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Economizing in a context of strategizing: governance mode choice in Cournot competition

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Abstract

This paper builds on Riordan and Williamson's (1985) paper by exploring the economizing choice of organizational form by firms competing in a homogeneous good market. The paper investigates rivalrous firms' investment and organization choice in a Cournot competition. The model suggests that both governance cost and strategic interactions can influence which asset–organization pair each firm chooses. Application of the model is illustrated with a discussion of the cola wars and the organization of the fountain channel. ©1999 Elsevier Science B.V. All rights reserved.

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1. Economizing and strategizing in Cournot competition

Williamson has categorized economic approaches to strategy as either strategizing, which appeals to a market power perspective, or economizing, which is principally concerned with organizational efficiency. Of the two, Williamson (1991, p.75) "aver[s] that . . . economizing is much the more fundamental." Teece et al. (1997, p.513) echo this view by arguing that the game-theoretic strategic conflict approach "ignores competition as a process involving the development, accumulation, combination, and protection of unique skills and capabilities," which they believe is central to building a long-run competitive advantage. Collectively,

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these scholars assert that managers are well advised to focus their efforts on building specific capabilities and organizing efficiently rather than attempting to deter or defeat rivals with clever ploys.

One result of this perspective is that the transaction cost economics (TCE) literature as well as other organizational approaches to strategic management are mostly devoid of formal models that incorporate strategic conflict. [1] The absence of strategic interactions in TCE, however, does not mean that strategic conflict is considered unimportant. For instance, Riordan and Williamson (1985) introduce an optimization calculus that begins to formalize TCE's heuristic model. While their model makes no provision for strategic behavior, they nevertheless acknowledge that rivalry needs to be considered whenever the preconditions for strategic behavior-dominant firms or highly concentrated industries where the condition of entry is difficult are satisfied (Riordan and Williamson, 1985, p.375). Similarly, Teece et al. (1997, p.513) argue that strategizing of a game-theoretic kind "is most relevant when competitors are closely matched and the population of relevant competitors and the identity of their strategic alternatives can be readily ascertained." While these scholars acknowledge that under certain conditions strategic interactions may play a role in organizational mode choice, they nevertheless have eschewed applying an efficiency calculus in the context of strategic conflict. Indeed, strategizing and economizing generally have remained separate fields of inquiry.

We maintain that exploring TCE's economizing calculus in the context of strategic conflict offers new insights for TCE at least for the range of competitive situations outlined by Riordan and Williamson and Teece et al. In particular, TCE predicts a pairing between transaction attributes (notably asset specificity) and organization of the transaction. The exemplary prediction is that hierarchy is reserved for transactions with highly specific assets while the market is the efficient organizational mode for organizing generic assets. TCE's 'discriminating alignment' hypothesis (Williamson, 1985, p.18), however, has little to say about which asset–organization pair (a specific asset organized under hierarchy or a generic asset organized through a market) a firm should choose (for an exception see Riordan and Williamson). We assert that strategic behavior between rivals may influence which asset–organization pair firms adopt. Moreover, strategic interactions may lead rivals to make asymmetric choices and adopt different asset–organization pairs, which is a potential source of organizational heterogeneity. Thus, investigating TCE's economizing calculus in the context of strategic behavior may inform both asset–organization pair choice and intra-industry organizational heterogeneity.

This paper makes an initial exploration of economizing in the context of strategizing by building on Riordan and Williamson (1985) to investigate rivalrous firms' asset specificity and organizational mode choices in Cournot competition. In the game, rivals compete in a downstream homogeneous product market. Each firm engages in a single upstream intermediate goods transaction in which it (1) chooses the level of asset specificity and (2) chooses an organizational mode. We assume that the organization mode choice is between market and hierarchy. The governance cost structure of the two alternative modes is assumed linear in asset specificity and is consistent with Williamson's (1985) heuristic model. Alternative governance cost equations are parameterized to explore how changes in comparative

[1] Similarly, game-theoretic models of rivalry typically ignore transaction costs and governance mode choice.

governance cost influence the pure strategy Nash equilibrium level of asset specificity and organizational mode choices.

Employing a well-known result from game theory, the paper shows that the pure strategy Nash equilibrium level of asset specificity and organization mode choice vary with the cost of governance. Firms make symmetric governance choices and use the market to organize the intermediate transaction when the cost penalty of hierarchy compared to the cost penalty of the market is large. Alternatively, firms symmetrically use hierarchy when the cost penalty of hierarchy is relatively small. Furthermore, the paper shows that firms make asymmetric choices under certain governance cost conditions— firms make asymmetric governance choices (one firm chooses market and the other firm chooses hierarchy to organize the intermediate transaction) when the cost penalty of hierarchy takes on intermediate values compared to the cost penalty of the market. The model shows that both alternative governance cost differences and strategic behavior influence which asset–organization pair firms choose. And, within certain governance cost regimes, strategic interactions lead to organizational heterogeneity even in a homogeneous goods market.

2. Model

Asset and organization mode choices by rivalrous firms are modeled in a modified Cournot game. The game captures strategic interaction between firms supplying homogeneous goods in a single product market. The game assumes that production requires each firm to engage in an intermediate transaction and to choose both the level of asset specificity and the organizing mode for the transaction. For instance, consider a product that requires two value-adding activities A and B. Assume that all firms perform Activity A because of investment in specific assets but face the choice of either internally performing Activity B or outsourcing it. [2]

Assume a two-stage Cournot duopoly game, wherein two firms simultaneously choose governance mode in Stage 1 for the intermediate transaction, observe Stage 1 choices, and simultaneously choose output in Stage 2. [3] Assume the marginal cost for the intermediate input is zero. The baseline model relies on the discrete governance alternatives described by Williamson (1985, 1991). By assumption, two governance choices are available for organizing the intermediate transaction B: market (M) or hierarchy (H). [4] Assume that the total cost of governance for firm i is common knowledge and linear in asset specificity. Thus, the governance cost of market and hierarchy are:

$$G^i_{\mathrm{M}}(k) = \alpha_{\mathrm{M}} k + \beta_{\mathrm{M}}$$

[2] This latter choice is referred to as an intermediate transaction. Any number of sequentially value-added activities can be modeled in this way. For instance, design and production, production and distribution, and distribution and retailing are sequential activities that fit this model.

[3] TCE typically assumes asset and organization choices are made simultaneously. While we agree with this view, in many instances specific investments lag the choice of organizational form. For instance, a firm may choose to integrate an activity but assembling the requisite assets (building, equipment, etc.) occurs only after the decision.

[4] As Williamson (1991) describes, there may be a wide variety of organizational forms between markets and hierarchy. The model presented in this paper focuses on polar organizational modes. As discussed later, the model is robust with respect to increasing the number of alternative organizational modes.

$$G^i_{\mathrm{H}}(k) = \alpha_{\mathrm{H}} k + \beta_{\mathrm{H}} \tag{1}$$

where β represents the fixed cost of governance and α represents the marginal cost of governance with M and H designating market and hierarchy, respectively. [5] In concert with transaction cost theory, we assume $\beta_{\mathrm{M}} < \beta_{\mathrm{H}}$ and $\alpha_{\mathrm{M}} > \alpha_{\mathrm{H}}$. That is, the fixed cost of using market exchange is less than the fixed cost of organizing exchange under hierarchy. Conversely, the marginal cost of organizing an exchange with a marginal increase in asset specificity is greater when organized in the market compared to when organized via hierarchy. The critical value, k^*, which is the level of asset specificity where a firm is indifferent between choosing either market or hierarchy, occurs when $G_{\mathrm{M}}(k) = G_{\mathrm{H}}(k)$, or, solving for k^*, when $k^* = (\beta_{\mathrm{H}} - \beta_{\mathrm{M}})/(\alpha_{\mathrm{M}} - \alpha_{\mathrm{H}})$. [6] k^* reflects the ratio of costs of hierarchy to the cost for markets. [7] A low value of k^* implies that the market is employed for only the smallest levels of asset specificity while a high value of k^* implies that the market is the economizing organizational choice for all but the highest levels of asset specificity. [8]

Riordan and Williamson treat asset specificity like capital in a variable cost function, thus the fixed cost of investing in greater asset specificity reduces the marginal cost of production, ceteris paribus. In our model, we assume that increases in asset specificity correspond to increases in capacity. [9] Thus, we assume that asset specificity k and production quantity q are proportional. [10] This assumption allows us to substitute q for k in Eq. (1), which thereby incorporates the organizational mode choice into the Cournot quantity choice game. [11] Fig. 1 illustrates the assumed relationship between alternative governance costs and production quantity.

Additionally, assume that (1) inverse demand $P(Q)$ is linear and equal to $(1 - Q)$ where $Q \leq 1$ and is total industry output, (2) payoff for firm i when firm i chooses governance u and firm j chooses governance v is:

$$\prod^i_{uv} = P(Q) q^i_{uv} - (\alpha_u q^i_{uv} + \beta_u) \tag{2}$$

[5] For a summary of empirical studies that support the cost structure proposed by TCE, see Shelanski and Klein (1995). Also, see Riordan and Williamson (1985) and Williamson (1985, 1991) for a development of alternative governance cost structures similar to the ones employed here.

[6] Additionally, production costs, should they vary in k, and governance costs could be subsumed by Eq. (1).

[7] Governance structures differ in their costs and competencies. Moving from market to hierarchy, one would expect a gain in coordinated adaptation but a loss in incentive intensity. One could think of k^* as capturing this tradeoff.

[8] Note that assuming $\beta_{\mathrm{M}} < \beta_{\mathrm{H}}$ and $\alpha_{\mathrm{M}} > \alpha_{\mathrm{H}}$ implies $k^* > 0$ and finite.

[9] Investments in specific assets also may improve quality. However, our model assumes a homogeneous goods market, which disregards the potential for quality enhancing investment.

[10] Hayes and Wheelwright (1984) and Safizadeh et al. (1996) describe differences between mass production and job-shop production that help to illustrate the assumed proportional relationship between k and production capacity, q. A job-shop utilizes flexible standard machine tools to produce a product but is limited in its production volume per unit of capital equipment; however, the production equipment is redeployable. Mass production lowers marginal production cost by developing non-redeployable inflexible machines that speed production and thereby increases production capacity. If capital expenditures are identical for both a job shop and mass production, the job shop will have a smaller production capacity and more generic capital equipment than will mass production.

[11] Assuming that q and k are proportional means that the model can be interpreted with respect to both market size and asset specificity. Nevertheless, we focus on developing the model's implications we respect to asset specificity.

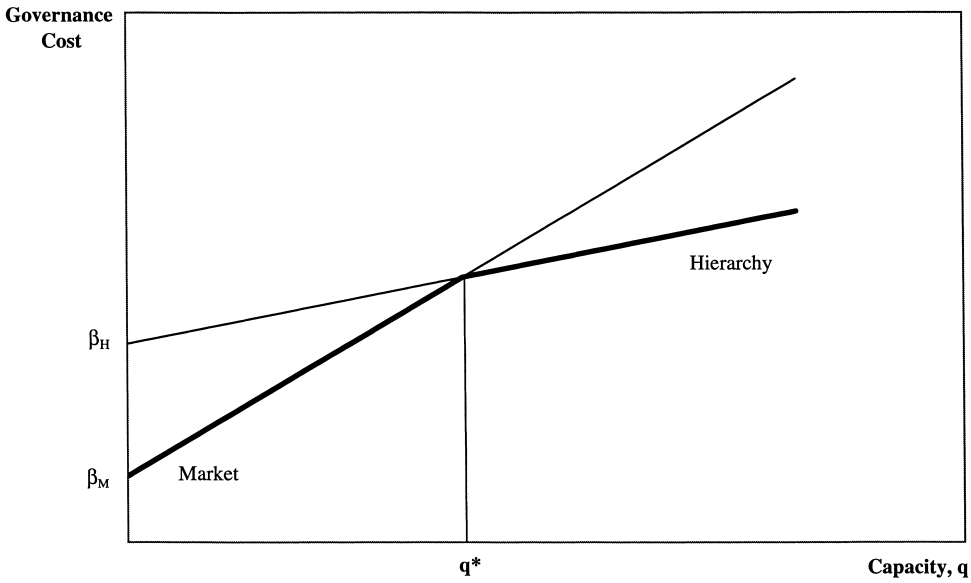

Fig. 1. Comparative costs of governance.

where q^i_{uv} is the quantity of firm i and $Q = q^i_{uv} + q^j_{uv}$, where j represents the second firm, and (3) firms have homogeneous production cost structures and production marginal costs are equal to zero. Attention is limited to pure strategy Nash equilibria because they represent an appropriate and realistic solution concept for our game.

Given the two-stage game, there are four possible outcomes for this game: (1) Firm 1 chooses market and Firm 2 chooses market (MM), (2) Firm 1 chooses market and Firm 2 chooses hierarchy (MH), (3) Firm 1 chooses hierarchy and Firm 2 chooses market (HM), and (4) Firm 1 chooses hierarchy and Firm 2 chooses hierarchy (HH). Fig. 2 displays the 'reaction curves' for this game. Note that due to discontinuity in the marginal cost curve across all values of output (see Fig. 1), each firm has two 'reaction curves,' one for each choice of governance. [12] The 'reaction function' for firm i choosing governance u is as follows:

$$R^u_i(q_j) = \frac{1 - q_j - \alpha_u}{2} \tag{3}$$

In this game, there are at most, four potential output pairs as illustrated in Fig. 2. Nodes 1 and 4 in Fig. 2 represent organizational heterogeneity. That is, one firm chooses to integrate the transaction while the other chooses market exchange. Nodes 2 and 3 are organizationally homogeneous or symmetric outcomes where both firms choose market or hierarchy, respectively.

The well-known Cournot optimization results are as follows when firm i chooses governance u and firm j chooses governance v:

[12] The discontinuity arises because of the discrete choice between alternative governance structures.

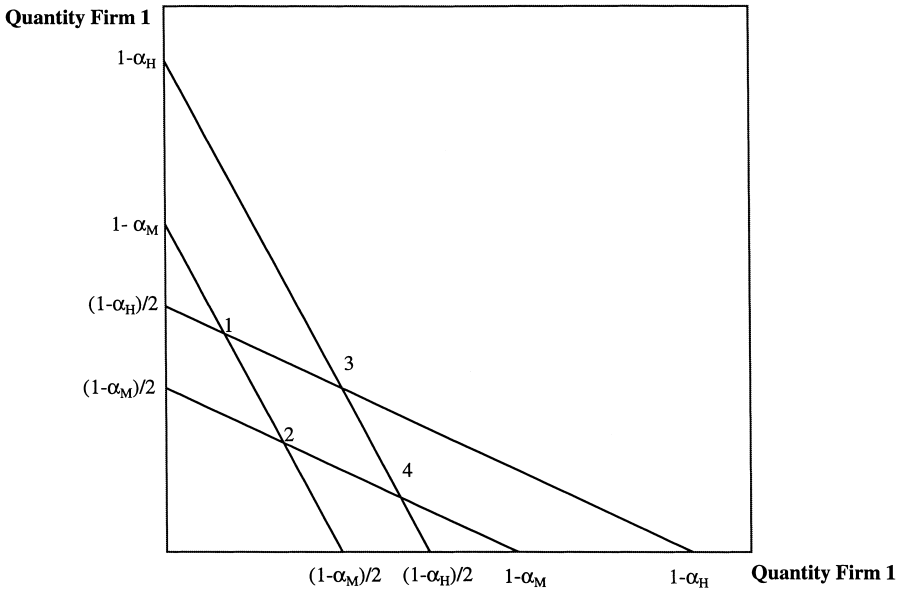

Fig. 2. Cournot reaction curves.

$$q^i_{uv} = \frac{1 - 2\alpha_u + \alpha_v}{3},\ \prod^i_{uv} = (q^i_{uv})^2 - \beta_u \tag{4}$$

To simplify the graphical analysis without loss of generality, we set $\beta_M = \alpha_H = 0$, which implies that $k^* = \beta_H/\alpha_M$.[13] Thus, equilibria for this game are solely a function of α_M and β_H. In order to facilitate discussion, equilibria are also expressed in terms of the critical level of asset specificity k^* and α_M.

3. Propositions[14]

Proposition 1. Firms make symmetric governance choices and use the market to organize the intermediate transaction when the cost penalty of hierarchy compared to the cost penalty of the market is large, that is when k^* is large.[15] Assuming $\beta_M = \alpha_H = 0$:

[13] Reducing the parameterization to two dimensions facilitates two-dimensional graphical analysis. Alternatively, the relative 'fixed cost penalty' of hierarchy and the relative 'marginal cost penalty' of market could be examined. That is, vertical and horizontal axes would be $\beta_H - \beta_M$ and $\alpha_M - \alpha_H$, respectively. The results in the text hold by setting $\beta'_H = \beta_H - \beta_M$ and $\alpha'_M = \alpha_M - \alpha_H$ and substituting β'_H for β_H and α'_H for α_M.

[14] A well known result in game theory is that discrete choice introduces a non-continuous action space which causes the economic actors' objective functions to be non-concave. Any symmetric game must have a symmetric equilibrium in mixed or pure strategies. But, if no symmetric pure strategy equilibrium exists, then a symmetric mixed-strategy equilibrium must exist. For example, see Hermalin (1994).

[15] Symmetric governance is a component of a MSNE when (a) $\frac{4}{9}\alpha_M(1 - \alpha_M) \leq \beta_H \leq \frac{4}{9}\alpha_M$ for $\alpha_M \leq \frac{1}{2}$ or (b) $\beta_H \leq 1/9$ for $\alpha_M \geq 1/2$, which states that between these two cost regimes exists another regime of mixed strategy

1. Symmetric governance, MM, is a unique PSNE outcome when $\beta_H \geq \frac{4}{9}\alpha_M$.
2. Equivalently, symmetric governance, MM, is a unique PSNE outcome when $k^* \geq \frac{4}{9}$.

Proposition 2. Firms make symmetric governance choices and use hierarchy to organize the intermediate transaction when the cost penalty of hierarchy compared to the cost penalty of the market is small, that is when k^* is small. Assuming $\beta_M = \alpha_H = 0$:

1. Symmetric governance, HH, is a unique PSNE outcome when:
   a. $\beta_H \leq \frac{4}{9}\alpha_M(1-\alpha_M)$ for $\alpha_M \leq \frac{1}{2}$ and;
   b. $\beta_H \leq \frac{1}{9}$ for $\alpha_M \geq \frac{1}{2}$.
2. Equivalently, symmetric governance, HH, is a unique PSNE outcome when:
   $k^* \leq \frac{4}{9}(1-\alpha_M)$ for $\alpha_M \leq \frac{1}{2}$ and;
   $k^* \leq \frac{1}{9}$ for $\alpha_M \geq \frac{1}{2}$.

Proposition 3. Firms make asymmetric governance choices where one firm chooses market and the other firm chooses hierarchy to organize the intermediate transaction when the cost penalty of hierarchy compared to the cost penalty of the market is intermediate, that is when k^* takes on intermediate values. Assuming $\beta_M = \alpha_H = 0$:

1. Asymmetric governance is PSNE when $\frac{4}{9}\alpha_M(1-\alpha_M) \leq \beta_H \leq \frac{4}{9}\alpha_M$ for $\alpha_M < \frac{1}{2}$.
2. Equivalently, $\frac{4}{9} \leq k^* \leq \frac{4}{9}(1-\alpha_M)$.

Proofs for the propositions are in the Appendix A. Fig. 3 diagrammatically captures the propositions and maps PSNE in terms of α_M and β_H and Fig. 4 maps the propositions in terms of α_M and k^*.

The region in the upper left of Fig. 3 depicts Proposition 1. Both firms find it optimal to choose identical levels of asset specificity and to organize their intermediate goods transaction across a market interface (MM) because the fixed cost of integrating a transaction, β_H, is high relative to the marginal cost penalty of markets, α_M, which favors market exchange. Fig. 4 provides a somewhat more intuitive depiction. Both firms choose market (MM) when the critical value k^* becomes large (in this case, when k^* exceeds 4/9) because k^* exceeds the level of asset specificity firms choose to employ.

Analogously, Proposition 2 states that when the fixed cost of hierarchy is low relative to the cost of market, both firms choose identical levels of asset specificity and organize the intermediate goods transaction hierarchically. The lower right region in Fig. 3 depicts both firms' symmetric choice of hierarchy (HH). Plotting the same region in Fig. 4 shows that hierarchy is symmetrically chosen for low values of k^* with k^* decreasing as the cost of market (α_M) increases. That is, relatively low β_H favors hierarchy because under the conditions stated the critical value of k^* is less than the level of asset specificity that both firms choose to employ.

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equilibria for which homogeneous organizations are a probabilistic outcome. Also, asymmetric governance is a component of MSNE when $\frac{4}{9}\alpha_M(1-\alpha_M) \leq \beta_H \leq \frac{4}{9}\alpha_M$ for $\alpha_M < \frac{1}{2}$.

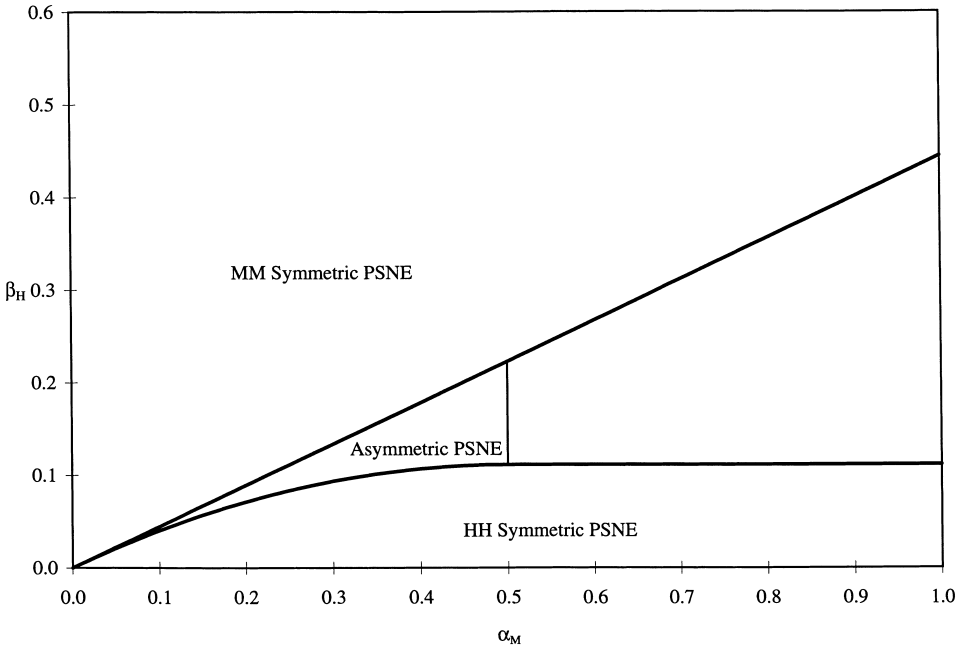

Fig. 3. Pure strategy Nash equilibria.

Proposition 3 describes the region in which firms make asymmetric choices. In this case, the governance cost difference between market and hierarchy is insufficient to cause one mode to dominate: firms choose different production quantities and corresponding different organizational forms when the costs of hierarchy and market are sufficiently close. In the region identified in Fig. 3, MH and HM are PSNE, which presents a coordination problem because the choice of hierarchy is more profitable than that of market and both firms prefer the more profitable strategy. [16]

The coordination problem is theoretically resolved by sequential choice. [17] Assume that the leader chooses governance mode M or H, the follower observes the leader's choice and chooses governance mode M or H, and both firms compete simultaneously on quantity knowing previous choices. The pure strategy Nash equilibria of the sequential choice game is identical to the propositions stated above except in the asymmetric region described in Proposition 3. The leader chooses the more profitable level of asset specificity and corresponding organizing mode, hierarchy, and the follower chooses market. Fig. 4 offers an intuitive interpretation of the asymmetric outcome. Organizational heterogeneity obtains when the costs of hierarchy and market are sufficiently close and k^* takes on an inter-

[16] It can be shown that profit for the integrated firm exceeds profit for the market-organized firm in this cost regime.

[17] The coordination problem can be theoretically resolved with simultaneous choice if firms employ mixed strategies, however, mixed strategies do not capture realistic behavior in our game.

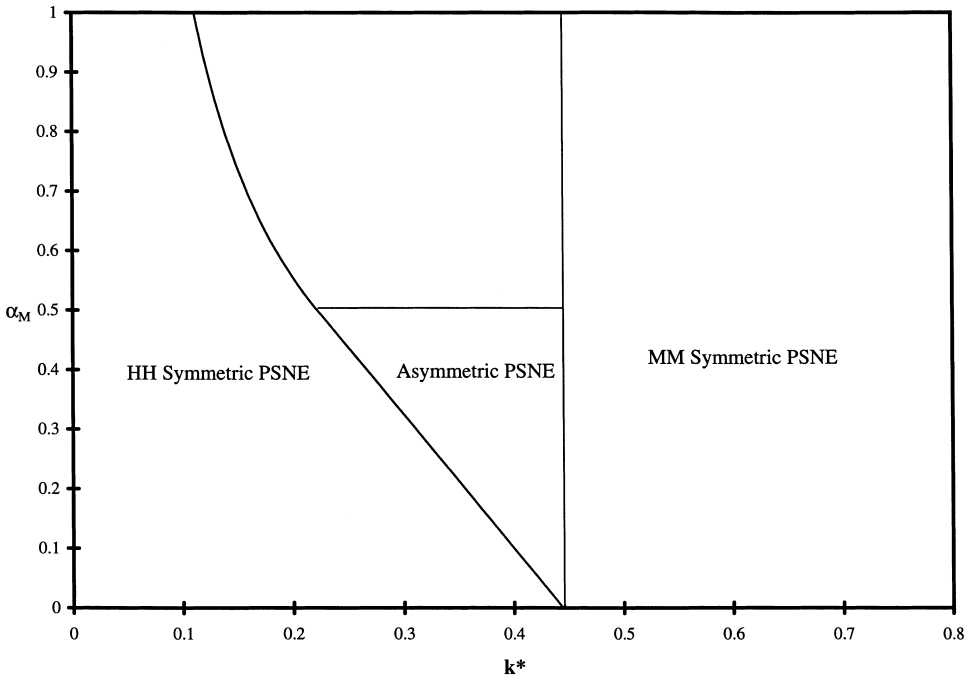

Fig. 4. Pure strategy Nash equilibria.

mediate value. Note the unlabeled region in Figs. 3 and 4. Within this cost regime, the downstream product market cannot support more than one firm. [18]

Also, we evaluated the model's robustness by varying elements of the model and resolving the game. For instance, we modeled competition (1) between two firms choosing between two organizing modes in a Stackelberg leadership game, (2) among three firms choosing between two organizing modes, and (3) between two firms choosing among three organizing modes. In all variations of the game, the nature of the PSNE were similar to the propositions above, albeit with somewhat differing boundaries. [19]

4. Discussion

Because of non-convexities in the cost structure, it is not surprising that the model generates both symmetric and asymmetric pure strategy Nash equilibria. Nevertheless, the model generates at least two interesting insights.

Recent work by organizational economists support the assumption that organizational forms indeed are discrete. For instance, Williamson (1991, p.271) avers that, "... each viable form of governance ... is defined by a syndrome of attributes that bear a supporting

[18] Although we consider a game with only two participants, the number of participants is endogenous, which implies the game could be extended to include endogenous entry.

[19] These games and their solutions are available from the authors upon request.

relation to one another. Many hypothetical forms of organization never arise, or quickly die out, because they combine inconsistent features." Williamson's argument suggests complementarities among governance attributes or activities. Complementary activities are ones for which decrease in a factor price and the corresponding increase in the use of the factor increases the returns to increasing the use of other factors. The notion of complementary activities provides a neoclassical explanation to support the empirical observation that firms tend to have clusters of attributes. A complementarities literature of organizational design (e.g. Milgrom and Roberts, 1990; Milgrom and Holmstrom, 1991; Holmstrom and Milgrom, 1994) has emerged which further supports the notion of discrete organizational forms. For instance, Milgrom and Roberts (1990) have argued that organizational forms are composed of complementary elements that "move up and down together in a systematic, coherent fashion. . . "; managers cannot modify individual elements without cost and performance pressures to revert to the original form or to change other elements of the organizational form as well.

This literature, however, has not investigated the extent to which discrete organizational choice may be affected by strategic behavior. Our model takes the notion of discrete organizational form seriously and suggests that when strategic behavior is feasible, discrete governance alternatives can lead to intra-industry organizational heterogeneity.

Although our model incorporates only two organizational forms, alternatives are not limited to market and hierarchy. Within hierarchy, for example, several discrete forms may be found (Williamson, 1985, Chap. 10). A substantial literature comparing centralized and decentralized (multi-divisional) hierarchy (e.g. Chandler, 1962; Rumelt, 1974; Williamson, 1975) clearly suggests that these alternatives comprise "different styles and systems of reward, control, resource allocation, review, and new business development" (Rumelt, 1974, p.3). Similarly, hybrid structures (Williamson, 1991) such as joint ventures (Hennart, 1988), which are categorized as falling between market and hierarchy, have been identified. To evaluate the effect of choosing among more than two discrete organization forms, we extended our model to consider two firms choosing among three discrete organization forms (model available from the authors upon request). Admitting a third discrete organization form that falls between the polar modes of market and hierarchy into the model did not alter our findings–asymmetric PSNE are present even when two firms choose among three organizational alternatives.

Second, the model shows that intra-industry organizational homogeneity or heterogeneity can emerge depending on the critical value of asset specificity, k^*. We observe organizational homogeneity in some industries and heterogeneity in other industries. Our model may help us understand this variation. The model is developed without reference to any institutional features associated with a specific industry. These features may vary by industry, which causes k^* to vary by industry as well. As k^* varies by industry, so too may the equilibria, organizational homogeneity or heterogeneity, that obtain. Ultimately, estimating k^* requires a comparative analysis.

Williamson (1991), for instance, argues that identifying the critical value of asset specificity is an exercise in the comparative analysis of alternative governance forms and that k^* may differ depending on the institutional environment (Davis and North, 1971). Williamson (1991, pp. 286–292) identifies five aspects of the institutional environment that may influence k^*. First, government expropriation of assets and the lack of credible commitments

may increase the cost of all forms of governance, which may or may not shift k^*. Second, a leakage of property rights because of appropriation or dissipation by suppliers due to a weak regime of appropriability (Arrow, 1962; Teece, 1986) increases the cost of using a market, which shifts k^* to the left. Third, contracts typically have gaps that courts may attempt to fill, which may favor markets or hierarchies depending on how courts interpret the contract. Fourth, reputations may develop within a small community of traders (e.g. ethnic communities) that lower the cost of markets thereby shifting k^* to the right. Finally, greater uncertainty of two types may shift k^*: an increase in either the number of disturbances (i.e. problems that arise between exchange partners) or the variance in the type of disturbances may shift k^* either left or right depending on the specific nature of the pattern of disturbances.

4.1. An Illustration

As an illustration, the model can be applied to interpret asset and organizational choices Coca-Cola and PepsiCo (Pepsi-Cola) have made in the carbonated soft drink industry. Coca-Cola and PepsiCo are the dominant firms in the US (and world-wide) accounting for 40.2 and 31.0 percent, respectively, of the U.S. market in 1987 (Muris et al., 1992, 1993), which suggests that the two firms behave strategically because they can disregard the remaining firms. [20] Soft drinks are distributed principally through three channels: grocery, fountain, and vending. Grocery refers to supermarket and convenience stores where drinks are sold in bottles and cans in varying shapes and sized. Fountain refers to the dispensing of a beverage from a spigot in which syrup typically is mixed with water and carbonation to produce a beverage. Retail establishments such as restaurants, sporting events, and bars are typical fountain consumers. Vending describes machines that dispense cans and bottles. Supermarkets alone accounted for 37.7 percent of the gallons of soft drink sold in 1987. Fountain and vending accounted for 24.8 and 12.4 percent, respectively.

Prior to the 1970s, both firms relied on franchisees (independent bottlers) with exclusive territories to supply groceries and vending channels. Coca-Cola was a first mover in the fountain business and either has always directly supplied fountain accounts or maintained an ownership position in bottlers who supply fountain accounts whereas PepsiCo relies on its franchisees to sell into the fountain channel. Coca-Cola also has a dominant market share with purportedly high gross margins in the fountain channel. The pre-1970s choice of organizational form coincides with the MM region in Fig. 3and for grocery and vending channels and with the HM for fountain channel.

Muris et al. (1992, 1993) studied the carbonated soft drink industry at length and noted that the changing competitive environment led Coca-Cola and PepsiCo to change organizational strategies. Coca-Cola and PepsiCo moved to make captive grocery and vending channels by purchasing or taking an equity position in their franchisees. [21] Yet PepsiCo did not move

[20] For instance, Beverage World (1996) reported that in 1995, Coca-Cola captured a 42.9 percent share of soft drink gallons produced, PepsiCo 30.6 percent, Cadbury 16.1 percent, Royal Crown 2.4 percent, and all remaining competitors received 2 percent or less.

[21] Since the Muris et al. study, Coca-Cola spun off company owned bottlers into Coca-Cola Enterprises, for which it retains 49% ownership. PepsiCo retains ownership of many of its franchisees.

to integrate its fountain channel even though it is the second most important channel in volume and Coca-Cola reported receives comparatively high profits from the channel. Why did both firms move to integrate forward into grocery and vending? Why did PepsiCo not integrate forward into fountain?

Muris et al. (1992, 1993) provide an answer to the first question. In a detailed analysis, they argue that four changes in the institutional environment triggered organizational changes. First, growth of national grocery chains and discount stores created soft drink customers that demanded service on a national level. Second, the proliferation of new product and packaging introductions created new coordination problems on a national scale. Third, new technologies increased economies of scale in bottling and transportation costs were reduced, which increased capital requirements and decreased the number of bottlers needed to serve the U.S. market. Fourth, the increasing importance of national advertising and promotions increased the governance cost of franchising compared to hierarchy so much so that hierarchy became the economizing choice of organizational form. Appealing to the explanation provided by our model and in the context of Fig. 4, their argument is equivalent to stating that the cost of using the franchising greatly increased compared to the cost of hierarchy, which shifted k^* to a low level from a large pre-1970 level. The shift in k^* from a high-level to a low level had the effect of shifting the PSNE from MM to HH.

But why did not PepsiCo also integrate forward into its fountain channel? Just as the shift from MM (or in this case franchising) to HH can be viewed in terms of responses to changing governance costs, so too can Pepsi-Cola's decision not to integrate and Coca-Cola's decision to remain integrated be viewed as a response to relatively stable governance costs. The relative costs of franchising and hierarchy did not change much for fountain compared to the changes experienced in grocery and vending channels. New packaging, economies of scale in bottling, transportation costs, and promotions and advertising had little or no effect on governance costs in the fountain channel. The relative costs of franchising and hierarchy, and thus k^*, for the fountain channel experienced no dramatic change as did the grocery and vending channels, which left unchanged the equilibrium HM. Neither firm could do better by deviating from their equilibrium organizational choice because doing so would not only alter their governance costs but would have led to a competitive response that would make such a move unwise. Indeed, in an interview with an industry executive in fountain sales, the interviewee argued that Pepsi-Cola does not vertically integrate to supply fountain accounts because doing so would invite a competitive response from Coca-Cola that would make the integrated form financially unattractive.[22] The apparent equilibrium between Coca-Cola and Pepsi-Cola and the shifts in organization form for grocery and vending distribution and not for fountain distribution is consistent with the model of strategic interdependencies developed herein.

[22] Another potential explanation is that Pepsi-Co's ownership of several fast food companies (e.g., KFC, Taco Bell), which are large fountain accounts, and fear that fountain customers would respond negatively to integration caused Pepsi-Co not to integrate in the fountain channel. While we can not reject this possibility, we note that the industry executive we interviewed focused on Coca-Cola's response to integration and not customers' response as the principal strategic constraint, which provides support for our model over the alternative hypothesis.

4.2. Limitations

Admittedly, our model is a first step and is limited in a number of important ways. Admittedly, the model's application is limited to industries in which strategic behavior has competitive implications. Firms in industries with a large number of competitors and into which entry is easy are likely to be unaffected by the strategic behavior described by our model. The model is also tied to a particular demand structure and the assumption of a homogeneous product market. Product markets in which consumers are heterogeneous may lead rivals to differentiate instead of choosing different organizational forms. In this case, asset specificity may have important quality implications in addition to production capacity and cost implications. Even when differentiation is feasible, strategic behavior may guide firms' asset and organization form choices. However, our model does not investigate this possibility. Also, our model assumed a linear relationship between asset specificity and production capacity. Notably, increased levels of asset specificity did not produce lower marginal cost. Future research should examine the effects of relaxing these assumptions.

5. Conclusion

This paper makes several contributions to the extant literature. First, it expands the strategic interaction literature of industrial organization. Discrete choice and small numbers competition leads to strategic interactions concerning organizational choice. Most game-theoretic industrial organization models have not considered discrete organizational choice and strategic choice outside of the market foreclosure and price discrimination literature (see, for example, Tirole, 1988). The model developed herein investigates both discrete organizational choice and strategic choice and suggests that strategic interaction may lead competitors to adopt differing organizational forms.

Second, in their discussion of transaction cost economics and organizational choice, Riordan and Williamson anticipated but did not formalize that organizational choice may be influenced by strategic as well as efficiency concerns under a condition of small numbers competition. This paper formalizes their intuition. In particular, the paper suggests that the governance choice for an intermediate transaction may be conditioned by both the attributes of the intermediate transaction *and* strategic considerations in the firm–customer transaction. Thus, the paper adds to the transaction cost economics literature by analyzing a situation in which both economizing and strategizing are relevant to organizational choice.

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Appendix A

A.1. Proof of propositions

The well-known Cournot outcome results when firm i chooses governance u and firm j chooses governance v are as follows:

$$q^i_{uv} = \frac{1 - 2\alpha_u + \alpha_v}{3}, \quad \prod^i_{uv} = \left(q^i_{uv}\right)^2 - \beta_u$$

With two possible organizational choices, M and H, payoff functions for each possible strategy are:

Firm 2

Firm 1	M	H
M	$\left(\frac{1-\alpha_M}{3}\right)^2 - \beta_M$ $\left(\frac{1-\alpha_M}{3}\right)^2 - \beta_M$	$\left(\frac{1-2\alpha_H+\alpha_M}{3}\right)^2 - \beta_H$ $\left(\frac{1-2\alpha_M+\alpha_H}{3}\right)^2 - \beta_M$
H	$\left(\frac{1-2\alpha_M+\alpha_H}{3}\right)^2 - \beta_M$ $\left(\frac{1-2\alpha_H+\alpha_M}{3}\right)^2 - \beta_H$	$\left(\frac{1-\alpha_H}{3}\right)^2 - \beta_H$ $\left(\frac{1-\alpha_H}{3}\right)^2 - \beta_H$

Note that mode HM is symmetric to mode MH. Also, for simplicity in this and the remaining appendices we assume that $\alpha_H = 0$ and $\beta_M = 0$.

With these payoff functions four PSNE are conceivable, one for each mode. For any mode to be a PSNE, it must be in each firm's best interest not to play a different strategy. For instance, MM is PSNE if only if $\prod^1_{MM} \geq \prod^1_{HM}$ and $\prod^2_{MM} \geq \prod^2_{MH}$. Substituting in appropriate payoff functions and solving the resulting relationship in terms of α_M and β_H describes the cost regimes in which MM is a PSNE. It can be shown that by generating an equivalent constraint equation for each mode and by solving for the range of α_M and β_H for which a PSNE exists, yields:

1. MM is PSNE for $\alpha_M \leq 9\,\beta_H/4$.
2. HH is PSNE for $\alpha_M(1-\alpha_M) \geq 9\,\beta_H/4$ when $\alpha_M \leq 1/2$ and for $\beta_H \leq 1/9$ when $\alpha_M \geq 1/2$
3. MH and HM are PSNE for $4\alpha_M/9 \geq \beta_H \geq 4\alpha_M(1-\alpha_M)/9$.

The last result, PSNE for MH and HM, is problematic because a coordination problem remains: which firm is to choose M and which firm is to choose H. Fortunately, the coordination problem can be analyzed by appealing to a mixed strategy Nash equilibria (MSNE) solution concept.

Assume Firm 1 chooses M with probability p_1 and firm chooses M with probability p_2 such that p_1 and p_2 are between 0 and 1. The value to Firm 1 of playing p_1 is:

$$v_1(p_1, p_2) = p_1 p_2 \prod^1_{MM} + p_1(1 - p_2) \prod^1_{MH} + (1 - p_1)\, p_2 \prod^1_{HM} + (1 - p_1)(1 - p_2) \prod^1_{HH}$$

Similarly, the value to Firm 2 of playing p_2 is:

$$v_2(p_1, p_2) = p_1 p_2 \prod_{\mathrm{MM}}^2 + p_1(1-p_2)\prod_{\mathrm{MH}}^2 + (1-p_1)\,p_2 \prod_{\mathrm{HM}}^2 + (1-p_1)(1-p_2)\prod_{\mathrm{HH}}^2$$

After substituting in appropriate payoff equations, it can be shown that MSNE in p_1 and p_2 exists for the regime interior to $\alpha_{\mathrm{M}} \leq 1/2$, $\alpha_{\mathrm{M}} \geq 9\ \beta_{\mathrm{H}}/4$ and $\alpha_{\mathrm{M}}(1-\alpha_{\mathrm{M}}) \leq 9\ \beta_{\mathrm{H}}/4$. Fig. 3 captures these equilibria diagramatically.

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