ryall, 2004). This can potentially make a biform analysis quite complicated: while identifying a firm's added value is relatively straightforward and easy to interpret, characterizing the core for an arbitrary set of payoffs can be quite complex and is not always intuitive.⁷ In this section, we identify a class of cooperative games involving buyers and suppliers where supplier payoffs are proportional to their added value.⁸

We start with a general cooperative game, which is defined by a set of N players and a characteristic function v . We think of this cooperative game as being the result of initial

⁶That is, with supplier 1 and 2, the buyer appropriates the full value of an increase in R , while with supplier 3 it appropriates only $R/2$.

⁷For concrete applications, Gans et al. (2005) advocate the use of linear optimization techniques implemented using spreadsheets to solve for the core as part of a strategy analysis. Because this requires specific numerical values, it is less useful for developing applied theory.

⁸We thank an anonymous reviewer for pushing us to develop these more general results.

non-cooperative firm strategies. The function v maps any group of players into the surplus they can create. Thus, $v(N)$ gives the total surplus that can be created by all the players. We make the usual restrictions that $v(\emptyset) = 0$ and that v is superadditive so that adding another player to a group does not decrease the available surplus.

We use the standard definitions of added value and of the core, as follows. We denote the added value of any individual k to any subset G as $AV_k(G) = v(G) - v(G \setminus k)$. An allocation x that specifies an allocation of surplus of x_k to all players $k \in N$ is in the core if and only if

$$\sum_{k \in N} x_k = v(N), \quad (\text{C1})$$

$$\sum_{k \in G} x_k \geq v(G) \text{ for all } G \subset N. \quad (\text{C2})$$

Condition (C1) assures efficiency: the maximum surplus is distributed amongst the players. Condition (C2) assures participation: no subgroup can increase their total payments by breaking away and transacting amongst themselves. It is possible that the core is empty; that is for some N and v there may be no x satisfying (C1) and (C2).

For our first result, we make two assumptions on v . The first is that the set of players can be divided into two subsets, which we label buyers and suppliers, and that at least one buyer and one supplier are required for the creation of surplus. Unlike the example in Section 2, we allow for multiple buyers.

(A1) The set of players N can be split into two non-empty, disjoint sets S and B , such that $v(S) = 0$ and $v(B) = 0$.

The second assumption is that the ability of suppliers to create surplus with a given buyer is independent of the surplus created with other buyers.

(A2) $v(N) = \sum_{j \in B} v(\{j\} \cup S)$.

Unlike (A1), (A2) has bite. For example, it rules out capacity constraints such that serving one buyer would preclude serving another buyer. On the demand side, it rules out network externalities such that a buyer's WTP for a supplier is increasing in the number of buyers using that supplier.

It is useful to define the following added values for any $i \in S$ and $j \in B$: $AV_i = AV_i(N)$, $AV_{ij} = AV_i(\{j\} \cup S)$ and $AV_j = AV_j(N)$. Note that (A2) implies that $AV_i = \sum_{j \in B} AV_{ij}$, which says that supplier i 's added value can be decomposed into its added value for each buyer. We have the following result, which was originally shown by Stuart (2004, Lemma 1).

Proposition 3.1. *Suppose v satisfies (A1) and (A2). (i) There always exist core allocations*

x satisfying (C1) and (C2). (ii) For any supplier $i \in S$, x_i is part of a core allocation if and only if $x_i \in [0, AV_i]$.

Proof All proofs are contained in an online appendix available at ———.

Although restrictive, there is considerable benefit from imposing assumptions (A1) and (A2). Existence of the core is assured. Moreover, in a biform game, a supplier's expected share of the surplus is $\alpha_i AV_i$, the product of the supplier's added value and its confidence index. Such a simple payoff structure facilitates the introduction of greater complexity in stage I of the biform game. (In our case, we are able to endogenize both the set of suppliers and their organizational designs.)

Given our focus on interactions among buyers and suppliers, it would be useful if we could interpret the confidence indices as the bargaining power of suppliers relative to buyers. Can we do this under (A1) and (A2)? Unfortunately, the answer is no, as illustrated in the following example.

Consider again suppliers 1,2 and 3 and buyer b from Section 2. Let the increase in surplus from using a sole supplier be $R = 10$. Suppose that the three suppliers all have $\alpha_i = \alpha$, which we want to interpret as their bargaining power relative to the buyer. It then makes sense to have $\alpha_b = 1 - \alpha$. Table 3.1 shows how surplus is divided under these assumptions.

Firm	$\pi_i^{\min}$	$\pi_i^{\max}$	Surplus
1	0	10	10α
2	0	10	10α
3	0	0	0
b	190	200	$200 - 10\alpha$

Table 3.1: Characterization of bargaining outcomes with all firms, $R = 10$ and $\alpha_i = 1 - \alpha_b = \alpha$

Notice that players expectations are not consistent: They sum to $200 + 10\alpha$, while the total surplus is only 200. As discussed in Brandenburger and Stuart (2007), consistency is not assured in a biform game. In our context, it means that one cannot interpret α as an objectively determined parameter of relative bargaining power, otherwise the buyer's payoff would be the remaining surplus after paying out what the suppliers negotiate.

The problem is that the lower bound on the buyer's core allocation ($\pi_i^{\min}$) is determined by the threat to drop *both* supplier 1 and supplier 2 and to use only supplier 3. This sort of threat is not reflected in the marginal contributions that are the basis for an added value analysis. The key feature of this example is the complementarity between supplier 1 and supplier 2: each has a higher added value when the other is in the negotiations. Without supplier 1, supplier 2

has no added value because then surplus is maximized by using only supplier 3. The following assumption rules out such complementarities by assuming that the added value of a supplier does not increase when the buyer is given access to additional suppliers:⁹

(A3) If $s' \subset s \subseteq S$, then $AV_i(\{j, s\}) \leq AV_i(\{j, s'\})$ for all $i \in s'$ and $j \in B$.

By adding this assumption, we have that the lower bound of the buyer's surplus is given by the difference of the buyer's added value and the added value of each supplier.

Proposition 3.2. *Suppose that (A1)–(A3) hold. For $j \in B$, x_j is part of a core allocation if and only if $x_j \in [AV_j - \sum_{i \in S} AV_{ij}, AV_j]$.*

We can now interpret the confidence indices as a parameterization of relative bargaining power! Consider first what happens if we follow Porter (1980) and assume that bargaining power is an element of industry structure. That is, bargaining power is $\alpha_i = \alpha$ for all suppliers and $\alpha_j = (1 - \alpha)$ for all buyers. Under (A1)–(A3), this leads to a highly tractable and well behaved biform game.

Corollary 3.3. *Consider a v that satisfies (A1)–(A3) which is part of a biform game where $\alpha_i = \alpha$ for all $i \in S$ and $\alpha_j = (1 - \alpha)$ for all $j \in B$. (i) The expected payoffs associated with v are*

$$\begin{aligned}\Pi_i &= \alpha AV_i, \\ \Pi_j &= AV_j - \alpha \sum_{i \in S} AV_{ij}.\end{aligned}$$

(ii) *The allocation $x_i = \Pi_i$ and $x_j = \Pi_j$ lies in the core.*

Now suppose bargaining power varies across firms.¹⁰ Then, a firm's expected surplus should depend on whether it creates surplus with strong or weak negotiators. However, such considerations are not captured by a player's confidence index because it is a constant independent of N and v , at least in the treatment of Brandenburger and Stuart (2007). In contrast, under (A1)–(A3), it is straightforward to allow for bargaining outcomes that vary with the identity of the pair of firms that are bargaining.

Corollary 3.4. *Suppose v that satisfies (A1)–(A3). For any set of $\alpha_{ij} \in [0, 1]$ for $i \in S$ and*

⁹Note that this complementarity concerns added value only and hence it can arise even when the production technology is additive, as in the example.

¹⁰For example, Wal-Mart is reportedly an especially effective negotiator.

$j \in B$, the allocation

$$\begin{aligned} x_i &= \Pi_i = \sum_{j \in B} \alpha_{ij} AV_{ij}, \\ x_j &= \Pi_j = AV_j - \sum_{i \in S} \alpha_{ij} AV_{ij}, \end{aligned}$$

is in the core.

For example, suppose that each firm has a power index of $p_k > 0$ that reflects its bargaining capabilities. Under (A1)–(A3), one could assume that the bargaining outcome involving any buyer-supplier pair depends on each firm’s power index as follows

$$\alpha_{ij} = \frac{p_i}{p_i + p_j} \text{ for all } i \in S \text{ and } j \in B.$$

We conclude that biform models with v ’s that satisfy (A1)–(A2) are particularly tractable vehicles for studying supplier strategies in stage I. The objective of suppliers is simply to maximize their added value. Biform games that satisfy (A3) as well allow for interpreting confidence indices as the bargaining power of suppliers relative to buyers. It should be kept in mind that all this tractability does not come for free. In particular, assumptions (A2) and (A3) are restrictive.

4. A Biform Model of Horizontal Scope

We consider a biform game of the following form. In the first stage, potential entrants decide whether to become suppliers, and those that do, choose an organizational design. In the second stage, suppliers and buyers negotiate terms for the outsourcing of two tasks.

4.1. Stage I: Entry and Organizational Design

There are at least three potential suppliers which can each incur a fixed setup cost of $F > 0$ to enter the market. F can be interpreted as a measure of the barriers to entry into the industry. Let $m \geq 0$ be the number of suppliers that choose to enter and index these suppliers by $i = 1, \dots, m$. Let $S = \{1, \dots, m\}$ be the set of suppliers.¹¹

With entry, each supplier also selects an organizational design D_i in the interval $[0, 1]$. The organizational design determines the effectiveness with which the supplier does each of two

¹¹In equilibrium, at most 3 suppliers will enter.

tasks, labelled A and B . We denote the surplus created by a supplier with organizational design D_i in task A by $V_A(D_i)$ and the surplus created in task B by $V_B(D_i)$. We assume that surplus is given by the following concave functions of the organizational design:

$$\begin{aligned} V_A(D_i) &= 1 - TD_i^2, \\ V_B(D_i) &= 1 - T(1 - D_i)^2. \end{aligned}$$

Then task A is best done by an organizational design of $D_i = 0$ and task B is best done by an organizational design of $D_i = 1$. The parameter T gives the importance of organizational tradeoffs: the greater the organizational tradeoffs, the more the surplus falls as a supplier's organization diverges from the optimal design for a given task. We assume that $0 < T < 1$ so that suppliers always have positive surplus for both tasks. In particular $V_A(1) = V_B(0) = 1 - T > 0$ and even a supplier that is focused on one type of task still creates some surplus when doing the other task.¹²

In stage I, the potential suppliers simultaneously make entry and organizational design decisions. This stage is played non-cooperatively and we solve for the pure-strategy Nash equilibria (PSNE) where payoffs are given by the expected outcome of the stage II negotiations. In Section 8.2, we extend the analysis to consider sequential entry by potential suppliers, in which case we solve for subgame perfect equilibria (SPE).

4.2. Stage II: Negotiations with Buyers

In the second stage, the suppliers negotiate with n buyers that are each outsourcing two tasks. We assume that a proportion p of the buyers are outsourcing one A task and one B task. We refer to these as type AB buyers. In addition, there are type AA buyers that are outsourcing two A tasks and type BB buyers that are outsourcing two B tasks. We make the simplifying assumption that there are an equal number of AA and BB buyers, with the proportion of each given by $(1 - p)/2$.¹³

We introduce client-specific economies of scope in the following manner. If a buyer uses the same supplier to perform both of its tasks, there is an extra surplus of $R \geq 0$ that is created by the stronger relationship. We assume that the confidence indices of the suppliers are $\alpha \in (0, 1)$ and that those of the buyers are $1 - \alpha$. The setup cost F is assumed sunk prior

¹²The assumption of a quadratic loss function is for convenience. What is required for the results is that the functions V_A and V_B are concave in D_i .

¹³One can also interpret the model as applying to a single buyer with stochastic task requirements, as we do in Section 8.

to the negotiations and hence, it does not effect the negotiations.

The paper proceeds as follows. Section 5 considers whether the model satisfies (A1)–(A3). Section 6 contains a typology of generic scope strategies and identifies the set of possible equilibria. Section 7 identifies the key drivers of supplier scope. Section 8 extends the analysis to address supply chain management. Section 9 concludes.

5. Model Properties

We now consider whether our model satisfies assumptions (A1)–(A3).¹⁴ By construction, players in our model are divided into two subsets and at least one member of each subset is required for the creation of surplus. Hence (A1) is satisfied.

To determine whether (A2) holds, we now derive the characteristic function v for our model. We start with the surplus created for each buyer type. Denote by $v_j(s)$ the surplus created by a set $s \subseteq S$ of suppliers and a buyer of type $j \in \{AA, BB, AB\}$. For a buyer with two A tasks we have that surplus is maximized by giving both tasks to the supplier with the organizational design closest to $D = 0$, which results in a surplus of

$$v_{AA}(s) = 2 - 2T \min_{i \in s} (D_i)^2 + R.$$

For a buyer with two B tasks we have that surplus is maximized by giving both tasks to the supplier with the organizational design closest to $D = 1$, which results in surplus of

$$v_{BB}(s) = 2 - 2T \min_{i \in s} (1 - D_i)^2 + R.$$

For a buyer with one A and one B task, surplus is maximized either by splitting the tasks between the two suppliers best suited to each and foregoing the benefit R , or choosing a single supplier who is best able to handle both. Denote by $v_{AB}^1(s)$ the surplus when using only one supplier and $v_{AB}^2(s)$ the surplus when using two suppliers. We have

$$\begin{aligned} v_{AB}^1(s) &= 2 + R - T \min_{i \in s} ((D_i)^2 + (1 - D_i)^2), \\ v_{AB}^2(s) &= 2 - T \min_{i \in s} (D_i)^2 - T \min_{i \in s} (1 - D_i)^2. \end{aligned}$$

¹⁴Brandenburger and Stuart (forthcoming) identify an alternative class of biform games with nice properties. However, our model satisfies neither their Adding Up nor their No Coordination conditions.

Surplus is then given by

$$v_{AB}(s) = \max\{v_{AB}^1(s), v_{AB}^2(s)\}.$$

The function v is then the sum of the surpluses created for each buyer. For the full set of players N , we have that v multiplies the surpluses $v_{AA}(S)$, $v_{BB}(S)$ and $v_{AB}(S)$ by the number of buyers of each type:

$$v(N) = npv_{AB}(S) + n\frac{1-p}{2}(v_{AA}(S) + v_{BB}(S)).$$

By construction, our model satisfies the independence property (A2). Hence, Proposition 3.1 applies and suppliers make their stage I entry and organizational design decisions so as to maximize

$$\Pi_i = \begin{cases} \alpha AV_i - F & \text{if entry,} \\ 0 & \text{otherwise.} \end{cases}$$

The example analyzed in Section 2 and Section 3 is a special case of our model with $D_1 = 0$, $D_2 = 1$, $D_3 = 1/2$, $n = 1$, $p = 1$ and $T = .4$ (except that we have scaled up the V_A and V_B functions by a factor of 100). Hence, we know from the counter example in Section 3 that assumption (A3) can be violated for at least some stage I outcomes. This occurs when competition from a generalist supplier makes two specialists complementary. We now show that such violations of (A3) are very limited.

Lemma 5.1. *In our model, assumption (A3) is violated only when there is at least one supplier with zero added value.*

Violations of (A3) require the entry of suppliers with intermediate organizational designs who do not have any added value. Given our assumption that there are fixed costs of entry, these subgames cannot be reached in equilibrium. Thus, when writing equilibrium payoffs, we can apply Proposition 3.2, which yields the following payoff for buyers

$$\Pi_j = v_j(S) - \alpha \sum_{i \in S} AV_{ij} \text{ for } j \in \{AA, BB, AB\}.$$

Moreover, we can interpret α as the bargaining power of suppliers relative to buyers.¹⁵

¹⁵When extending the analysis to consider initial actions by a buyer, one needs to be careful when buyer strategies lead to subgames in which suppliers have zero added value (e.g. buyers subsidizing suppliers). However, this does not occur in the analyses presented in this paper.

6. Organizational Design and Generic Scope Strategies

A supplier's organizational design and scope should fit with its environment. Our model incorporates two key elements of the firm's environment: buyers and competitors. We start our analysis by looking at how the buyer landscape limits the set of optimal organizational designs.

Looking ahead to the negotiations, a supplier should seek to maximize its added value across all buyer types that it expects to serve. Suppose supplier i expects to only serve the buyers of type AA . Its added value is

$$\begin{aligned} AV_i &= n \frac{1-p}{2} (v_{AA}(S) - v_{AA}(S \setminus i)) \\ &= n(1-p)T(\min_{k \in S \setminus i} (D_k)^2 - \min_{k \in S} (D_k)^2), \end{aligned}$$

which is maximized for the organizational design $D_i = 0$. Intuitively, if a supplier is only doing one type of task it should select the organizational design that maximizes its surplus for that task. Analogously, if a supplier only expects to serve the type BB buyers, its optimal organizational design is $D_i = 1$. Thus, specialization in the scope of output leads to specialization in organizational design.

Suppose that supplier i expects to serve all buyer types. Then its expected added value is

$$AV_i = n(2 + R - T(D_i)^2 - T(1 - D_i)^2) - v(S \setminus i).$$

Since there are no externalities, the surplus without supplier i in the game, $v(S \setminus i)$, does not depend on supplier i 's organizational design. Thus, the first order condition of AV_i with respect to D_i is

$$-2TD_i + 2T(1 - D_i) = 0$$

and the optimal organizational design when serving all buyer types is $D_i = 1/2$. The supplier selects a generalist organizational design that combines elements from the two types of specialists.¹⁶

There is one final possibility, namely the tasks of a buyer of type AB are done by a single supplier and the same supplier serves either the AA or BB buyer types. Start with the case of a supplier that expects to serve AA types in addition to AB types. Intuitively, the supplier

¹⁶The optimality of an intermediate design is due to the concavity of the surplus functions V_A and V_B , with the generalist design falling precisely in the middle because of the equal number of AA and BB type buyers.

cares about its capability of doing both types of task but it places greater weight on efficiency in the A task. Formally, the supplier's added value is

$$\begin{aligned} AV_i = & n \frac{1-p}{2} (2 + R - 2T(D_i)^2) - v_{AA}(S \setminus i) + \\ & np(2 + R - T(D_i)^2 - T(1 - D_i)^2 - v_{AB}(S \setminus i)). \end{aligned}$$

Solving the first order condition yields the following expression for the optimal design

$$D_i = D_H \equiv \frac{p}{1+p}.$$

The optimal organizational design in this case, which we denote by D_H and which satisfies $D_H \in (0, 1/2)$, depends on the extent to which there are buyers with heterogenous task requirements as given by the parameter p . Specifically, as p increases there are more buyers that want both tasks and the optimal organizational design moves from 0 up to $1/2$.

The final possible organizational design occurs when a supplier expects to be the sole supplier for buyers of type AB and BB . The optimal organizational design in this case is $D_i = 1 - D_H$, which involves skewing the organizational design towards the B task.

The requirement that organizational designs fit the demand environment (the set of buyer types and whether or not they are splitting their tasks among suppliers) restricts the set of optimal organizational designs in our model to five. Formally,

Lemma 6.1. *Any supplier i that has positive added value optimally uses one of the following organizational designs: 0, D_H , $1/2$, $1 - D_H$ and 1.*

The Lemma gives rise to a natural typology of generic scope strategies employed by suppliers:

Definition A supplier is a **specialist** if it does only one type of task and has an extreme organizational design. An **A-specialist** has $D = 0$ and a **B-specialist** has $D = 1$.

Definition A supplier is a **generalist** if it does both A and B tasks and has equal capability in each, $D = 1/2$.

Definition A supplier is a **hybrid** if it does both A and B tasks, but does more of one task than the other and is more capable in that task with $D \in \{D_H, 1 - D_H\}$.

For specialists and generalists, the organizational design is fixed. For hybrids, it varies with p : the greater the proportion of buyers with heterogenous task requirements (higher p) the less specialized is the organizational design.

Organizational design and scope strategies need to fit not only the structure of buyer demand, but also the strategies of competitors in the environment. There are two dimensions of competition in our model: the number of suppliers that decide to enter and their organizational designs. The demand-side and supply-side drivers come together in the equilibrium entry and design decisions. We find five possible equilibrium strategy configurations. These equilibria vary in the number of suppliers that enter and in the extent of specialization among them.

Proposition 6.2. *The set of possible equilibria are as follows:*

NE: No supplier enters the market.

G: There is a single generalist supplier.

SS: There is one A-specialist supplier and one B-specialist supplier.

SH: There is a specialist supplier and a hybrid supplier.

GSS: There is a generalist, an A-specialist and a B-specialist.

In the case of a specialist and a hybrid supplier coexisting, there is either a hybrid supplier at $D = D_H$ facing an B-specialist or a hybrid supplier at $D = 1 - D_H$ facing an A-specialist.

The intuition for Proposition 6.2 comes from the fundamental requirement that a supplier needs to have sufficient added value to cover its setup costs. As only one supplier can have added value for a given buyer type, there can be at most three suppliers that enter, with fewer entrants also being possible.

Suppose that only one supplier enters. Since $T < 1$, the organizational tradeoffs are low enough to allow the supplier to serve all buyer types. Then, by Lemma 6.1, $D = 1/2$ is the optimal organizational design, and we have the *G* equilibrium with a single generalist.

Suppose two suppliers enter. There are two possibilities. If the task *AB* is split between them, then the suppliers each specialize in a different task, which leads to the *SS* equilibrium with two specialists. Alternatively, one supplier could undertake both tasks for buyers of type *AB* in addition to serving one of the other types (*AA* or *BB*), in which case the hybrid organizational design is optimal while the other supplier becomes a specialist, the *SH* equilibrium.

Suppose there are three suppliers. Each takes the optimal organizational design that is appropriate for the buyer type it serves (i.e., 0, 1 or 1/2) and we have the *GSS* equilibrium.

Our theory accommodates a range of possible outcomes, including just specialists, just a generalist, the coexistence of the two, and the coexistence of a hybrid and a specialist. This range contrasts with what occurs in prior models of competition in the presence of scope economies. With symmetric demand and two products, MacDonald and Slivinski (1987) have

only two outcomes: either there are just generalist suppliers or there are just specialists. Which outcome occurs depends on the relative efficiency of the specialist versus the generalist technology. With asymmetric demand (i.e. greater demand for one of the two products), they can get a third outcome in the case where the generalist technology is more efficient: some specialists enter to partially supply the product that is in greater demand. Thus, they have only two types of scope strategy and at most two types of suppliers coexist in a given market.¹⁷

Although our model varies from the free entry and perfect competition model of MacDonald and Slivinski (1987) on several dimensions, a key driver of the richer strategy space is the existence of client-specific scope economies in our model. Intuitively, although there are only two discrete products A and B , joint consumption by buyers means that there are three product bundles (i.e. AA , AB and BB). This enriches the landscape to allow for the coexistence of more types of suppliers as well as creating the possibility for the additional hybrid scope strategy.¹⁸

7. Drivers of Scope Strategy

We now consider how industry structure – the extent of organizational tradeoffs, client-specific scope economies, the heterogeneity of buyer task requirements, the extent of setup costs, and the relative power of buyers and suppliers – impacts the extent of supplier specialization. Formally, this involves characterizing the effect of various parameters on the existence of the different equilibria.

A parameter of particular interest is R , the impact of client-specific scope economies. Setup costs are another fundamental driver of firm scope as they are an important determinant of the extent of specialization that the market can support (Stigler, 1951). Entry depends on setup costs relative to the surplus suppliers can extract from the set of buyers. Thus, what matters for equilibrium existence is $F/(n\alpha)$, setup costs relative to market size and bargaining power. Figures 7.1 and 7.2 show how equilibrium existence varies with R and $F/(n\alpha)$ for the parameter values $T = 1/2$ and $p = 1/3$.

We now characterize the effect of $F/(n\alpha)$ on industry equilibrium. These effects depend on whether R exceeds a critical value $R_S = \frac{T}{1+p}$ (see Figure 7.2).

¹⁷Eaton and Lemche (1991) study a more general model, but reach the same general conclusion that the number of products places an upper bound on number of types of firms that can coexist.

¹⁸If one relaxes the assumption that there is an equal number of AA and BB buyers, there would be an even richer set of possible organizational designs. In particular, a generalist that serves the whole market would no longer perform an equal number of A and B tasks. Hence, its optimal organizational design would be different from a generalist that is just serving AB buyers. In addition, one would no longer have that the hybrid designs had the form D_H and $1 - D_H$.

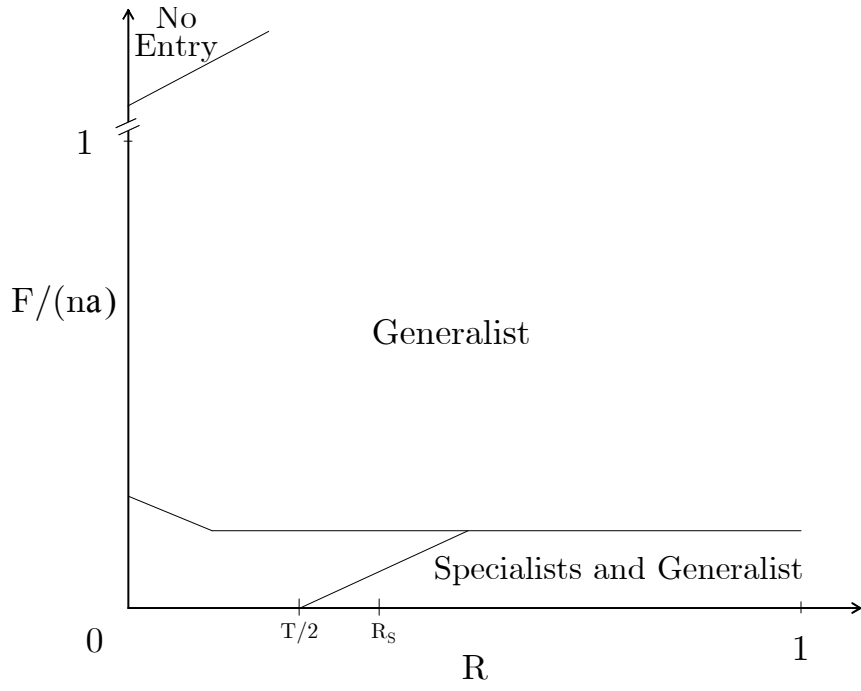


Figure 7.1: Regions of equilibrium existence for the no entry, generalist, and specialists plus generalist equilibria when $T = 1/2$ and $p = 1/3$.

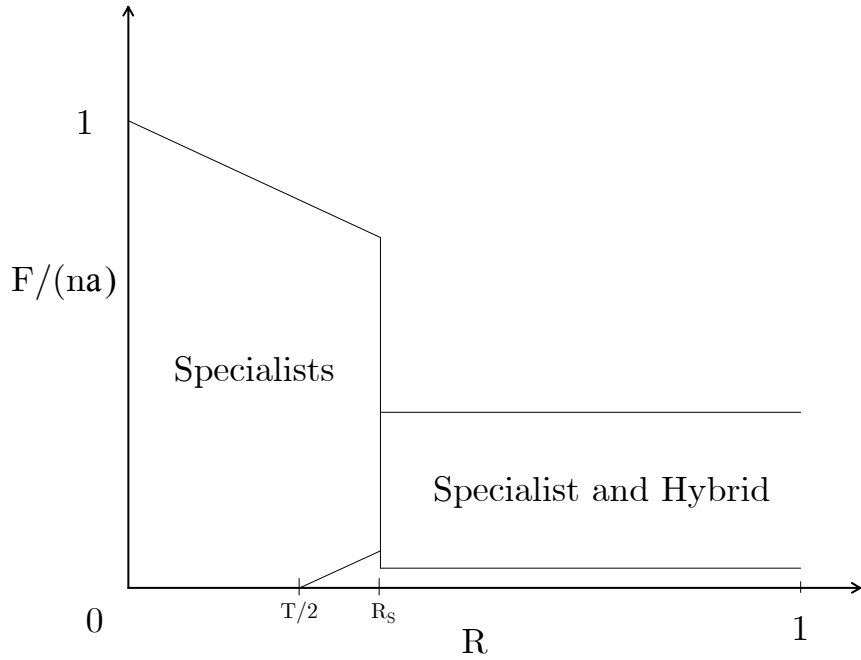


Figure 7.2: Regions of equilibrium existence for the specialists and specialist plus hybrid equilibria when $T = 1/2$ and $p = 1/3$.

Proposition 7.1. *Consider the sequence of equilibria as $F/(n\alpha)$ falls from an arbitrarily high value down to zero. (i) For $R < R_S$, one gets the following sequence of equilibria: NE , G , SS , and finally GSS , with the GSS equilibrium only occurring for R sufficiently close to R_S . (ii) For $R > R_S$, one gets the following sequence of equilibria: NE , G , SH , and finally GSS , with the SH equilibrium being a necessary part of the sequence only for values of R sufficiently closer to R_S .*

Proposition 7.1 illustrates how the theory can elucidate the ways in which shifts in the environment can force suppliers to change their scope strategies. Suppose, as in the proposition, that setup costs are falling over time from an initial level at which no supplier enters. The market is always pioneered by a generalist. For low levels of R (specifically, $R < R_S$), the pioneer eventually needs to specialize because the generalist position is not sustainable: the generalist will get outcompeted by specialists if it does not occupy one of those positions itself. For high values of R , a generalist strategy is viable even when setup costs become low because the market supports suppliers targeting each buyer type and the generalist strategy is optimal for buyers that need both A and B tasks. However, even in this case, the pioneer may still be pressured to adapt its scope over time either because the specialist strategy is more profitable (which will be the case for low p) or because the market supports a specialist and a hybrid strategy for intermediate levels of setup costs.

We delve deeper into issues raised by Proposition 7.1 in the following section on supply chain management. The importance of F and α makes them potentially valuable levers for large buyers to manage their suppliers. Section 8.4 considers the optimal supplier subsidies given by a large buyer. Section 8.5 considers optimal levels of buyer power. The possibility of multiplicity in the set of equilibria is the focus of Section 8.2, which addresses supply chain coordination.

We turn now to comparative statics results on equilibrium existence. Consider the impact of R on the existence of the equilibrium with two specialists as illustrated in Figure 7.2. Starting from $R = 0$, increases in R lower the upper bound and raise the lower bound on the set of $F/(n\alpha)$ for which the SS equilibrium exists until the threshold R_S beyond which the equilibrium ceases to exist. Thus, there is a negative association between R and the existence of this equilibrium in the figure. When such a negative association holds for all T and p we will say that an equilibrium is decreasing in R . To formalize this and to generalize to parameters other than R , let $\mathcal{F}_x(z)$ be the set of setup costs such that an equilibrium exists when the parameter x takes on the value z .

Definition An equilibrium is **increasing** in parameter x if, for any $z_1 < z_2$, $\mathcal{F}_x(z_1) \subseteq \mathcal{F}_x(z_2)$ for any possible values of the other parameters. An equilibrium is **decreasing** in parameter x if for any $z_1 < z_2$ we have that $\mathcal{F}_x(z_2) \subseteq \mathcal{F}_x(z_1)$ for any possible values of the other parameters.

Proposition 7.2. *The effect of the parameters R , T and p on equilibrium existence is as follows*

Equilibrium	Relationships (R)	Trade-offs (T)	Heterogeneity (p)
G	increasing	decreasing	increasing
SS	decreasing	increasing	decreasing
SH	increasing	.	.
GSS	increasing	.	.
NE	decreasing	increasing	.

For the extreme cases of a market served by just specialists or just a generalist, we get unambiguous and intuitive results. The more important are relationships in a market, the harder it is to sustain an outcome with just specialists and the easier it is to sustain outcomes with a generalist. Conversely, the greater are organizational tradeoffs and the fewer the proportion of buyers with heterogeneous task requirements, the easier it is to sustain an outcome with just specialists and the harder it is to sustain an outcome with just a generalist. As developed in the proof, these results mask considerable complexity in the effects of the parameters on the different equilibrium boundaries illustrated in Figure 7.1 and Figure 7.2.¹⁹

8. Supply Chain Management

Sometimes industry supply chains are dominated by large buyers that actively seek to manage their supplier base. In this section, we extend both the analysis and the modeling to address a variety of topics in supply chain management. We can adapt our model to treat the case of a single large buyer as follows. Take $n = 1$ and suppose that the buyer's type is revealed after stage I decisions. We can then interpret the parameter p as the probability that the buyer has two tasks of type AB . The remaining probability $1 - p$ is split equally between the outcomes AA and BB . Suppliers then maximize their *expected* added value in stage I.

¹⁹The lack of clear comparative statics for the GSS and SH equilibria arises because these equilibria require the coexistence of specialized firms with those pursuing less specialized strategies.

8.1. Background on Supply Chain Management

We now review various practices associated with supply chain management in order to identify relevant questions for analysis. Prominent examples of large firms that actively manage their supply chains include General Motors and Toyota in automobiles, Ikea in home furnishings and Dell in PCs.

One of the most important roles of powerful players in a supply chain is to assure coordination throughout the chain. Much of this coordination involves the efficient execution of logistics across the supply chain and is outside the scope of our model. However, coordination can go well beyond logistics, to include the broad design of the supplier network including influencing the scope strategies of suppliers (Fawcett and Magnan, 2004). In terms of our model, this raises the question of whether a large buyer can benefit from coordinating the entry and organizational design decisions of its suppliers. One can then ask whether such coordination is detrimental to total supply chain profitability, echoing the criticisms of some large firms. See, for example, the *Business Week* cover story “Is Wal-Mart Too Powerful?” (October 6, 2003). We address these question in Section 8.2 on the coordination of suppliers.

There are a variety of investments that buyers can make such as developing IT systems, altering incentive systems and cultivating the appropriate mindsets which are said to increase the benefits from close buyer-supplier relationships (Fawcett and Magnan, 2004). Some firms, such as Dell and Toyota, are known for having configured their organizations so as to get higher benefits from close supplier relationships than their competitors. Moreover, managerial articles encourage companies to make differential investments across types of transactions.²⁰ Section 8.3 considers the incentives of buyers to increase the benefits from close buyer-supplier relationships.

Buyers such as Ikea are known to facilitate entry by suppliers by providing them with assistance that reduces their setup costs (see, for example, “Ikea Weaves Benefits in Vietnam,” *Wall Street Journal*, 19 September, 2003). Such assistance can involve a variety of services from the transfer of production know-how to outright financing. Section 8.4 explores whether such subsidies are desirable in the context of our model.

Some companies such as Wal-Mart are stronger negotiators than others. Ignacio Lopez became famous as head of purchasing at General Motors thanks to his ability to bargain hard with suppliers. Firms have some influence over their bargaining power. Volkswagen hired

²⁰Fawcett and Magnan (2004) state that “[t]he ability to define relationship intensity is a vital managerial skill. Astute supply chain managers realize that not all relationships are created equal – nor should they be” (p. 72). For a discussion of supplier segmentation in the automotive industry see Dyer et al. (1998).

Lopez from General Motors and Wal-Mart earned its reputation as a fierce negotiator through a variety of policies such as meeting suppliers in Spartan offices and calling them collect (Ghemawat et al., 2003). Section 8.5 considers the optimal level of buyer power, including interactions with client-specific scope economies.

8.2. Coordination of Suppliers

How is the coordination of suppliers important in our model? Superimposing the equilibrium existence regions in Figure 7.1 on those in Figure 7.2 reveals the potential importance of coordination in our model: for some parameter values there are multiple equilibrium outcomes. Multiplicity arises because of the need for suppliers to coordinate their entry and organizational design decisions. Otherwise, they may not have sufficient added value to cover their setup costs. When there is multiplicity, a powerful buyer can benefit from coordinating its suppliers on the equilibrium that is most favorable to its own interests. We start by characterizing the extent of this multiplicity. We then consider whether or not coordination by buyers raises total industry profits and whether competitive jockeying among suppliers in a sequential move game leads to the same outcome.

Proposition 8.1. *(i) There exist parameter values such that each of the five possible equilibria in Proposition 6.2 is unique. (ii) Except for the boundaries between equilibria, at most two equilibria exist for a given set of parameter values and the following equilibrium pairs can coexist: G with SS , G with SH , SH with GSS .*

Much of the multiplicity in the model – that involving G with either SS or SH – arises because a generalist, positioned as it is in the middle of the market, does not easily coexist with other suppliers. In contrast, a specialist can more easily coexist with another specialist or a hybrid because greater distance between competitors allows for more added value. Similarly, multiplicity in the case of SH and GSS arises when the presence of a hybrid serving two buyer types deters entry by a generalist and a specialist targeting those same buyers.

Consider a buyer which can influence the strategies of its suppliers. What are its preferences over the different equilibria? We limit the analysis to multiplicity involving G as one of the equilibria.

Proposition 8.2. *Suppose the G equilibrium coexists with either SS or SH . The profits of the buyer are higher when two suppliers enter than when there is a single generalist supplier.*

A large buyer facing a single generalist supplier unambiguously benefits by encouraging greater supplier specialization in order to make room for an additional supplier to enter. The benefit is greater competition, which lowers the added value of each supplier and allows the buyer to capture more surplus. Does such coordination by the buyer increase the combined profits of the buyer and the suppliers?

Proposition 8.3. *Suppose the G equilibrium coexists with either SS or SH . There is no strict ordering of total supply chain profitability among the available equilibria.*

Together, Proposition 8.2 and Proposition 8.3 show that there is no guarantee that the private interest of the buyer coincides with the interest of the supply chain taken as a whole.²¹ To see why, consider the factors affecting the overall efficiency of the supply chain. First, more suppliers allows for greater specialization and surplus is enhanced for a buyer with homogenous demands of AA or BB . On the other hand, a buyer with heterogeneous task requirements of AB may lose the relational benefits because there is no generalist. Finally, the additional supplier doubles the setup costs. While the first two concerns impact the buyer, the extra setup costs are entirely borne by the suppliers. This, and the greater surplus capture that comes from competition among suppliers, leads buyers to be strongly biased towards increased competition.

So far we have explored one mechanism for selecting among multiple equilibria, namely allowing the buyer to make its preferred equilibrium focal. Another mechanism would be for competitive jockeying among the suppliers to determine the outcome. A simple way to incorporate competitive jockeying into the model is to allow for sequential entry so that some suppliers can stake out competitive positions. Specifically, define the **sequential entry extension** of the model as follows. The potential suppliers sequentially decide on entry and organizational design, with subsequent suppliers observing the actions of prior suppliers. We solve for subgame perfect equilibria (SPE) of this entry game, with the payoffs still given by the expected revenues from the stage II negotiations.

Proposition 8.4. *Consider the sequential entry extension. G is the unique SPE if and only if G is a PSNE of the base model with the PSNE existence conditions holding with strict inequalities.²²*

²¹Note that total supply chain profitability would be a natural candidate for social welfare in this model.

²²The PSNE existence conditions hold with strict equalities if the parameters are in the interior of the area labeled G in Figure 7.1. More generally, this requires that condition 1.1 in the online appendix holds with strict rather than weak inequalities.

According to this proposition, a supplier that is in a first mover position would choose a generalist organizational design and prevent further entry whenever G is an equilibrium of the simultaneous move game. Thus, one can also think of the G equilibrium as incorporating an element of preemption. This result serves to highlight the value of supply chain coordination for a buyer. The sequential outcome of a single generalist is the opposite of what the buyer desires.

8.3. Investments in Relational Capabilities

In this section, we consider a large buyer's incentive to invest in relational capabilities, which would increase R . Define the **R-investment extension** as follows. Suppose that prior to stage I, buyers can make costly investments to increase R . We equate the incentive to increase R in a given equilibrium with the marginal impact of R on buyer profits.

Proposition 8.5. *Consider the R -investment extension and compare the incentives to invest in R across the G , SS , SH and GSS equilibria. (i) For $\alpha > 1/2$, the buyer has the greatest incentive to invest in R in the SS equilibrium. For $\alpha < \frac{p}{1+2p} \leq \frac{1}{3}$ the buyer has the least incentive to invest in R in the SS equilibrium. (ii) The incentive to invest in R is weakly greater in the SH equilibrium than in the GSS equilibrium and strictly greater in the GSS equilibrium than in the G equilibrium.*

Part (i) of the proposition is striking. If suppliers have greater bargaining power than buyers (i.e., $\alpha > 1/2$) then a buyer gets the highest returns from investing in R when there are two specialists despite the fact that benefit R is least likely to be realized in that equilibrium! Intuitively, in the SS equilibrium R serves to make a buyer's threat to exclude a supplier from the negotiations more credible. The greater the bargaining power of the supplier, the greater the buyer's incentive to increase R .

In part (ii) we see that the incentive for investment in R is lowest when there is a single generalist. With competing suppliers, in at least some demand states, R does not contribute to any one supplier's added value and hence the returns to increasing R entirely accrue to the buyer. Without competition, the returns to R are always split between the generalist supplier and the buyer. This is a classic case of holdup, and it reduces the buyer's incentives to invest.

Our analysis highlights that in addition to traditional efficiency considerations – invest where strong relationships create more surplus – firm decisions about whether and where to invest in relational capabilities also depends on surplus capture considerations.

8.4. Subsidization

This section considers the extent to which buyers can increase their profits by subsidizing their suppliers. Define the **subsidy extension** of the model as follows. Prior to stage I, the buyer can offer one or more potential entrants a subsidy conditional on entry. Suppose that with or without subsidies the buyer can get suppliers to coordinate on its most preferred PSNE. We now show that for *any* possible market, there exist levels of setup costs such that the buyer can increase its profits by offering subsidies to its suppliers.

Proposition 8.6. *Consider the subsidy extension. For any values of α , p , T and R there exist values of F such that the buyer increases its profits by offering a positive subsidy to one or more of its suppliers in order to create the SS or SH equilibrium. The subsidies to support these equilibria are increasing F and p , decreasing in α and T and weakly decreasing in R .*

From Proposition 8.2 we know that equilibria SS and SH are always preferred to G by the buyer. Consider a level of setup costs ε beyond the highest level consistent with either SS or SH (whichever one exists for the given parameters). One can show that the unique outcome is then G (for ε not too large). However, an ε subsidy allows the buyer to shift play to an equilibrium with two competing suppliers that yields greater value capture to the buyer. For ε sufficiently small the subsidy is profitable.

Thus, buyers in our model can potentially benefit by offering subsidies in order to increase competition among suppliers. The greater the setup costs and the proportion of buyers with heterogeneous task requirements, the greater the required subsidies. On the other hand, the greater are supplier power and organizational tradeoffs, the greater the profits of the specialist suppliers and hence the lower the required subsidies. While we have abstracted from coordination problems, the possibility to use subsidies to coordinate on equilibria with greater entry is an additional motivation for subsidies in our model.

8.5. Optimal Buyer Power

It is possible to solve for a large buyer's optimal level of bargaining power in our model. While greater bargaining power increases a buyer's profits for any given set of suppliers, there is a tradeoff. Higher levels of buyer power make it harder for suppliers to cover their setup costs and eventually lead suppliers to exit the market, which causes a downward jump in buyer profits. This is consistent with buyers having short-term gains from slashing their costs of purchasing through tough bargaining but then suffering long-term detrimental effects due to

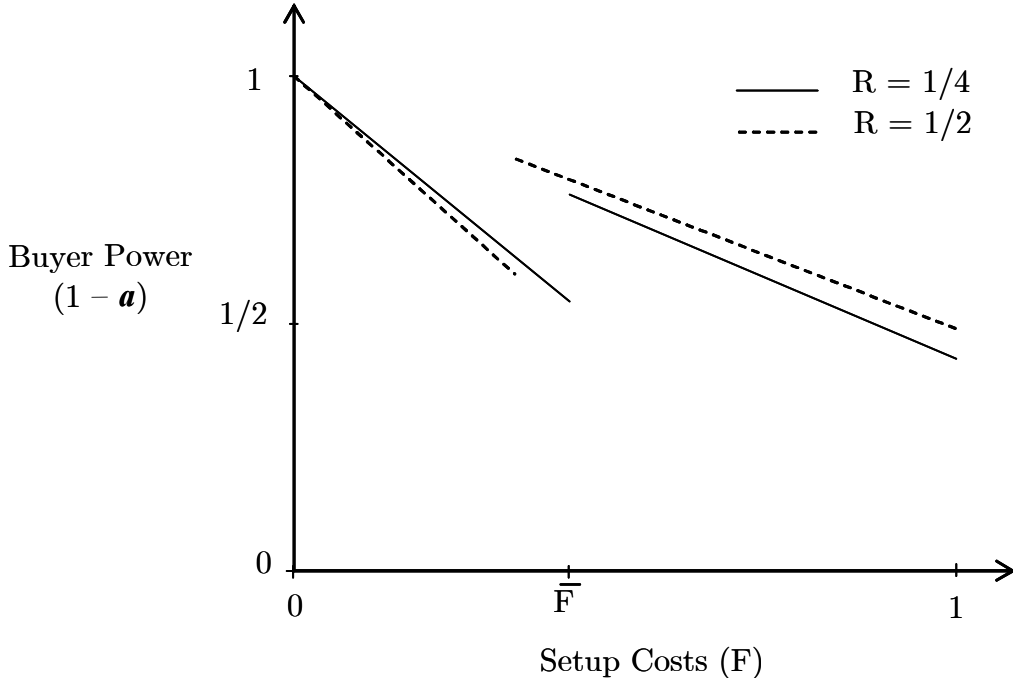


Figure 8.1: The optimal buyer power as a function of setup costs when $T = 1$ and $p = 1/3$ for two values of R .

the weakening of their supplier base.

Define the **endogenous buyer power extension** as follows. Prior to stage I, the buyer can costlessly select any value of α in $[0, 1]$. We simplify the analysis by restricting attention to the case where $R < T/2$, which implies that $R < R_S = \frac{T}{1+p}$, so that the possible equilibria are SS and G . We assume that the buyer can get its suppliers to play the SS equilibrium when it exists.

Figure 8.1 shows how the optimal buyer power varies with F for two value of R . The buyer optimally sets its bargaining power such that suppliers are just covering their setup costs. Hence, the buyer gets all the surplus. For low setup costs, having two specialists enter maximizes the total surplus and the buyer's optimal power is such that the two specialists are just covering their setup costs. The optimal level of buyer power is then falling as setup costs increase because suppliers need more inducement to enter. The greater are client-specific scope economies, the lower the buyer's optimal power. (Recall that higher R leads to greater competition between the specialists, which is a substitute for bargaining power.) Although not pictured in the figure, greater organizational tradeoffs lead to less competition among the specialists and calls for higher buyer power.

When setup costs exceed a critical threshold ($\bar{F}$ in the Figure 8.1), having two suppliers

generates less surplus than having a single generalist and hence there is a discontinuous change as the buyer optimally shifts to a sole sourcing strategy. The loss of competition from the shift from SS to G causes the optimal level of buyer power to jump upward. It then continues its downward trend as setup costs increase further. Interestingly, the effect of relationships reverses: higher R now calls for greater bargaining power. The generalist's added value increases in R and a smaller fraction is required for the generalist to cover its setup costs. Optimal buyer power is now falling in organization tradeoffs because a generalist creates less surplus. These results are general.

Proposition 8.7. *Consider the endogenous buyer power extension and suppose that $R < T/2$. The optimal buyer power $(1 - \alpha)$ is non-monotonic in F , R and T . Specifically, there exists a critical level of setup costs $\bar{F}$ such that the optimal buyer power is decreasing in F except for an upward jump at $\bar{F}$; the optimal buyer power is decreasing in R and increasing in T for $F < \bar{F}$ and increasing in R and decreasing in T for $F > \bar{F}$.*

Treatments of competitive strategy going back to Porter (1980) generally view strong bargaining power within the industry value chain as advantageous to a firm. Our analysis suggests that there may be an optimal level of power. The analysis here is only exploratory and a more general theory of optimal buyer power could be an interesting subject of future study.

9. Conclusion

We have studied buyer-supplier relationships in a two-stage model. In the first stage, potential suppliers make entry decisions and those that enter select an organizational design. Firms that enter incur a setup cost. In the second stage, suppliers negotiate with buyers that have two tasks that they seek to outsource. Some buyers have heterogenous task requirements, while others have a single type of task. Selecting a single supplier for both tasks is assumed to deepen the relationship and thereby give rise to what we have termed client-specific scope economies. The effectiveness of suppliers also depends on their organizational design, which may be more or less specialized to a given task type.

A supplier's scope strategy, including its organizational design, should fit its environment. In our model, the environment is composed of demand (i.e., buyer task requirements) and the set of competitors and their organizational designs. We find that there are three broad strategies that fit with the demand side of the model. With a specialist strategy, firms do only

one type of task and have an organizational design optimized for that task. With a generalist strategy, a supplier does both types of task and has an organizational design combining elements of the two specialists. Finally, with a hybrid strategy, a supplier has a primary task specialization but makes some adjustments in its organizational design to allow it to take on some of the other task as well.

There are only a limited number of strategies that can coexist in a given market. Suppliers must have sufficient added value to cover their setup costs. We find four possible configurations. We characterize the settings in which an opportunity is served by a generalist, by two specialists, by a specialist and a hybrid, or by a generalist and two specialists. Our results contrast with prior work based on scope economies in production where there are fewer possible strategies and less possibility for coexistence of different strategies.

We consider the effect of falling setup costs, say as an industry matures and the barriers to entry fall. In general, the supplying industry is pioneered by a generalist. However, this position is not sustainable when client-specific scope economies are too weak: the generalist is outcompeted by specialists as setup costs fall. In contrast, when client-specific scope economies are strong, a generalist strategy is sustainable. When setup costs fall and specialists enter, the generalist is able to survive by offering a strong relationship to buyers with heterogeneous task requirements. However, even in this case, we show that the generalist may be better off switching to a hybrid strategy for intermediate levels of setup costs.

While we show that the possible equilibria can all be unique, we also show that there is considerable scope for multiplicity of equilibria. For example, in many contexts, a market could either be served by two specialists or by a single generalist. Multiplicity arises because of the need for suppliers to coordinate their entry and organizational design decisions so as to assure sufficient added value to cover their setup costs. Such multiplicity raises the issue of supply chain management, which involves in part the coordination of suppliers.

We study supply-chain management by a single large buyer. We find that such buyers have a strong interest in fostering specialization among their suppliers so as to move away from dependence on generalists. Conversely, when suppliers have the opportunity to make strategic commitments, they have a tendency to stake out generalist positions as a way to preempt the market. In terms of the total surplus created by the supply chain, we find that the ideal lies between the opposing preferences of buyers and suppliers.

While buyers always have an incentive to emphasize strong relationships, we find that this incentive can be *greatest* when buyers face specialist suppliers. This result is somewhat

surprising because a close relationship is not developed when a buyer splits its tasks among specialists. The intuition is that the benefits to deeper relationships can be a powerful check on the surplus capture of specialists because the buyer’s threat to put all of its business with a single supplier is enhanced.

9.1. Future Work

While there has been much empirical work in the strategy literature on synergies and scope decisions across industries, there has been much less attention paid to issue of horizontal scope within an industry. Our analyses suggest that intra-industry scope is a potentially interesting area of research for strategy. Ideal settings in which to empirically explore the issues raised in our paper are ones with well defined task areas and with well defined measures of supplier capabilities in each. For example, Chatain (2006) analyzes scope strategies in the legal market using evaluations of law firm capabilities across 60 practice areas. In light of our results, it would be particularly interesting to see how measures of client-specific scope economies affect the relative performance of specialists and generalists, as well as the evolution of firm scope. An important exception to the lack of empirical work on intra-industry scope is population ecology, specifically the branch concerned with resource partitioning (Carroll et al., 2002). While this literature approaches competition between specialists and generalists based on sociological constructs, we wonder to what extent more economic-based theories such as ours could be used to analyze similar data.

There are several avenues for future theoretical development. One could allow suppliers to vary in the extent to which they are able to exploit client-specific scope economies. Formally, this would involve each supplier having its own R_i . One could then consider how differences in R_i impact scope decisions and how much suppliers should invest in their relational capabilities. We introduced the topic of optimal levels of buyer power. One could develop a more general theory of optimal buyer and supplier power.

In terms of methods, we have explored the use of biform games to develop formal foundations of strategy. We focused on a particular class of biform games involving buyers and suppliers where transactions with buyers can be analyzed independently of each other. Supplier added value plays a central role in the analysis, which reinforces one of the original messages of Brandenburger and Stuart (1996). Rumelt (2003) points out that the term “competitive advantage” lacks a consistent definition in the strategy literature. In the class of biform games

that we identify, it seems natural to equate added value with competitive advantage.²³ Another attractive feature of this class of biform games is that there is a natural parameterization of bargaining power. Despite these features, it would be useful to have other classes of highly tractable biform games that relax some of the restrictive assumptions that we impose. In particular, future work in this area could be directed at introducing capacity constraints and a parameter for the extent of rivalry.

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²³Within our class of biform games, added value seems to be consistent with the criteria that Postrel (2006) puts forward for a definition of competitive advantage.

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