The Performance Effects of Congruence Between Product Competitive Strategies and Purchasing Management Design

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The objective of this study is to examine a performance contingency effect between product competitive strategy and organization design using an archival approach. Specifically, this study examines a sample of 194 firms from 20 industries based on the data collected by Center for Advanced Purchasing Studies (CAPS) in its benchmarking surveys between 1989–1994 and links the benchmarking data to the COMPUSTAT (Standard & Poor's) financial data of these firms. The results of the study reveal a contingency relationship among product competitive strategies, purchasing design characteristics, and overall firm financial performance (return on assets). Specifically, the nature of this contingency relationship suggests that a firm's product competitive strategy must be enabled with a complementary design in purchasing management to promote firm performance. Given the growing practice of benchmarking at the functional level, this study also examines whether or not a firm achieving a congruency in product strategy and design will necessarily enjoy higher operational efficiency at the purchasing management level. The results show that this is true only under specific conditions. The implications of the preceding findings are discussed accordingly.
(*Contingency Theory; Supply Chain; Competitive Strategies; Benchmarking; Firm Performance*)

Contingency theory literature often suggests that a firm's overall performance may be contingent upon the nature of the alignment between its organization design and product strategy (Galbraith 1973, Tushman and Nadler 1978, Govindarajan 1986). However, empirical research that directly explores this performance contingency is sparse, even though this effect has been recognized as an important agenda for both theory and practice (e.g., Lewin and Minton 1986, Rajaratnam and Chonko 1995, Besanko et al. 1996). The importance of exploring this contingency link can be illustrated by the following observations.

The arguments underlying a performance contingency effect between organization design and strategy are compelling. After all, designing the organization to fit changing organizational practices and strategic initiatives has been a central principle of organization design (e.g., Thompson 1967). A firm's design characteristics and organizational capacities are the results of its adaptation to the changing environment (e.g., Tushman and Nadler 1978, Huber 1991, Barnett and Burgelman 1996, Hendersen and Michell 1997). Likewise, most strategic management studies have taken this adaptive view. That is, strategy

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adoption must consider a firm's environment, organizational capacities, and design characteristics (e.g., Porter 1980, Hrebiniak and Joyce 1985). Given that design and strategy are the result of managerial adaptive choices, it is important to ensure that these choices are congruent with one another, especially when this congruency affects firm performance. From a theory validation perspective, evidence of this performance contingency effect should help to define the boundary of the contingency theory. In essence, this contingency effect suggests that a firm must achieve *internal congruency* in choices between its design and strategy, while responding to the external environmental changes. In contrast, prior empirical evidence of a performance contingency effect is largely limited to the relationships between environmental influences and organization design choices (e.g., Tushman and Nadler 1978, Schoonhoven 1981, Huber et al. 1990, Doty et al. 1993) or between environmental influences and strategy orientations (e.g., Hambrick 1983, Prescott 1986, Ramaswamy et al. 1994, Kotha and Nair 1995). Thus, despite its theoretical importance, the performance contingency effect between organization design and product strategy has rarely been examined directly. In fact, of the limited studies that have directly explored this contingency link, their findings are largely based on the survey responses of limited sample size (e.g., Govindarajan 1988, Miller 1988, Huselid 1995).

The objective of this study is to explore the aforementioned performance contingency effect. Specifically, this study examines the archival data collected by Center for Advanced Purchasing Studies (CAPS) in its benchmarking surveys. By linking these benchmarking results to the COMPUSTAT financial data of these firms, this study examines the contingency relationships among the following variables after controlling for environmental effects:

(1) characteristics of product competitive strategies—cost leadership versus differentiation;

(2) characteristics of organization design of the purchasing management practices—degree of decentralization and span of (supply chain) coordination;

(3) operational efficiency of the purchasing management function; and

(4) overall firm financial performance—return on assets.

Specifically, this study seeks to answer the following two empirical questions. First, do firms that achieve a congruency between the characteristics of their product competitive strategy and the organization design characteristics of their purchasing management practices exhibit higher overall financial performance than those firms that fail to do so? Analysis of this question permits an empirical test of the performance contingency effect. The second question examined by this study is: Do firms that achieve a congruency between purchasing management design and product strategy exhibit higher efficiency at the purchasing management level than those failed to do so? This question is motivated by the growing use of benchmarking data across firms at the functional level. The conventional wisdom for this benchmarking practice is to search for "best practices of others," and that emulating these practices at the functional level should enable better performance outcomes at the firm level. The contingency theory, on the other hand, suggests that it may be a moot point to benchmark the practices of others if a firm fails to consider the conditions under which these practices are implemented.

Evidence of a performance contingency effect has important implications on many managerial contexts. For example, with the increasing strategic impact of the supply chain,[1] many firms are seeking ways to better integrate purchasing management practices and firms' strategic initiatives to improve supply chain efficiency and services (e.g., Zaheer et al. 1998). Likewise, there is a growing recognition of the importance of achieving a "fit" between human resources management policies and a firm's competitive strategies. This literature, although largely conceptual, argues that this "fit" is necessary for a firm to maintain and sustain superior performance (see Huselid 1995 for a review). Similarly, studies in the product development literature also have asserted this performance contingency effect when aligning organizational practices to a firm's new product development

[1] Surveys of manufacturing firms in the United States indicate that purchased materials account for an average of 55% of the total product costs, compared with about 15% for direct labor costs (Watts et al. 1995).

strategy (e.g., Gupta et al. 1986, Olson et al. 1995). All preceding examples highlight the growing recognition that the design characteristics of a firm should enable its chosen strategy to enjoy a sustainable performance effect (e.g., Porter 1985).

The rest of the paper is organized as follows. The next three sections provide a brief review of the relevant literature on three related constructs of interest: product strategy, purchasing organization design, and the performance effect of congruency between the two. The sections that follow describe our research sample, the methodology, and our findings. The paper concludes with a discussion of the results and their limitations.

Literature Review and Hypothesis Development

Product Strategy

To achieve a competitive advantage in products, the organization must not only create positive value; the magnitude of the created value must equal or exceed that of competitors. In essence, firms bid for customers on the basis of consumer surplus. However, different competitive strategies can be equally effective in the sense of achieving equal levels of consumer surplus at equilibrium: There is no dominant strategy (Besanko et al. 1996). As argued in Porter (1980) and others (e.g., Govindarajan 1986), firms following a cost leadership strategy focus their efforts on cost efficiency. For a given level of profits, any cost reduction can allow for a corresponding price reduction, which increases consumer surplus. Thus, a cost leadership strategy is often applied to relatively standardized, low-margin products and supported with low levels of advertising, service/maintenance/warranty costs, research and development expenditures, and other administrative expenditures. This product strategy also emphasizes other cost efficiency means such as standardized mass production, design for manufacturability, tight cost controls, and process (rather than product) innovation. In contrast, firms following a differentiation strategy intend to boost consumer surplus by emphasizing the perceived benefits of their products. Higher perceived benefits support higher prices and hence higher profit margin. Thus, a differentiation strategy is often applied to relatively unique, high-margin products and supported with high levels of advertising, service/maintenance/warranty costs, R&D expenditures, and other administrative expenditures. A differentiation strategy also emphasizes responsiveness to customer requests and in the form of manufacturing flexibility, design for uniqueness, high inventory levels, and product (rather than process) innovation.

These two product strategies are often associated with different levels of governance needs because of different levels of uncertainty from the environment, the particular forms of technologies and capital investment deployed, or the amount of coordination needed (Govindarajan 1986, Besanko et al. 1996, Fisher 1997). Products that emphasize differentiation because of their uniqueness in design and functionality face higher uncertainty in consumer demand, require a broader portfolio in capital asset investment, and demand a higher level of coordination throughout a firm's value chain. In addition, the product life cycle for these products is relatively short in that as imitators erode the competitive advantage these innovative products enjoy, firms are forced to introduce a steady stream of newer innovations—all of which demand more capital asset investment, often in diverse geographic locations. The short life cycle and the product line diversity thus 1) increase the volatility in predicting product demand, 2) require continuing higher investment in R&D and capital assets, and 3) demand higher coordination and flexibility in product manufacturing and management (e.g., Hambrick 1983, Porter 1985, Sanchez 1995). In contrast, products that emphasize cost efficiency are unlikely to face the above governance situations because of more predictable demand and longer product life cycles. This in turns permits higher efficiency in asset utilization for economies of scale.[2]

[2] It is not our intention to suggest that a firm can choose a strategy without regarding its environment. In fact, literature on strategy management suggests that a firm's environment may influence its selection of particular strategies. For example, differentiation strategies (e.g., by innovation, marketing) are typically more necessary in dynamic and uncertain environments, as recently illustrated by the heavy investments to R&D and marketing by the software and

Organization Design of Purchasing Management

Given the governance implications associated with different product strategies, how should firms design their purchasing management function? The importance of this question is further echoed by the growing practice of empowering the purchasing management function with more responsibilities across the value chain. These responsibilities include: backward integration with the upstream firms (e.g., supplier alliance), coping with demand volatility for parts and services, and improving distribution and logistic efficiency (Zaheer et al. 1998). Furthermore, it is often argued that how effectively these responsibilities are executed often depends on the product strategies used by the firms. As argued in Fisher (1997), firms with a cost leadership strategy should rely on a centralized purchasing management function to minimize inventory and maximize production efficiency throughout the supply chain. By contrast, firms with a differentiation strategy should rely on a decentralized purchasing management function due to the needs for speed and flexibility to cope with high coordination needs throughout the supply chain. For these firms, the costs of lost sales from stockouts often outweigh the savings from inventory minimization and production efficiency.

The general doctrine of contingency theory of organization design also supports the above argument. This doctrine argues that organization design should be adaptive to managers' governance needs. Differences in governance needs (e.g., from the level of uncertainty, or needs for managing complexity in asset portfolio and supply chain) create differences in information requirements (e.g., Tushman and Nadler 1978). Because different organizational structures have different information processing capacities, a firm can effectively deal with the different governance needs with appropriate design choices. For example, when governance needs are high, designs characterized by higher decentralization and decision autonomy are more appropriate than their counterparts characterized by centralization and formalization. This is because the former has a greater capacity to process information and coordinate unexpected events. Based on the preceding premise, Govindarajan (1986) argues that decentralization (centralization) is likely to be more effective and appropriate for firms using a differentiation (cost leadership) strategy because of the uncertainty and coordination differences associated with these strategies. By a similar extension, a decentralized (centralized) design is more effective for firms using nonroutine (routine) or custom (mass) production technologies or when the product designs are complex (simple) (e.g., Miller 1988). The preceding idea of aligning organization design to a firm's governance needs can also be found in the classic writings of organizational design (e.g., Thompson 1967, Galbraith 1973, and Huber and McDaniel 1986).

The above contingency approach to organization design is often premised on a cost and benefit trade-off (Galbraith 1973). A design choice better suited for higher uncertainty often is complex and costly (Tushman and Nadler 1978). Malone (1987) further provides analytical insights on the trade-off between alternative design structures and their resulting cost elements (i.e., production costs, coordination costs, and vulnerability costs). A decentralized structure is lower in coordination costs than its centralized counterpart. However, the reverse is true when comparing the production costs between the design structures. Another factor that may affect the relative efficiency of different organization structures is the need to balance the tension between the need for differentiation and the desire for cost control. For example, a differentiation product strategy requires a structure that supports innovative ideas and fosters rapid crossfunctional communication among the players to produce distinct products or services (Miller and Friesen 1983). A cost leadership strategy, on the other hand, requires a structure that emphasizes budget controls and formalization of rules to keep costs at a minimum (Porter 1980).

high-tech industries. In contrast, cost leadership strategies (e.g., by cost efficiency in design and logistics) would make sense in a stable environment where price, rather than innovation, dominates consumer choice.

The Effect on Firm Performance of Congruence Between Product Strategy and Organization Design

The above discussion suggests a performance congruency effect between product strategy and organization design. Firms pursuing differentiation strategies will likely face higher governance needs than their counterparts pursuing cost leadership strategies. Thus, for firms to exhibit superior performance, the design of their purchasing management function should emphasize responsiveness—e.g., having a management style that relies less on rigid rules and procedures, and more on forming crossfunctional teams that coordinate actions for unexpected events across the value chain. In contrast, for firms pursuing cost leadership strategies to exhibit superior performance, the design of their purchasing management function will need to emphasize cost efficiency—e.g., maximizing logistic and distribution efficiency, and relying on formalization for achieving consistency and simplicity. Accordingly, we propose the following hypothesis:

HYPOTHESIS 1. *The degree of congruency between a firm's product strategy and its design of purchasing management will be positively associated with the firm's performance.*

Note that this hypothesis stipulates that the performance effect of either product strategy or organization design is jointly determined by both: i.e., whether there is a congruency between the two. This congruency is reflected by a *complementary* relationship—similar to the "matching" concept argued in Govindarajan (1986) and Miller (1988).[3] Both studies suggest that product strategy must be enabled with a complementary organizational structure to promote firm performance. A complementary relationship hence suggests that the performance effect of a firm's chosen strategy can be either positive or negative, depending upon the nature of its design. A cost leadership (differentiation) strategy when enabled by a centralized (decentralized) design will result in a positive effect on performance; when such a relationship is absent, the performance will suffer. This conceptualization of the congruency effect is consistent with the classical thesis in organization design. For example, Chandler (1962) notes that a diversification strategy requires a multidivisional structure, whereas a geographical expansion strategy requires field units, and absence of such congruence will lead to inefficiency or weaker performance. The above congruency effect between design and strategy must be supported with a nonmonotonic form of the interaction (Schoonhoven 1981)—as will be examined in the results section.

[3] The contingency theory literature contains alternative conceptualizations of matching (see Venkatraman 1989 and Doty et al. 1993 for excellent reviews).

The Effects on Purchasing Efficiency of Congruence Between Product Strategy and Organization Design

If achieving a congruency between product strategy and purchasing management design is associated with higher firm performance, it is important to also study the growing practice of benchmarking at the functional level. Specifically, we examine whether or not a firm achieving such a congruency will necessarily enjoy higher operation efficiency at the purchasing level. On this, our expectation is that a higher purchasing efficiency is likely only for firms pursuing cost efficiency with a centralized purchasing management function. By contrast, for firms pursuing differentiation with a decentralized purchasing management design, pursuing purchasing efficiency may not even be desirable.

Evidence shows that firms pursuing cost efficiency tend to have narrow product lines in order to minimize inventory costs and to benefit from economies of scale. Likewise, these firms tend to emphasize product and process standardization to increase capacity utilization and minimize the needs for supply chain coordination. On the other hand, firms employing differentiation tend to have a broader set of products, deploying a wider variety of process technologies to create uniqueness and economy of scope (e.g., Hambrick 1983, Porter 1985, Sanchez 1995). Thus, it makes sense for a firm pursuing cost efficiency to emphasis purchasing efficiency. On the other hand, as discussed in Fisher (1997), for firms selling differentiation products, given their novelty and demand volatility throughout the supply chain, pursuing inventory efficiency and standardization is not only costly, but also difficult. These differentiated

products often demand customization throughout all stages of their life cycle (Sanchez 1995). All of these customization efforts tend to increase the costs in purchasing management as well as other product sustaining activities.

Similar arguments are made in the organization design literature. Some major virtues of centralization are to create opportunities for resource sharing, to minimize idle capacity and coordination costs, and to achieve economies of scale. On the other hand, decentralization emphasizes flexibility, time to market, and speed of coordination. In fact, evidence shows that cost efficiency firms tend to have high resource sharing, including R&D, manufacturing facilities, marketing, and administrative services, in order to capitalize on the economies of scale. In contrast, for differentiation firms the net benefits of resource sharing are far less, in that resource sharing tends to limit the flexibility as well as customization needed for the differentiated products (e.g., Gupta and Govindarajan 1986). Accordingly, it would make sense for a purchasing management function to manage highly specialized parts with suppliers capable of supporting a firm's unique product design. Clearly, doing so will result in higher coordination costs and, thus, lower purchasing efficiency than the counterpart scenario in which the purchasing management is responsible for the procurement of standardized parts from commodity suppliers.

The preceding examples suggest that even when firms achieve a congruency between product strategy and purchasing management design, not all of those firms will exhibit high operational efficiency in purchasing management. Specifically, firms pursuing cost leadership with a centralized purchasing management design are more likely to achieve higher purchasing efficiency than those firms pursuing product differentiation with a decentralized purchasing management design. The preceding discussion thus leads to the following hypothesis:

HYPOTHESIS 2. *Purchasing efficiency is more likely to be associated with firms pursuing cost efficiency with a centralized design than with those pursuing differentiation with a decentralized design.*

Method and Analysis

Sample

The Center for Advanced Purchasing Studies (CAPS) has partnered with 20 manufacturing and service industries[4] to perform benchmarking studies. Each survey project was commissioned by a set of industry partners, and thus survey questions tend to be initiated by the participants and vary across industries and/or years to reflect specific objectives and needs stipulated by the participants. Relying on these CAPS surveys presents a potential limitation of our data set: The survey instruments are not consistent over years or between industries. However, unlike the industry specific studies (e.g., Govindarajan 1986, Miller 1988, Ramaswamy et al. 1994, Kotha and Nair 1995, and Ittner and Larcker 1997), the CAPS data set has the advantage of covering a very diverse set of industries. Most of the sample firms used in this study are in the following industries: aerospace/defense (16.7%), carbon steel (7%), chemical (5.9%), computer and electronics (6.9%), food manufacturing (4.2%), machinery (4.5%), paper (8%), petroleum (10.5%), pharmaceutical (6.6%), semiconductor (10.1%), and telecommunication (6.3%).

The analysis was based upon the archival survey data collected by the CAPS between 1989–1994. Our sample selection criteria were as follows. First, we collected and standardized the 819 survey responses from firms within the manufacturing and service industries. Second, given the research need to link each company's benchmarking data to their financial statement data in the COMPUSTAT database, 95 observations from nonpublic firms (i.e., private and internationally traded) were eliminated from the sample. Because large firms with divisions in multiple industries could participate in multiple surveys, the next step in the sample selection process was to combine a firm's responses using simple averages to create one response for each firm-year. This reduced the sample size by 104 observations. An additional 134 observations were eliminated because of missing

[4] They have also performed studies with banking, investment recovery and financial services firms, educational institutions, and governmental agencies. Those industries have been omitted from this study.

Table 1 Panel A **Descriptive Statistics for Variables from CAPS Surveys**

Variables (CAPS sample used)	Mean (STD)
Number of purchasing functions	4.92 (2.56)
Number of potential functions	11.28 (3.74)
Purchasing operating expense (million)	64.17 (489.96)
Purchasing headcount	154.27 (262.38)
Professional purchasing headcount	101.86 (189.80)
Total purchase amount (million)	1,154.85 (1,707.47)
Numbers of active suppliers	8,008.09 (14,217.40)
Numbers of active suppliers Responsible for 90% of purchase	1,247.43 (2,328.86)
Percent of purchase using EDI	14.84 (22.13)
N: Number of sample firms	194

Table 1 Panel B **Selected Variables: Final CAPS Sample vs. COMPUSTAT**

	Sample mean (STD)	COMPUSTAT mean (STD)
AST_UTIL: Fixed assets/net sales	1.13 (0.59)	1.65 (2.07)
EMPLOYEE: Numbers of firmwide employees	42,678 (71,398)	6,905 (27,378)
FCF: Std of cash/operating income	0.30 (0.50)	1.74 (25.23)
FSIZE: Market capitalization: Log(price × shares outstanding)	7,928 (13,491)	1,025 (4,180)
GMR (%): Gross margin/net sales	0.34 (0.18)	0.32 (0.37)
INV_TR: Inventory turns	9.17 (15.23)	15.87 (37.07)
MKBK: Market to book ratio	2.55 (2.31)	3.08 (95.24)
NEW_INV: New capital expenditures/net sales	0.13 (0.09)	0.18 (0.56)
RDPROP: R&D expenditures/ net sales	0.03 (0.05)	0.07 (0.45)
ROA: Return on assets (excluding interest charges)	0.10 (0.07)	−0.01 (1.98)
Sales: Company sales dollars (million)	8,447.31 (15,098)	1,237.58 (5,804)
N	194	35,958

data from COMPUSTAT and the need for including the most common benchmarking questions used in the CAPS survey across all industries and over time. Finally, to avoid the problem of repeated measures—i.e., multiple observations for a given firm over different years—an average value for the corresponding variables of a firm is calculated for the final analysis.[5] We thus have a total of 194 unique firms for our final analysis.[6] Table 1 provides the descriptive statistics for the variables associated with the sample firms and how they compared to the overall Standard & Poor's COMPUSTAT firms. As shown in this table, the sample firms included in our analysis are relatively larger in size and market share.

Measures for Product Strategy

This study uses Porter's (1980) strategy framework to conceptualize a firm's product strategy. This framework is well accepted and internally consistent (e.g., Hambrick 1983, Dess and Davis 1984, Govindarajan 1988, Miller 1988) and is empirically congruent with other frameworks such as Miles and Snow's topology of strategies (e.g., Galbraith and Schendel 1983, Shortell and Zajac 1990). Porter (1980) identifies two generic ways in which a firm can gain a sustainable competitive advantage: "cost leadership" and "differentiation." A cost leadership strategy requires "aggressive construction of efficient scale facilities, vigorous pursuit of cost reduction from experience, tight cost and overhead control... and cost minimization in area like R&D, service, sales force, advertising and so on" (Porter 1980, p. 35). In contrast, to adopt a differentiation strategy a firm "selects one or more attributes that many buyers in an industry perceive as important, and unique strategy." It can take many forms, including R&D, marketing and advertising for brand image, pre- and postsales service, quality, and product attributes.

To capture Porter's conceptualization of product strategies, the current study uses two measurement criteria. First, the measures of product strategy are based on the financial-statement-level data extracted from COMPUSTAT. This permits an explicit gauge on the "realized strategies" rather than the "intended strategies" (Mintzberg 1978). In addition, by using the financial-statement-level data, these measures are not prone to the perceptual biases—a rising concern noted in the recent strategy literature (see Reger and

[5] One possible solution to this problem is to apply the technique of unbalanced panel analysis. However, given that many of the firms have firm years of less than three, the trade-off of a panel analysis will be a substantial reduction of the numbers of firms included in the analysis.

[6] As for robustness analysis, an alternative approach is to use the most recent observation of a given firm as the final sample. In a later section of the sensitivity analysis we will discuss our findings under this approach.

Huff 1993 for a review). Second, the selected measures must be identified by the prior studies (see below) as reflecting the cost efficiency or the differentiation dimension of a firm's product strategies. Following these two criteria, the following six variables were selected.

(1) R&D Propensity. R&D Expenditures divided by Net Sales. This ratio captures an aspect of a firm's product differentiation strategy (e.g., Porter 1980, Hambrick 1983, Prescott 1986). The higher the R&D propensity, the more likely the firm is pursuing product differentiation by way of new product innovation and functionality.

(2) Advertising and Administrative to Net Sales. Sum of advertisement and administrative expenses over the company's net sales. This ratio reflects the proportion of resources a firm devotes to servicing/marketing its products. By having a greater emphasis in advertising and services, a firm can achieve differentiation by crafting its product image and strengthening postsales support. The higher the ratio, the more likely the firm is pursuing differentiation by service and/or brand name marketing (e.g., Kobrin 1991, Kotha and Nair 1995).

(3) Relative Gross Margin. The moving average (up to 10 years) of the differences between a firm's gross margin and industry mean gross margin. Rather than focusing on an individual firm's gross profit margin, we focused on the relative gross profit margin of the firm against the industry average. A larger value of this measure implies the firm's ability to command a higher profit margin as compared to its peers and is likely to be associated with a differentiation product strategy (e.g., Porter 1985, Besanko et al. 1996).

(4) Market to Book Ratio. Closing share price multiplied by the number of common shares divided by common equity. This ratio mirrors a firm's potential growth opportunities—a commonly used measure for assessing a firm's ability to secure abnormal returns in the future years (i.e., market price), given its investment base (i.e., book value) (Palepu et al. 1996). Thus, one expects a positive association between this measure and a firm's tendency in pursuing a differentiation product strategy.

(5) New Capital Investment to Sales. Amount of new capital investment divided by a company's net sales.

(6) Asset Utilization. Amount of total fixed assets divided by a company's net sales. Both (5) and (6) measure a firm's efficiency in utilizing its capital investments for revenue generation. Thus, they reflect a critical dimension of cost efficiency in that the lower the ratio between input (i.e., capital assets) and output (i.e., sales), the more likely a firm is to achieve cost efficiency in utilizing its resources (e.g., Hambrick 1983, Prescott 1986, Kotha and Nair 1995). In addition, capital asset investment has been shown to be a critical strategic option of a firm (e.g., Gale 1980, Porter 1980). A firm focusing on differentiation often needs to invest in a wider range of capital assets to allow for greater resource redeployment and coordination flexibility in product development, manufacturing, and distribution (Sanchez 1995). In contrast, a firm pursuing cost efficiency often opts to restrict, and thus minimize, its investments to fewer specific assets to achieve greater economies of scale and resource sharing in asset utilization (e.g., Porter 1985, Gupta and Govindarajan 1986). Thus, a smaller value of these variables is likely to be associated with firms pursuing a cost leadership strategy.

Based on the preceding description, the first four variables (1–4) reflect the product uniqueness dimension of a firm's differentiation strategy, whereas the last two variables (5–6) reflect the intensity of the capital asset investment to support the strategy. These six variables were factor analyzed for their construct validity and a parsimonious representation of a firm's product strategy[7] (Kim and Mueller 1978). As

[7] These financial statement variables are arithmetically linked to the dependent variable (i.e., ROA) and may thus produce R^2 that is biased upward. However, the focus of this current study is not on the main effect of these variables, but rather their interactive effect with the design variables on ROA. As noted in Prescott (1986, p. 337), the interpretation of the interaction effects on ROA between strategy and design remains valid despite an inflated R^2.

expected, the factor analysis results show two dimensions. The first factor is *Product Uniqueness* (denoted UNIQ) (Eigenvalue = 2.73). The second factor is *Capital Intensity* (denoted CAP_INT) (Eigenvalue = 1.57). The higher (lower) the factor score in either dimension reflects a firm's greater (lesser) emphasis on differentiation. The raw factor scores from the preceding analysis were standardized and rescaled to the range of −1 to 1 and used as the inputs to the subsequent main analyses (described later).

Measures for Organization Design at Purchasing Management Level

All measures of organization design variables for purchasing management are based on a common set of survey data used in the benchmarking studies by CAPS and guided by the prior studies (see below). These measures are:

(1) Organization Form. Degree of decentralization vs. centralization. This measure has received persistent attention in the literature, has been used extensively in practice (see Huber et al. 1990 for a survey), and is believed to have effects on organization performance (Govindarajan 1986, Lewin and Minton 1986). This measure has been frequently used to proxy the extent of within-firm governance style—e.g., the degree of decentralization and flexibility in decision making.

(2) Purchasing Dollars per Supplier. Total purchase amount divided by number of suppliers.

(3) Supplier Concentration. Number of active suppliers accounting for 90% of purchases. Measures 2 and 3 reflect the distribution or concentration of purchasing activities of a firm and gauge the nature of the supplier relationship. Collectively, these two measures reflect the governance style used by a firm to manage its upstream suppliers (Heide and John 1990, Heide 1994). Firms that use a market mechanism will have a greater number of suppliers with a smaller amount of purchase per transaction (i.e., low purchasing dollars per supplier and lower supplier concentration). Conversely, firms using a partnership mechanism often show an opposite pattern (Noordewier et al. 1990).

(4) Span of Coordination. This is measured by the number of other functions (e.g., quality assurance, transportation logistics, R&D) that report to the purchasing management function divided by the total number of all applicable functions listed on the CAPS survey. A greater span of coordination suggests a higher reliance on crossfunctional teams for communication and resolving unanticipated problems (Dobler and Burt 1996).

(5) Percent of Purchases Through Electronic Data Interchange (EDI) Usage. The greater use of EDI signals a higher degree of logistic coordination between firms and their trading partners (Greis and Kasarda 1997, MacDuffie and Helper 1997). It also indicates a higher level of commitment between firms in that this requires greater investment in information technology for communication and execution of transactions (Heide 1994).

The first three variables (1–3) are used to proxy the organizational governance structure and the last two variables (4–5) are used to proxy the scope of coordination. Using the same rationale as in the analysis for product strategy, we factor analyzed these five measures of organization design. As expected, the results show two factor dimensions. The first factor, *Organizational Structure* (denoted DECENT) (Eigenvalue = 1.28), reflects the governance structure of the purchasing management function, with a higher (lower) score denoting greater decentralization (centralization). The second factor dimension *Scope of Activities* (denoted SCOPE) (Eigenvalue = 1.06), reflects the extent of coordination of purchasing-related activities, with a higher (lower) score denoting more (less) extensive coordination. Again, the preceding raw factor scores were standardized and rescaled to the range of −1 to 1 and used in the later main analysis.

Measures of Interaction

Following Schoonhoven (1981) and others (Govindarajan 1988, Ittner and Larcker 1997), we adopt a multiplicative form of interaction for our model. Four interactive variables are created by multiplying each product strategy factor score by each purchasing organization design factor score. Furthermore, transforming factor scores to a value in the range of −1 and +1

Table 2 Defining the Multiplicative Interactive Terms

		Product uniqueness (factor score)		Capital intensity (factor score)	
		Unique (+)	Functional (−)	High capital intensity (+)	Low capital intensity (−)
Purchasing organizational structure (factor score)	Decentralized (+)	Congruent (A)	Not congruent	Congruent (C)	Not congruent
	Centralized (−)	Not congruent	Congruent (A)	Not congruent	Congruent (C)
Scope of purchasing activities (factor score)	Extensive (+)	Congruent (B)	Not congruent	Congruent (D)	Not congruent
	Narrow (−)	Not congruent	Congruent (B)	Not congruent	Congruent (D)

allows extreme values of both factor scores (positive or negative) to be defined as a "congruent" organization. For example, a negative value of the organizational structure factor score (highly centralized purchasing organization) multiplied by a negative value of the product uniqueness factor score (functional product) is defined as a "congruent" organization.

Table 2 provides a brief summary of the various congruency constructs. A differentiation (cost leadership) product strategy, i.e., high (low) degree of product uniqueness or capital intensity, with a highly decentralized (centralized) purchasing organization or requiring relatively extensive (narrow) coordination among various purchasing management activities are defined to be congruent organizations. Pursuing differentiation (i.e., unique products and high capital intensity) requires managers to be close to the market and to be responsive to changes of conditions in both technology and market. Thus, a more flexible and decentralized purchasing management organization is more likely to perform well in situations where a firm pursues a differentiation strategy with unique products. Similarly, differentiation requires innovation. Thus, extensive coordination across functional areas is crucial for achieving fast turnaround time on design, product engineering, and procurement. We therefore expect that purchasing activities may require more extensive coordination.

Measures of Purchasing Operational Efficiency

Three measures of purchasing operational efficiency are used in the study: purchasing amount per dollar of purchasing operating expenses, purchase amount per employee, and inventory turnover. All three measures are commonly used for benchmarking operational efficiency of a purchasing organization. In fact, these measures were consistently captured in the benchmarking surveys conducted by CAPS. A higher purchasing amount per dollar of expenses or per employee is assumed to be more efficient in executing purchasing activities. Similarly, inventory turnover captures the efficiency gains from reducing a company's inventory buffer. High inventory turnover means lower carrying cost, fewer defects and spoilage, and more efficient resource utilization. Purchasing dollars per purchasing operating expenses and the number of purchasing employees were obtained from the CAPS surveys, as was inventory turnover. COMPUSTAT data is used only when inventory turnover was not available from a survey.

Measure for Financial Performance

Return on assets has been used in many studies to examine the performance effects of corporate strategies (e.g., Ramaswamy et al. 1994, Roger et al. 1999) and design characteristics, including supplier management policies (Ittner and Larcker 1999). This measure is appropriate when the management phenomena in question may impact both a firm's income

Table 3 Correlation Among Product Strategy, Purchasing Organization Design, and Performance Variables

	Product strategy		Purchasing org. design		Overall financial performance	Purchasing operating efficiency		
	UNIQ	CAP_INT	DECNT	SCOPE	ROA	PUR_EFF1	PUR_EFF2	TURNS
UNIQ	—							
CAP_INT	—	—						
DECNT	−0.09	0.16	—					
SCOPE	−0.16**	0.12	—	—				
ROA	0.62*	−0.28*	−0.12+	−0.05	—			
PUR_EFF1	−0.10	−0.02	−0.11	−0.02	−0.01	—		
PUR_EFF2	−0.07	−0.01	−0.44*	0.07	−0.01	0.23*	—	
TURNS	−0.16**	−0.04	−0.03	0.08	−0.02	−0.05	−0.03	—

*Significant at 1% level; **Significant at 5% level; +Significant at 10% level;
UNIQ: Factor 1 of product strategy—product uniqueness;
CAP_INT: Factor 2 of product strategy—capital intensity;
DECNT: Factor 1 of purchasing organization design—organizational structure;
SCOPE: Factor 2 of purchasing organization design—scope of activities;
ROA: Operating income before extraordinary events, tax and interest expenses;
PUR_EFF1: Log(purchasing dollars per dollar of purchasing expense)—purchasing efficiency;
PUR_EFF2: Log(purchasing dollars per purchasing employee)—purchasing efficiency;
TURNS: Inventory turnover.

and its assets. As discussed earlier, firms in this study that adopt differentiation strategies may enjoy higher gross margins and profits, but may require more assets to produce their products. Thus, looking solely at income or asset utilization measures would be inappropriate. Rather, using return on assets combines both measures and enables an examination of their joint effect on firm performance (Balakrishnan et al. 1995). In this study, return on assets is calculated before interest and extraordinary events (denoted ROA). Because a firm's financing policy and extraordinary events are outside of the scope of purchasing, it was determined that this measure of firm performance was more appropriate than others.[8] Simple Pearson correlation among the product strategy factors, purchasing organization structure, efficiency measures of the purchasing management function, and the overall financial performance measures are provided in Table 3.

[8] For the same reason, we do not use Return on Equity (ROE) as the performance measure. This is because measurement such as ROE often reflects the net outcomes of a firm's financing and equity decisions. However, the focus of this study is exclusively on operation aspects of purchasing management.

Control Variables

To focus on the interactive effects between strategy and design on performance as stipulated earlier, the environmental influences at both industry and firm levels must be controlled (e.g., Dess and Beard 1984, Hrebiniak and Joyce 1985, Prescott 1986, Miller 1988, Huselid 1995). The industry-level control variables (defined by three-digit SIC code) include four measures (1–4), and the firm-level variables include four measures (5–8). These measures are defined as follows:

(1) IR&D. Industry R&D propensity, calculated based on aggregate R&D expenditures divided by aggregate net sales of an industry.

(2) IHERF. Industry competitiveness, and it is measured by using the Herfindahl index as calculated by the sum of the squares of the market shares for the firms in the industry.

(3) IDU. Industry demand uncertainty, calculated by the standard deviation of industry average net

sales. The measure reflects the demand fluctuation and market uncertainty of an industry.

(4) ICS. Industry cost to sales ratio, reflected by an industry's profit margin or profitability (the moving average of the aggregate cost of goods sold/aggregate net sales).

(5) FDU. Firm-level demand uncertainty (standard deviation of the residual terms from regressing individual firm's net sales against industry average).

(6) FCS. Relative firm-level cost to sales ratio (firm-level cost to sales ratio minus industrywide cost to sales ratio); reflected by a firm's profit margin or profitability as compared to its peers.

(7) FCF. Firm-level cash flow predictability (standard deviation of cash flow divided by operating income).

(8) FSIZE. Proxy by the log of a firm's total market value.[9]

Results

Testing Hypothesis 1

Hypothesis 1 predicts a congruence effect on performance between product strategy and organization design on performance. To test the hypothesis, we use the following two-step regression with the hypothesized effect modeled as the interaction terms. The first step of the analysis (i.e., Equation (1)) extracts the effects of environmental, industry- and firm-specific variables out of the raw performance measure. The adjusted performance measures (i.e., $E_{i,j}$ in Equation (1), renamed ROA_a in Equation (2)), represent the residuals from the regression of performance variable on environmental and other moderator variables (Ittner and Larcker 1997).

$$\begin{aligned}\mathrm{ROA}_{i,j} &= a_0 + a_1\mathrm{IR\&D}_j + a_2\mathrm{IHERF}_j + a_3\mathrm{IDU}_j \\ &\quad + a_4\mathrm{FDU}_{i,j} + a_5\mathrm{ICS}_j + a_6\mathrm{FCS}_{i,j} + a_7\mathrm{FCF}_{i,j} \\ &\quad + a_8\mathrm{FSIZE}_{i,j} + E_{i,j}. \qquad (1)\end{aligned}$$

$$\begin{aligned}\mathrm{ROA}_{a_{i,j}} &= b_0 + b_1\mathrm{UNIQ}_{i,j} + b_2\mathrm{CAP\_INT}_{i,j} \\ &\quad + b_3\mathrm{DECNT}_{i,j} + b_4\mathrm{SCOPE}_{i,j} \\ &\quad + b_5\mathrm{UNIQ}*\mathrm{DECNT}_{i,j} + b_6\mathrm{UNIQ}*\mathrm{SCOPE}_{i,j} \\ &\quad + b_7\mathrm{CAP\_INT}*\mathrm{DECNT}_{i,j} \\ &\quad + b_8\mathrm{CAP\_INT}*\mathrm{SCOPE}_{i,j} + \varepsilon_{i,j}. \qquad (2)\end{aligned}$$

Note Equation (1) "purges" the effects of environmental variables on the performance measure. Thus, by construction, the "residuals" term (i.e., $\mathrm{ROA}_{a_{i,j}}$, the adjusted performance measure) will contain no environmental effects. As a result, Equation (2) regression captures the "incremental" variation of a firm's financial performance attributed to the strategy and organization design variables. Using a two-step regression is based on the assumption that the existing strategy and organization design reflect the results of managerial "adaptation" to changes in environmental factors.[10] Thus, by treating the environmental factors as *exogenous*, this study focuses on the congruency effects of product strategy and organization design on financial performance.[11]

Table 4 presents the regression results: Of the four interaction terms, two are significant and one is marginally significant. Specifically, we observed a marginally significant interaction between Product Uniqueness (UNIQ) and Organization Structure (DECNT), significant interactions between Capital Intensity (CAP_INT) and Organization Structure (DECNT), and between Capital Intensity (CAP_INT) and Scope of Activities (SCOPE). We did not detect any significant interaction effect between Product Uniqueness (UNIQ) and Scope of Activities (SCOPE).

The presence of significant interaction terms is only a necessary but not a sufficient condition for supporting the hypothesized congruency effect. The functional form of these interaction terms must be nonmonotonic. To examine the functional form, we

[9] We also use the log value of total assets as a proxy for size. Qualitatively, our findings remain the same.

[10] This is an assumption commonly found in many contingency theory studies on design choices (e.g., Tushman and Nadler 1978, Huber et al. 1990) and strategy adoptions (e.g., Porter 1980, Hrebiniak and Joyce 1985). This assumption, however, does not presume that all firms have adapted to their environmental contingencies successfully.

[11] However, it is important to note that the purpose of above two-step regression is *not* to remove collinearity among the environmental, strategies, and design variables. See the sensitivity analysis section for further discussion.

Table 4 Performance Outcomes at the Firm Level (Residual Model)

$$ROA_{i,j} = a_0 + a_1 IR\&D_j + a_2 IHERF_j + a_3 IDU_j + a_4 FDU_{i,j} + a_5 ICS_j + a_6 FCS_{i,j} + a_7 FCF_{i,j} + a_8 FSIZE_{i,j} + E_{ij}$$

$$ROA_a = b_0 + b_1 UNIQ_{i,j} + b_2 CAP\_INT_{i,j} + b_3 DECNT_{i,j} + b_4 SCOPE_{i,j} + b_5 UNIQ * DECNT_{i,j} + b_6 UNIQ * SCOPE_{i,j} + b_7 CAP\_INT * DECNT_{i,j} + b_8 CAP\_INT * SCOPE_{i,j} + \varepsilon_{i,j}$$

	Dependent variable: ROA_a (t-statistics in parentheses)
INTERCEPT	−0.004 (0.35)
UNIQ	0.042 (2.78)*
CAP_INT	−0.061 (3.03)*
DECNT	0.045 (1.68)+
SCOPE	0.016 (0.76)
UNIQ * DECNT	0.059 (1.45)+
UNIQ * SCOPE	−0.023 (0.84)
CAP_INT * DECNT	0.112 (2.208)**
CAP_INT * SCOPE	0.060 (1.606)**
R^2	0.26
F-statistics	9.57
N	194

Main effects: Two-tail test; *Significant <1% level; **Significant <5% level; +Significant <10% level;
Interactions: One-tail test; *Significant <1% level; **Significant <5% level; +Significant <10% level;
ROA_a: Adjusted performance measure; $E_{i,j}$ from Equation (1), renamed;
UNIQ: Factor 1 of product strategy—product uniqueness;
CAP_INT: Factor 2 of product strategy—capital intensity (new & old investment);
DECNT: Factor 1 of purchasing organization design—organizational structure;
SCOPE: Factor 2 of purchasing organization design—scope of activities;
UNIQ * DECNT: Interaction of Factor 1 of product strategy with Factor 1 of purchasing*;
UNIQ * SCOPE: Interaction of Factor 1 of product strategy with Factor 2 of purchasing;
CAP_INT * DECNT: Interaction of Factor 2 of product strategy with Factor 1 of purchasing;
CAP_INT * SCOPE: Interaction of Factor 2 of product strategy with Factor 2 of purchasing;
IHERF: Herfindahl index for concentration indices;
IR&D: Industrial R&D expenditures divided by industrial sales (based on two-digit SIC);
ICS: Common industry cost-to-sales ratio;
IDU: Common industrywide demand uncertainty;
FCS: Firm-level average relative cost to sale ration;
FDU: Firm-level relative demand uncertainty;
FCF: Firm-level cash flow predictability;
FSIZE: Log of total market capitalization;
ROA: Operating earning before tax and interest expenses.

first take the partial derivatives of the Performance Equation (2) with respect to the purchasing organization variables:

$$\frac{\partial ROA_a}{\partial DECNT} = b_3 + b_5 UNIQ + b_7 CAP\_INT. \quad (3)$$

$$\frac{\partial ROA_a}{\partial SCOPE} = b_4 + b_6 UNIQ + b_8 CAP\_INT. \quad (4)$$

As shown in Equations (3) and (4), respectively, the values of $\partial ROA/\partial DECNT$ and $\partial ROA_a/\partial SCOPE$ depend on both of the product strategy factors: uniqueness (UNIQ) and capital intensity (CAP_INT). A nonmonotonic relationship requires the presence of an inflection point such that the value of $\partial ROA/\partial DECNT$ and $\partial ROA_a/\partial SCOPE$ will change sign (e.g., from negative to positive). As will be seen next, for each equation one must solve the corresponding inflection point for UNIQ and CAP_INT separately, while holding the effect of the other constant.

Table 5 Panel A Inflection Points

	Estimated inflection point	Cumulative probability for the estimated inflection point to be within the range of sample factor scores
Interaction of decentralization vs. uniqueness: $UNIQ^*_{DECNT}$	$UNIQ^*_{DECNT} = -0.108$	$Prob(UNIQ^*_{DECNT} \in [-1, 1]) \cong 0.99$
Interaction of scope vs. uniqueness: $UNIQ^*_{SCOPE}$	NA	NA
Interaction of decentralization vs. capital intensity: $CAP\_INT^*_{DECNT}$	$CAP\_INT^*_{DECNT} = -0.204$	$Prob(CAP\_INT^*_{DECNT} \in [-1, 1]) \cong 0.93$
Interaction of scope vs. capital intensity: $CAP\_INT^*_{SCOPE}$	$CAP\_INT^*_{SCOPE} = 0$	$Prob(CAP\_INT^*_{SCOPE} \in [-1, 1]) \cong 0.99$

NA: interaction of product uniqueness and scope of activities was not available.

Table 5 Panel B The Sign of the Partial

	Below inflection point	Above inflection point
Interaction of decentralization vs. uniqueness: $UNIQ^*_{DECNT}$	$\frac{\partial ROA_a}{\partial DECNT}\Big\|_{UNIQ \le UNIQ^*_{DECNT}} \le 0$	$\frac{\partial ROA_a}{\partial DECNT}\Big\|_{UNIQ > UNIQ^*_{DECNT}} > 0$
Interaction of decentralization vs. capital intensity: $CAP\_INT^*_{DECNT}$	$\frac{\partial ROA_a}{\partial DECNT}\Big\|_{CAP\_INT \le CAP\_INT^*_{DECNT}} \le 0$	$\frac{\partial ROA_a}{\partial DECNT}\Big\|_{CAP\_INT > CAP\_INT^*_{DECNT}} > 0$
Interaction of scope vs. capital intensity: $CAP\_INT^*_{SCOPE}$	$\frac{\partial ROA_a}{\partial SCOPE}\Big\|_{CAP\_INT \le CAP\_INT^*_{SCOPE}} \le 0$	$\frac{\partial ROA_a}{\partial SCOPE}\Big\|_{CAP\_INT > CAP\_INT^*_{SCOPE}} > 0$

We substitute the values of the coefficients from Table 4 into Equation (3), resulting in:

$$\frac{\partial ROA_a}{\partial DECNT} = 0.045 + 0.059UNIQ + 0.112 \times CAP\_INT. \quad (3b)$$

Then, by setting Equation (3b) equal to zero, one can solve for the inflection point of UNIQ for $\partial ROA/\partial DECNT$. This results in:

$$UNIQ^*_{DECNT} = -\frac{0.045 + 0.112 \times CAP\_INT}{0.059}. \quad (3c)$$

Now consider the case when the value of CAP_INT equals the sample mean (−0.344). Equation (3c) yields an inflection point $UNIQ^*_{DECNT} = -0.108$ (reported in Column 2 of Table 5 Panel A). As can be shown, $\partial ROA_a/\partial DECNT$ is *negative* when $-1 \le UNIQ < -0.108$ and *positive* when $0.108 \le UNIQ \le 1$ (reported in Table 5 Panel B).

Note that the preceding calculation uses estimates (e.g., 0.045, 0.059, and 0.112) from the regression model (Table 4). Hence the corresponding inflection point is not deterministic. In addition, from Equation (3c) the inflection point is a *nonlinear* function of these estimates. Unlike previous studies, we provide an estimate of the probability that the inflection point is within the range of the observed sample data. We use a linear Taylor series approximation (Greene 1993) for estimating the inflection points, and its corresponding Wald statistics (details upon request from the authors). We conclude that the *p-value* to reject the null hypothesis that the inflection point is outside the entire range of the sample data $Pr\{UNIQ^*_{DECNT} \notin$

$[-1, 1]\}$ is less than 0.01 (Table 5 Panel A). This shows a statistically significant nonmonotonic relationship.

Following similar procedures, from Equation (3b) one can solve for the inflection point of CAP_INT as:

$$\text{CAP\_INT}^*_{\text{DECNT}} = -\frac{0.045 + 0.059 \times \text{UNIQ}}{0.112}. \quad (3d)$$

Substituting the sample mean score of -0.386 for product uniqueness, UNIQ, in Equation (3d) yields an inflection point $\text{CAP\_INT}^*_{\text{DECENT}} = -0.204$ (reported in Column 2 of Table 5 Panel A). Consequently, $\partial \text{ROA}_a/\partial \text{DECNT}$ (Equation (3b)) is *negative* when $-1 \le \text{CAP\_INT} < -0.204$ and *positive* when $-0.204 \le \text{CAP\_INT} \le 1$ (reported in Table 5 Panel B). As before, by using a Taylor series approximation and the related Wald statistics we conclude that the *p-value* to reject a null hypothesis that the inflection point is outside the entire range of the sample data, $\Pr\{\text{CAP\_INT}^*_{\text{DECNT}} \notin [-1, 1]\}$, is less than 0.07 (Table 5 Panel A). This again shows a statistically significant nonmonotonic relationship.

Similarly, one can test for the existence of a nonmonotonic relationship in Equation (4). Note from Table 4 that the coefficients b_4 and b_6 are not significant statistically. We therefore let b_4 and $b_6 = 0$ in the following analysis. Substituting the b_8 coefficient from Table 4 into Equation (4) results in:

$$\frac{\partial \text{ROA}_a}{\partial \text{SCOPE}} = 0.060 \times \text{CAP\_INT}. \quad (4a)$$

The inflection point of product strategy, $\text{CAP\_INT}^*_{\text{SCOPE}}$, on $\partial \text{ROA}/\partial \text{SCOPE}$ is then:

$$\text{CAP\_INT}^*_{\text{SCOPE}} = -\frac{0}{0.060} = 0. \quad (4b)$$

Thus, the $\partial \text{ROA}_a/\partial \text{SCOPE}$ slope changes sign at $\text{CAP\_INT}^*_{\text{SCOPE}} = 0$, showing the relationship to be nonmonotonic. The probability that this inflection point is outside the entire range of the sample data, $\text{Prob}(\text{CAP\_INT}^*_{\text{SCOPE}} \notin [-1, 1])$, is less than 0.01 (Table 5 Panel A), indicating a statistically significant nonmonotonic relationship. Finally, the inflection point of product uniqueness, UNIQ, on $\partial \text{ROA}_a/\partial \text{SCOPE}$ was not tested as the UNIQ∗SCOPE interaction was not significant.

In summary, of the four interactions between product strategy (UNIQ, CAP_INT) and organization design (DECNT, SCOPE), three interactions are significant: UNIQ∗DECENT, CAP_INT∗DECENT, and CAP_INT∗SCOPE, and each reflects a nonmonotonic relationship. These results support Hypothesis 1, which predicts that the performance effect of either product strategy or organization design is determined jointly by both.

Testing Hypothesis 2

Hypothesis 2 posits that purchasing efficiency is more likely to be associated with firms pursuing cost efficiency with a centralized design than those pursuing differentiation with a decentralized design. This is because emphasizing purchasing efficiency makes sense only for a subset of the congruent firms that are pursuing cost efficiency strategy with a centralization design. To test this hypothesis, we first extract a common factor from all three measures of purchasing efficiency. This permits a parsimonious test. We rank ordered the sample firms by their common factor score and classified those above (below) the median as high (low) in purchasing efficiency. We likewise classify the sample firms by using the median factor score of Uniqueness and Organizational Structure (the degree of decentralization). Table 6 Panel A presents the frequency distribution from the preceding classification. The results show that among firms that achieve a congruency ($N = 93$), those firms low in product uniqueness and with a centralized design are more likely to be higher in purchasing efficiency than those high in uniqueness and with a decentralized design ($\chi^2 = 7.23$, $p < 0.01$). In contrast, among those firms that failed to achieve a congruency ($N = 101$), no such relationship exists ($\chi^2 = 1.11$, $p = 0.293$). In addition, we repeat the preceding analysis using a regression model, with purchasing efficiency factor score as a continuous dependent variable and product uniqueness and organization structure as the dummy variables. The results (not reported in the table) show that congruent firms with low product uniqueness and centralized design exhibit a higher purchasing efficiency than those firms with high product uniqueness and decentralized design. ($t = 1.81$, $p < 0.05$). For noncongruent firms, no such relationship exists.

We repeat this procedure by reclassifying the sample firms using the median factor score of the degree

Table 6 Panel A **Effects of Congruent Product Uniqueness and Organizational Structure on Purchasing Efficiency**

	Congruent		Not congruent	
	Low uniqueness & centralization purchasing org.	High uniqueness & decentralized purchasing org.	Low uniqueness & decentralized purchasing org.	High uniqueness & centralized purchasing org.
% of firms with high purchasing efficiency	60.0% (33/55)	31.6% (12/38)	47.8% (32/67)	58.82% (20/34)
	$\chi^2 = 7.23^*$		$\chi^2 = 1.11$	

Table 6 Panel B **Effects of Congruent Capital Intensity and Organizational Structure on Purchasing Efficiency**

	Congruent		Not congruent	
	Low capital investment & centralized purchasing org.	High capital investment & decentralized purchasing org.	Low capital investment & decentralized purchasing org.	High capital investment & centralized purchasing org.
% of firms with high purchasing efficiency	70.8% (34/48)	48.7% (19/39)	37.8% (25/66)	46.43% (19/41)
	$\chi^2 = 4.42^{**}$		$\chi^2 = 0.75$	

*Significant <1% level.
**Significant <5% level.

of centralization and that of the second factor of product strategy—i.e., degree of capital intensity. The frequency distribution is presented in Table 6, Panel B. Again, for firms achieving a congruency ($N = 87$), the same pattern of results is observed as in the previous test ($\chi^2 = 4.42$, $p < 0.05$). Firms low in capital intensity (i.e., emphasis on efficiency) with a centralized design are higher in purchasing efficiency than those firms high in capital intensity (emphasis on differentiation) with a decentralized design. Again, we ran a parallel test using a regression model with the purchasing efficiency factor score as the continuous dependent variable and capital intensity and organization design as the dummy variables. For the congruent firms, the results show the same pattern as before ($t = 2.41$, $p < 0.05$). The above results support Hypothesis 2—purchasing efficiency is more likely to be associated with firms pursuing cost efficiency with a centralized design than with firms pursuing differentiation with a decentralized design.

Sensitivity Analysis

To check the robustness of our model and findings, several sensitivity analyses were conducted. First, in light of the potential collinearity among environmental, strategies, and design variables, we performed an analysis using a full model that combines both Equations (1) and (2). Analytically, it can be shown that the following relationship holds among the coefficients between the full and two-step model: beta (of full model) = beta (of two-step) $[1 - \rho^2_{\text{Env,Strategy}}]$. Indeed, after comparing the regression coefficients from the full model to those from the two-step model, we found that the differences were minimal. Thus, collinearity is not a problem. Second, to address some

of the concerns that the impacts of strategy and organization design variables on performance may not necessarily be instantaneous, a one-year-lag model was estimated for testing the matching hypotheses (results not reported in the paper). Overall, the findings are qualitatively the same. Third, we also ran other sensitivity analyses including: use alternative measures of firm performance (e.g., return on assets after interest, depreciation, and tax expenses) and select the most recent observation of each firm's for the analysis (rather than the average of the multi-year observations, as was done in the reported main analysis). Again, the results of these analyses were qualitatively similar to those reported in the main analysis.

Discussion of Results and Implications

The major findings of this study are summarized as follows. Consistent with Hypothesis 1, the performance effect of either product strategy or organization design is determined jointly by whether there is a congruency between the two. Specifically, firm performance is higher when firms pursuing a cost strategy are centralized rather than decentralized, or when firms pursuing a differentiation strategy are decentralized rather than centralized. Supporting Hypothesis 2, purchasing efficiency is more likely to be associated with firms pursuing cost efficiency with a centralized design than those pursuing differentiation with a decentralized design. These findings are discussed as follows.

Evidence of the hypothesized congruency effect is important for a number of reasons. First, the prior literature has long recognized the need to align choices in organization design and product strategy for firms to excel in performance, even though evidence supporting this thesis is sparse. Thus, evidence found in this study is important to theory validation. In particular, this study shows that the effect of either design or strategy on firm performance can be *positive* or *negative*, depending upon the nature of the other variable (see Table 5). The results suggest that when pursuing a differentiation strategy (i.e., with high product uniqueness and/or capital intensity), performance is likely to be *enabled* with a decentralized design. Conversely, when pursuing a cost efficient strategy (i.e., with low product uniqueness and/or capital intensity), performance is likely to be *hindered* by a decentralized design. Likewise, the relationship between scope and capital intensity on firm performance reveal a similar observation. A differentiation firm, high in product differentiation, is likely to enjoy higher performance when enabled by a broader scope of coordination. Conversely, when a firm fails to do so, its performance is likely to suffer. Increases in decentralization and scope of coordination are costly. Unless the benefits of doing so (e.g., improving demand forecast, supply chain efficiency) outweigh the costs, a firm is better off with a centralized design (e.g., Malone 1978, Tushman and Nadler 1978, Fisher 1997). Collectively, the preceding evidence supports the contingency wisdom that to excel in firm performance, the choices in organization design should enable, or complement, the choices in strategy (e.g., Chandler 1962, Tushman and Nadler 1978, Govindarajan 1986, Miller 1988, Huselid 1995).

Second, evidence of a nonmonotonic relationship on this performance contingency link supports an important thesis in the organization adaptation literature. To illustrate, consider Equation (3c). It contains a negative sign, which indicates the inflection point for product uniqueness is a decreasing function of the other product strategy variable, capital intensity. When CAP_INT is -0.344, the sample mean value, the inflection point of product uniqueness ($\text{UNIQ}^*_{\text{DECNT}}$) is -0.108 (see Equation (3c)). Under this scenario, the relationship between design and performance, denoted by $\partial \text{ROA}_a/\partial \text{DECNT}$, is positive (negative) when the score of product uniqueness is above (below) the inflection point. However, the value of CAP_INT can change, which in turn will change the value of the corresponding inflection point, $\text{UNIQ}^*_{\text{DECNT}}$. For example, as CAP_INT increases to -0.2, the corresponding inflection point, $\text{UNIQ}^*_{\text{DECNT}}$, decreases to -0.389. Thus, for firms whose product uniqueness score is between the two inflection points, $\partial \text{ROA}_a/\partial \text{DECNT}$ can change sign from a negative value to a positive value as the level

of capital intensity (CAP_INT) increases.[12] This suggests that as a firm changes its product strategy (e.g., as reflected by the changes in capital intensity), it may alter the existing relationship between design and performance, and hence call for future realignments.

Equation (3c) also reveals an important implication for strategy management. To achieve the same level of performance under a given design (i.e., by holding $\partial ROA_a/\partial DECNT$ as constant), there are alternative ways to manage a firm's product strategy. If a firm is low in capital intensity, it should strive for higher product uniqueness than a counterpart firm high in capital intensity. This observation echoes an equifinality argument noted in Katz and Kahn (1978, p. 30): "a system can reach the same final state from differing initial conditions and by a variety of paths." Thus, a key challenge is to find a blend of capital intensity and product uniqueness such that the relationship between design and performance is positive rather than negative.

Finally, a performance congruency effect found in this study calls for an early involvement of the purchasing management function in corporate product strategy decisions. This suggestion echoes the recent development in supply chain management practices that emphasize the strategic role of purchasing management, hence the need for integrating purchasing management with other related activities throughout the supply chain (MacDuffie and Helper 1997, Zaheer et al. 1998). Given the rising movement of business-to-business e-procurement, this integration not only is essential for achieving supply chain efficiency, but also paves the way for future collaboration among firms throughout the industry's supply chain (e.g., Greis and Kasarda 1997).

The finding on Hypothesis 2 also warrants discussion. Specifically, only firms pursuing cost efficiency with a centralized design are more likely to achieve a higher level of purchasing efficiency. This evidence echoes the cost control orientation of a low-cost strategy, especially when a firm is able to achieve a higher degree of resource sharing via centralization (e.g., Porter 1980, Gupta and Govindarajan 1986). On the other hand, for firms pursuing differentiation with a decentralized design, our finding suggests that it is difficult to achieve local efficiency at the purchasing management level. After all, the value creation of those firms does not rest upon cost efficiency at the purchasing management level, but rather through other activities such as basic research, product engineering, customization, and flexibility to market demand. Accordingly, those firms should rely on alternative measures for their purchasing management function (e.g., supplier flexibility, assistance/suggestions to emergencies, degree of design collaboration) (Noordewier et al. 1990, MacDuffie and Helper 1997). In fact, as noted in Dobler and Burt (1996, p. 673), "Performance in most of these areas is hard to measure in quantitative terms. Hence, the very nature of purchasing function makes it unusually difficult to establish meaningful performance standards.... The intangible nature of purchasing's responsibilities often prohibits the direct measurement of purchasing accomplishment." Collectively, the preceding discussion suggests a potential problem of relying on benchmarking analyses to improve purchasing performance. Our results show that it is inappropriate to use benchmarking to judge the performance of purchasing management without considering a firm's product strategy and the design of its purchasing management function. The recent recognition in the performance measurement literature (e.g., Kaplan and Norton 1996) underscores the merit of this suggestion—performance measurement should tie to a firm's strategy to achieve goal congruency among seemingly conflicting perspectives (e.g., customer, financial, operational, and growth).

Concluding Remarks and Limitations

One of the major strengths of this analysis is the composition of the sample pool. By focusing on the data collected from a wide spectrum of industries, as opposed to a single industry, the results of this study should be more generalizable than many prior empirical studies. In addition, our study is based on a combination of data sources, independently collected by

[12] By a similar extension, the preceding effects can also be derived from Equation (3d), which again shows that the inflection point for capital intensity, CAP_INT_{DECNT} is a decreasing function of the other product strategy variable, uniqueness.

different third parties. The results are thus less prone to the instrument biases of research using study-specific surveys. This study does have its limitations. First, our measures for product strategy and firm performance are based on financial statement data extracted from the COMPUSTAT. While this avoids the response bias that survey research tends to suffer, the measures are subject to noise. Second, as for the measures for purchasing organization design, we are confined to variables captured in the CAPS benchmarking data set. Thus, we can only proxy a subset of the organization design characteristics of these firms in our sample. Third, although our sample has the advantage of covering a diverse set of industries, it also suffers a bias of excluding smaller firms. One must be cautious in extrapolating findings to small firms. Finally, we recognize that the relationship among strategy, design, and performance is dynamic, whereby strategic and design choices may influence each other in an iterative manner. Clearly, the static nature of this study is incapable of capturing such a dynamic process, thus suggesting the need for a longitudinal research design. Despite of these limitations, our research results show evidence consistent with the prediction of the contingency link on performance between product strategy and organization design.

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References

Balakrishnan, R., T. Linsmeier, M. Venkatachalam. 1996. Financial benefits from JIT adoption: Effects of customer concentration and cost structure. *Accounting Rev.* **71**(2) 183–206.

Barnett, W. P., R. A. Burgelman, eds. 1996. Evolutionary perspectives on strategy. *Strategic Management J.* **17** 5–19.

Besanko, D., D. Dranove, M. Shanley. 1996. *Economics of Strategy*. John Wiley & Sons, New York.

Chandler, A. D. 1962. *Strategy and Structure. The History of the American Industrial Enterprise*. MIT Press, Cambridge, MA.

Dess, G., G. Beard. 1984. Dimensions of organizational task environments. *Admin. Sci. Quart.* **29** 52–73.

——, P. S. Davis. 1984. Porter's 1980 generic strategies as determinants of strategic group membership and organization performance. *Acad. Management J.* **27** 467–488.

Dobler, D. W., D. N. Burt. 1996. *Purchasing and Supply Management, Text and Cases*, 6th ed. The McGraw-Hill Companies, New York.

Doty, H. D., W. H. Glick, G. P. Huber. 1993. Fit, equifinality, and organizational effectiveness: A test of two configurational theories. *Acad. Management J.* **36**(6) 1196–1250.

Fisher, M. L. 1997. What is the right supply chain for your product? *Harvard Bus. Rev.* **75** (March–April) 105–116.

Galbraith, C. R., D. Schendel. 1983. An empirical analysis of strategy types. *Strategic Management J.* **4**(2) 153–173.

Galbraith, J. 1973. *Designing Complex Organizations*. Addison-Wesley, Reading, MA.

Gale, B. T. 1980. Can more capital buy higher productivity? *Harvard Bus. Rev.* **58**(4) 78–86.

Govindarajan, V. 1986. Decentralization, strategy and effectiveness of strategic business units in multi-business organization. *Acad. Management Rev.* **11**(4) 844–856.

——. 1988. A contingency approach to strategy implementation at the business-unit level: Integrating administrative mechanisms with strategy. *Acad. Management J.* **31**(4) 828–853.

Greene, W. H. 1993. *Econometric Analysis*. Prentice-Hall, Englewood Cliffs, NJ.

Greis, N. P., J. D. Kasarda. 1997. Enterprise logistics in the information era. *California Management Rev.* **39**(4) 55–78.

Gupta, A. K., V. Govindarajan. 1986. Resource sharing among SBUs: Strategic antecedents and administrative implications. *Acad. Management J.* **29** 695–714.

——, S. P. Raj, D. Wilemon. 1986. A model for studying R&D marketing interface in the product development process. *J. Marketing* **50** 7–17.

Hambrick, D. C. 1983. High profit strategies in mature capital goods industries: A contingency approach. *Acad. Management J.* **26** 687–707.

Heide, J. B. 1994. Interorganizational governance in marketing channels. *J. Marketing* **58**(1) 71–85.

——, G. John. 1990. Alliances in industrial purchasing: The determinant of joint action in buyer-supplier relationships. *J. Marketing Res.* **27**(1) 24–36.

Henderson, R., W. Michell. 1997. The interactions of organizational and competitive influences on strategy and performance. *Strategic Management J.* **18** 5–14.

Hrebiniak, L. G., W. F. Joyce. 1985. Organizational adaptation: Strategic choice and environmental determinism. *Admin. Sci. Quart.* **30** 336–349.

Huber, G. P. 1991. Organizational learning: The contributing processes and the literatures. *Organ. Sci.* **2** 88–115.

——, R. R. McDaniel. 1986. The decision-making paradigm of organization design. *Management Sci.* **32**(5) 572–589.

——. C. C. Miller, W. H. Glick. 1990. Developing more encompassing theories about organizations: The centralization-effectiveness relationship as an example. *Organ. Sci.* **1**(1) 11–40.

Huselid, M. A. 1995. The impact of human resource management practices on turnover, productivity, and corporate financial performance. *Acad. Management J.* **38**(3) 635–672.

Ittner, C. D., D. F. Larcker. 1997. Product development cycle time and organization performance. *J. Marketing Res.* **34**(1) 13–23.

——, ——. 1999. Supplier selection, monitoring practices, and firm performance. *J. Accounting Public Policy* **18**(3) 253–281.

Kaplan, R. S., D. P. Norton. 1996. *Translating Strategy into Action: The Balanced Scorecard*. Harvard Business Press, Boston, MA.

Katz, D., R. L. Kahn. 1978. *The Social Psychology of Organizations*, 2nd ed. Wiley, New York.

Kim, Jae-On, C. W. Mueller. 1978. *Factor Analysis: Statistical Methods and Practical Issues*. Sage Publications, Inc., Newbury Park, CA.

Kobrin, S. J. 1991. An empirical analysis of the determinants of global integration. *Strategic Management J.* **12** 17–31.

Kotha, S., A. Nair. 1995. Strategy and environment as determinants of performance: Evidence from the Japanese machine tool industry. *Strategic Management J.* **16** 497–518.

Lewin, A. Y., J. W. Minton. 1986. Determining organization effectiveness: Another look and an agenda for research. *Management Sci.* **32**(5) 514–538.

MacDuffie, P. J., S. Helper. 1997. Creating learn suppliers: Diffusing lean production through the supply chain. *California Management Rev.* **39**(4) 118–151.

Malone, T. W. 1987. Modeling coordination in organization and market. *Management Sci.* **33**(10) 1317–1332.

Miller, D. 1988. Relating Porter's business strategies to environment and structures: Analysis and performance implications. *Acad. Management J.* **31**(2) 280–308.

——, P. H. Friesen. 1983. Strategy making and environment: The third link. *Strategic Management J.* **4** 221–235.

Mintzberg, H. 1978. Patterns in strategy formation. *Management Sci.* **24** 934–948.

Noordewier, T. G., G. John, J. R. Nevin. 1990. Performance outcomes of purchasing arrangements in industrial buyer–vendor relationships. *J. Marketing* **54**(4) 80–93.

Olson, E. M., O. C. Walker, R. W. Ruekert. 1995. Organizing for effective new product development: The moderating role of product innovativeness. *J. Marketing* **59** 48–62.

Palepu, K. G., V. L. Bernard, P. M. Healy. 1996. *Business Analysis and Valuation: Using Financial Statements: Text and Cases*. South-Western College Publishers, Cincinnati, OH.

Porter, M. 1980. *Competitive Strategy*. Free Press, New York.

——. 1985. *Competitive Advantage*. Free Press, New York.

Prescott, J. E. 1986. Environments as moderators of the relationship between strategy and performance. *Acad. Management J.* **29**(2) 329–346.

Rajaratnam, D., L. B. Chonko. 1995. The effects of business strategy type on marketing organization design, product market growth strategy, relative marketing effort, and organization performance. *J. Marketing—Theory and Practice* **3**(3) 60–75.

Ramasamy, K., A. S. Thomas, R. Litschert. 1994. Organization performance in a regulated environment: The role of strategic orientation. *Strategic Management J.* **15** 63–74.

Reger, R. K., A. Huff. 1993. Strategic groups: A cognitive perspective. *Strategic Management J.* **14**(2) 104–124.

Roger, P. R., A. Miller, W. Q. Judge. 1999. Using information processing theory to understand planning, performance relationships in the context of strategy. *Strategic Management J.* **20** 567–577.

Sanchez, R. 1995. Strategic flexibility in product competition. *Strategic Management J.* **16** 135–159.

Schoonhoven, C. B. 1981. Problem with contingency theory: Testing assumptions hidden within the language of contingency "theory." *Admin. Sci. Quart.* **26** 347–375.

Shortell, S. M., E. J. Zajac. 1990. Perceptual and archival measures of Miles and Snow's strategic types: A comprehensive assessment of reliability and validity. *Acad. Management J.* **33**(4) 817–832.

Thompson, J. D. 1967. *Organization in Action*. McGraw-Hill, New York.

Tushman, M. L., D. A. Nadler. 1978. Information processing as an integrating concept of organization design. *Acad. Management Rev.* (July) 613–624.

Venkatraman, N. 1989. The concept of fit in strategy research: Toward verbal and statistical correspondence. *Acad. Management Rev.* **14** 423–444.

Watts, C. A., K. Y. Kim, C. K. Hahn. 1995. Linking purchasing to corporate competitive strategy. *Internat. J. Purchasing Materials Management* **31**(2) 3–8.

Zaheer, A., B. McEvily, V. Perrone. 1998. The strategic value of buyer-supplier relationships. *Internat. J. Purchasing Materials Management* **34**(3) 20–26.

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