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SME–SUPPLIER ALLIANCE ACTIVITY IN MANUFACTURING: CONTINGENT BENEFITS AND PERCEPTIONS

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We address the following two questions: how upstream vertical alliance (UVA) activity affects the performance of small and medium-sized enterprises (SMEs); and how SME perceptions of that relationship influence the choice to engage in UVA activity. Using responses from a recent survey of business unit managers representing 200 SMEs, we find that UVA activity benefits SME performance when self-selection effects are controlled. Instead of being a source of differentiation advantages, UVA activity leverages the SME's existing advantages. And, while SME perceptions appear to drive the self-selection of UVA activity, those perceptions are inaccurate; the result is that the SMEs likely to benefit less from such activity engage in it more. Copyright © 2006 John Wiley & Sons, Ltd.

INTRODUCTION

Small and medium-sized enterprises (SMEs)—firms with 500 or fewer employees—are critical to the U.S. economy (Beekman and Robinson, 2004). SMEs contribute 95 percent of the non-farm businesses in the U.S. economy (Spragins and Harnish, 2004), 50 percent of the employment, over 90 percent of jobs lost due to firm failure, and over 99 percent of firm failures. One means of increasing survival rates for SMEs is through alliance activity (Baum and Oliver, 1991). For some SMEs, strategic alliances are critical (Golden and Dollinger, 1993; MacGregor, 2004; Parise and Casher, 2003). SMEs use alliance activity to improve their competitive positions (Beekman and Robinson, 2004) in many ways. For example, SMEs use upstream vertical alliances (UVAs) to access critical resources, to obtain needed legitimacy, and to learn about current benchmarks as well as about future opportunities. The use of alliances, by SMEs and larger firms to gain such benefits, has been significant. The growth rate of alliance activity, especially based in the SME-favored knowledge industries, has been estimated at 20–25 percent per year over the last two decades (Contractor and Lorange, 2002; Narula, 2004; Parise and Casher, 2003).

Unfortunately, there is little theory focused on SME's use of UVAs, little empirical testing of such relationships (Park and Krishnan, 2001; Quayle, 2002), and none such testing that controls for *self-selection*—a methodology that would isolate the direct effects of UVA activity on SME performance. The first contribution of this paper is to address the issues in testing and methodology. While there are a few studies that consider the impact of self-selection effects on strategic choices (e.g., Masten, 1993; Shaver, 1998) at the firm level, the analyses of what the self-selection

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activity itself is *based on*, and whether the most appropriate firms select the focal choice, are essentially non-existent. The second contribution of this paper is to address those issues of self-selection—i.e., we offer a basis for self-selection, and we evaluate its efficiency.

We address those latter issues with analysis of survey data from senior SME managers that includes their perceptions of how the alliance activity affects firm performance. We are able to test whether decision-maker perceptions are driving the alliance activity selection, while also testing whether those perceptions are correct. If the perceptions are inaccurate, as some researchers have implied because of decision biases that SMEs are more susceptible to (Busenitz and Barney, 1994), then it may be that the SMEs that could most benefit from alliance activity are not necessarily the ones engaging in it. We base the empirical analysis on a survey of 421 senior managers at 200 SMEs drawn from APICS (American Production and Inventory Control Society) and ISM (Institute of Supply Management). These managers ran strategic business units in the United States, Mexico, and Europe (where the United States represents 319 of the 421 cases) in the late 1990s.

We use a non-standard approach to address the issues outlined above, but one that is applicable to the research questions at hand. First, we analyze how UVAs affect SME performance controlling for self-selection. This first step addresses the research question of whether UVA activity is beneficial for SMEs. Second, given those results, we then test whether the SMEs that could most benefit from UVA activity are the ones more prone to engage in it. This second step addresses the research question of whether management misperceptions generate an outcome where the SMEs that could most benefit from alliance activity are not the ones that most engage in it. Third, we then analyze the bases of the self-selection process itself to see whether those biases affect whether the most appropriate SMEs are engaging in UVA activity. This third step addresses the research question of whether SME managers make the UVA choice based on their perceptions of the choice's performance effect.

The paper continues as follows: We generate the hypotheses that address the first research question on the benefits of UVA activity for SMEs. We describe the data, the empirical methodology, and the results. We then generate the hypotheses that address the second and third research questions based on the results from the first hypotheses. We describe the empirical methods and results relevant to the analysis of the bases of the self-selection process and the outcome of that process. We then discuss the full results, the limitations, and the conclusions.

GENERATION OF UVA–SME HYPOTHESES

A UVA is a continuing long-term relationship among parties in a supply chain. The relationship involves expected mutual benefits based on collaboration and significant contributions by parties of capital and knowledge. A UVA is an incomplete contract where both supplier and producer have some control (Contractor and Lorange, 2002; Gomes-Casseres, 1997; Stuart, 1997a, 1997b). SMEs stand to gain from the use of UVAs in many ways,[1] including through: increased quality and responsiveness (Dean and Terziovski, 2001); cost reductions from making production steps adjacent (Johnson and Houston, 2000); the ability to foreclose supply to rivals; the ease of creating compatible products when suppliers are complementors or supply the complementors. SMEs are also attracted to UVAs because UVAs elicit lower competitive intensity effects than horizontal alliances (Silverman and Baum, 2002).

UVA activity provides these many benefits in the form of supply chain management. Essentially, the UVA is a form of virtual vertical integration. The UVA allows partners to benefit from each other's complementary assets (Teece, 1986) and knowledge without many of the associated risks, commitments, and management costs of full ownership of those assets. In many instances, the best governance form for a transaction is an alliance. While all forms are potentially vulnerable to hazards like adverse selection and hold up, the alliance is less costly and risky than the

[1] SMEs engaging in UVAs may also enjoy the general benefits of alliance activity, such as: increased market power; risk reduction; an improved firm profile; improved financial strength (Torres, 2002); access to expertise (Rindfleisch and Moorman, 2001; Torres, 2002); strength over peers (BarNir and Smith, 2002); speed in access to funding and to additional production capabilities (Miles, Preece, and Baetz, 1999); rapidity of exploiting technology for first mover advantage and learning curve advantages (Forrest, 1990); access to a larger pool of management talent (Johnson and Houston, 2000); and, access to options for expansion and leverage of any relevant advantage that arises (Miles *et al*., 1999).

acquisition, and more flexible and more capable of generating inter-firm synergies than the spot market. For a technologically progressive SME that desires growth and requires differentiation and speed to compete, the alliance is an attractive and accessible mode of transacting with other firms that are in its supply chain. SMEs should benefit from alliances, and from UVAs in particular, as an alternative way to access resources. SMEs realize the benefits in two ways: First, the SME should realize improved performance as measured in returns and market share. Second, the SME should realize an improved basis for that performance in an enhanced competitive position stemming from greater differentiation dimensions like higher product quality and customer service. The first hypothesis follows:

> *Hypothesis 1: After controlling for self-selection, SMEs that engage in UVA activity outperform SMEs that do not engage in it as measured by market share, ROA, product quality, competitive position, and customer service.*

The SMEs that are more likely to choose UVA activity share several characteristics that independently are likely to provide superior SME performance. SMEs more likely to engage in UVA activity tend to have slack resources available to devote to the alliance (Golden and Dollinger, 1993), and social networks that give potential partners the idea that the SME has something to lose if it inappropriately exploits the alliance (BarNir and Smith, 2002). These SMEs have relatively less fear regarding loss of control due to the alliance (Gomes-Casseres, 1997) and are more trusting of partners (MacGregor, 2004) due to greater networking experience (Pangarkar, 2003) and greater beliefs in mutual benefits (Dainty, Briscoe, and Millett, 2001). These SMEs tend to have better knowledge of the industry key success factors (Hoffman and Schlosser, 2001), and are less dependent on alliances (Miles *et al*., 1999). Additionally, SMEs attracted to UVA activity should be more flexible and adaptive to changes in the competitive environment and in the supply chain in order to take first advantage of new opportunities (Forrest, 1990; Lieberman and Montgomery, 1988). These SMEs are likely to be more certain and confident in their ability to influence a supplier relationship where they have limited control (Isabella and Waddock, 1994). They tend to be proactive, moving quickly in choosing business relationships (Miles *et al*., 1999). These SMEs are more attracted to UVA activity because of stronger downstream relationships that can be leveraged and fulfilled more effectively and efficiently by extending the network upstream (Miles *et al*., 1999; Silverman and Baum, 2002). They are also attracted because they are more growth-oriented and more likely to seek scaling up through upstream contacts (Beekman and Robinson, 2004; Dean, Holmes, and Smith, 1997).

Such SME characteristics are likely to have direct positive effects on firm performance. The characteristics can be categorized into two main types: those that make an SME capable of engaging in alliance activity (e.g., slack resources); and those that increase the SME's desire to engage in UVAs (e.g., greater belief in mutual benefits). An SME that is *capable of engaging in UVAs* should be a good performer even without UVA activity because the SMEs have the resources, flexibility, managerial expertise, networks, experience, orientation, and confidence that would independently drive superior firm performance (e.g., Daniel *et al*., 2004; Jack and Raturi, 2002; Narasimham, Talluri, and Das, 2004; O'Brien, 2003; Swamidass and Newell, 1987). An SME *that considers UVA activity more attractive* should be a good performer even without UVA activity because their existing networks, confidence, belief in potential benefits, and orientation to be proactive are also often independently associated with superior firm performance (Collins, Hanges, and Locke, 2004; Ensley, Carland, and Carland, 2000; Ghosh *et al*., 2001; Simon *et al*., 2002). The second hypothesis follows:

> *Hypothesis 2: SMEs that engage in UVA activity tend to have characteristics that enable them to outperform SMEs that do not, independent from the performance effects of the activity itself.*

The SME characteristics that are more likely to encourage self-selection of UVA activity are likely to *complement* the activity itself. For example, constrained optimization indicates that the SME with the option to engage in an alliance, in addition to the slack resources and the desire for growth, should enjoy better performance than a similar SME that does not have that option. Similarly, a capable SME that is engaged in an alliance that

provides deeper insights into privileged knowledge of what is required to succeed in an industry should enjoy superior performance compared to the SME without the exposure to such knowledge. Thus, synergies should arise when a firm has not only the capability and desire to engage in UVA activity but also engages in it as well.

While we may argue that self-selection characteristics of SMEs complement SME UVA activity, it is a further step to argue that the interaction is increasing returns. We can start by noting that increasing returns should lead to the skewed distributions noted in previous alliance studies, where the few firms with the best selection characteristics transacted the majority of the alliance activity in an industry.[2] Potential increasing returns (Arthur, 1983, 1994) should exist in this present context as well. There are many possibilities. UVA experience may lead to an increase in the SME's UVA size without a corresponding increase in its costs (Pangarkar, 2003). Network economies (Frels, Shervani, and Srivastava, 2003) may exist in terms of leveraging capabilities through UVA activity that can involve alliance partners' partners (Silverman and Baum, 2002). Compatibility benefits relevant to SME products may also enjoy network economies (Axelrod *et al*., 1991; Kulkosky, 1989; Samu, Krishnan, and Smith, 1999). Extra returns may emerge from the evaluation of the UVA activity as a nested option on future uncertain opportunities to exploit SME capabilities (Bowman and Hurry, 1993; Kogut, 1991; McGrath, Ferrier, and Mendelow, 2004). UVAs where SMEs can learn from partners (Kogut, 1988, 1989) or share risks (Hagedoorn, 1993; Bloch, 1995) may also provide extra returns. UVAs where SMEs gain the critical mass level of legitimacy and trust in an industry (Baum and Oliver, 1991, 1992; Gulati, 1995) are also essentially nonlinear in returns. These possibilities of synergies and the observed skewed distributions of alliance activity in past studies give rise to the expectation that SME selection characteristics and UVA activity are of the increasing returns type. The third hypothesis follows:

Hypothesis 3: For SMEs, the characteristics attributable to SMEs engaging in UVA activity complement the alliance activity itself. SMEs with both the characteristics and the alliance activity will outperform the SMEs that lack at least one.

DATABASE AND EMPIRICAL METHODOLOGY

The data

The responses to a recent survey of U.S., Mexican, and European managers formed the basis of our dataset. We pre-tested the survey using 30 senior U.S. managers of supply and production, and then validated and revised it based on the feedback. The databases of APICS and ISM provided identities of senior U.S., Mexican, and European managers to whom we circulated the survey between December 1998 and October 1999. We distributed the survey in three phases of three mailings each (i.e., one mailed survey with cover letter, one reminder postcard, and one second survey with cover letter). In the first phase mailing, we targeted the supply manager of each of 1500 U.S. manufacturing firms selected at random from the ISM database. In the second phase mailing, we targeted the production manager of each of 1000 U.S. manufacturing firms and 2000 U.S. service firms. We selected these firms at random from the APICS database. In the third phase mailing, we targeted the production manager of each of 970 Mexican and European manufacturing firms selected at random from the APICS database. We considered 556 of the 5470 surveys useable (i.e., the effective response rate was 10.2%). Considering the survey length, complexity, and focus, this was a reasonable response rate. We reduced the sample to 421, of which 319 were from U.S. managers, based on whether the survey contained useable performance data. From this reduced set, we found 200 responses from SMEs—firms with 500 or fewer employees. We then checked the database for non-response bias and non-redundancy, finding neither issue problematic.[3]

[2] For example, in the Information Technology sector, 1989–93, IBM and a handful of other firms dominated alliance activity according to the Information Technology Strategic Alliance database (i.e., IBM had over 180 alliances alone while about 60 percent of firms had fewer than three alliances). Other studies have determined similar skewness in alliance activity (e.g., Hagedoorn and Sadowski, 1999).

[3] We tested for statistically significant differences between early and late waves of returned surveys (Armstrong and Overton, 1997; Lambert and Harrington, 1990) to evaluate non-response bias, and found none. In each survey phase, we considered

The variables

We describe the dependent and independent variables below (NB: we provide the reliability test result when a variable is a scaled response). Table 1 provides detailed descriptions of the dependent variables. The main outcome variables measure a focal firm's market share, return on assets (ROA), product quality, competitive position, customer service, and overall performance (i.e., *MarketShareOutcome, ROAOutcome, QualityOutcome, CompetitivePositionOutcome, CustomerServiceOutcome, PerformanceOutcome*, respectively). The intermediate outcome variable measures whether a focal firm practices vertical alliance activity with its suppliers (i.e., *UVA*).

We separate the independent variables as follows. Explanatory variables for the self-selection model (i.e., the probit model explaining the choice to engage in UVA activity) are provided in Table 2. Explanatory variables for the self-selection corrected OLS model (i.e., the model that explains SME performance) are provided in Table 3.

We use three types of independent variables in the first stage of the self-selection process. First, there are *motivation*-related variables (i.e., *SupplierTimeliness, SupplierFlexibility, SupplierParticipation, SupplierSize, SupplierJustInTime, SupplierImportance, SupplierCommitment, SupplierInformation*). These indicate how the firm ranks the importance of the supplier partner's ability to fulfill the SME's motive (e.g., in increasing customer responsiveness; in improving new products; in learning about the competitive environment through access to confidential information). Second, there are *context*-related variables (i.e., *IndustryPosition, SupplierProximity*). These provide insight into the SME's environment (e.g., its place in the industry value-chain; its physical distance from sources of productive inputs). Third, there are *firm attribute* control variables (i.e., *FirmSize, SCM, Outsourcing, FirmasKeySupplier*). These indicate previous choices of the firm, not toward a specific motive, but nonetheless relevant to the attractiveness of the choice to engage in UVA activity.

We also use four types of independent variables in the second stage of the self-selection process.

the final wave of responses as the proxy for non-respondents and early wave responses as the proxy for respondents. *t*-Tests for differences between the two groups yielded no statistically significant results in the survey items used in the analysis. We found no statistically significant differences between early respondents and late respondents at the 2-tailed $p < 0.05$ levels for any of the dependent or independent variables (for either the APICS or ISM surveys or for both taken together). We addressed non-redundancy by deleting all firms with multiple listings in APICS and ISM databases *ex ante*.

Table 1. Dependent variables in the self-selection probit model

ID	Explanation
MarketShareOutcome	This is a 5-point Likert scale assessment of the firm's level of performance compared to its major industrial rivals in terms of *market share* (1 = low, 5 = high).
ROAOutcome	This is a 5-point Likert scale assessment of the firm's level of performance compared to its major industrial rivals in terms of *return on assets* (1 = low, 5 = high).
QualityOutcome	This is a 5-point Likert scale assessment of the firm's level of performance compared to its major industrial rivals in terms of *overall product quality* (1 = low, 5 = high).
CompetitivePositionOutcome	This is a 5-point Likert scale assessment of the firm's level of performance compared to its major industrial rivals in terms of *overall competitive position* (1 = low, 5 = high).
CustomerServiceOutcome	This is a 5-point Likert scale assessment of the firm's level of performance compared to its major industrial rivals in terms of *overall customer service* (1 = low, 5 = high).
PerformanceOutcome	This is a scaled response, measuring the average of the above five performance-related scale measures. The Cronbach alpha is 0.75 for this scale measure.
UVA	This is a 1–0 coded variable used as the selection-dependent variable in the self-selection model, indicating whether the firm practices vertical alliance activity with its suppliers.

Table 2. Explanatory variables in the self-selection probit model

ID	Explanation
IndustryPosition	A set of three Industry Position dummy (0/1) variables. Indicate the business function that best describes the firm—upstream: raw materials to components; midstream: final products; downstream: wholesale, retail, service.
SCM	A dummy variable indicating whether the firm practices supply chain management based on the survey question: Does your firm practice supply chain management? (Y/N—1/0)
Outsourcing	A three-value variable (−1/0/1) indicating the trend in outsourcing upstream activities based on the survey question: In the last 3 years, has there been an increase (+1), a decrease (−1), or no change (0) in your firm's outsourcing of: primary materials, components, subassemblies and services?
SupplierTimeliness	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME evaluates supplier timeliness based on the survey question: How important in evaluating your key supplier's performance is a quick response time in case of emergency, problem or special request?
SupplierFlexibility	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME evaluates supplier flexibility based on the survey question: How important in evaluating your key supplier's performance is their willingness to change their products and service to meet your changing needs?
SupplierParticipation	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME evaluates supplier innovation participation based on the survey question: How important in evaluating your key supplier's performance is their willingness to participate in your firm's new product development and value analysis?
SupplierSize	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME evaluates supplier size based on the survey question: How important in selecting your key supplier is their company size?
SupplierJustInTime	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME evaluates supplier just-in-time production capability based on the survey question: How important in selecting your key supplier is their past effort in promoting JIT principles?
SupplierImportance	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME evaluates supplier strategic importance based on the survey question: How important in selecting your key supplier is their strategic importance to your firm?
SupplierCommitment	This is a scaled response measuring the average of three related questions (all on a 5-point Likert scale assessment) of how the SME evaluates supplier commitment based on the survey questions: How important in selecting your key supplier is their willingness to integrate a supply chain management relationship? How important in selecting your key supplier is their commitment to continuous improvement in product and process? How important in selecting your key supplier is their reserve capacity or the ability to respond to unexpected demand? (Cronbach alpha 0.78)
SupplierInformation	This is a scaled response measuring the average of two related questions (all on a 5-point Likert scale assessment) of how the SME evaluates supplier information sharing based on the survey questions: How important in selecting your key supplier is their willingness to share confidential information? How important with respect to improving customer service and satisfaction is sharing of confidential information? (Cronbach alpha 0.70)
FirmasKeySupplier	A dummy variable indicating whether the firm is a key supplier to its customers based on the survey question: Is your firm a key supplier to your customers? (Y/N—1/0)
SupplierProximity	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME evaluates supplier geographic proximity based on the survey question: How important with respect to improving customer service and satisfaction is your firm's geographic proximity to your supplier firm's facility?
FirmSize	A composite variable measuring the average of two standardized variables: of firm size based on employee count, and of firm size based on gross U.S. sales.

First, there are *strategy*-related variables (i.e., *SupplierConformity, ProductDesign, JITCostSaving, Quality, CustomerSatisfaction*). These indicate how the firm rates the importance of a particular strategy (e.g., differentiation on quality, product design, customer service; efficiency through just-in-time). Second, there is a *context*-related variable (i.e., *IndustryPosition*) that indicates the SME's

Table 3. Explanatory variables in the self-selection corrected OLS model

ID	Explanation
IndustryPosition	A set of three Industry Position dummy (0/1) variables. Indicate the business function that best describes the firm—upstream: raw materials to components; midstream: final products; downstream: wholesale, retail, service.
SCM	A dummy variable indicating whether the firm practices supply chain management based on the survey question: Does your firm practice supply chain management? (Y/N—1/0)
Outsourcing	A three-value variable (−1/0/1) indicating the trend in outsourcing upstream activities based on the survey question: In the last 3 years, has there been an increase (+1), a decrease (−1), or no change (0) in your firm's outsourcing of: primary materials, components, subassemblies and services?
SupplierConformity	This is a scaled response measuring the average of three related questions (all on a 5-point Likert scale assessment) of how the SME evaluates supplier's ability to conform to given specifications based on the survey questions: How important in assuring that supplier's products and service conform to your specifications is the supplier's need to maintain procedures to control and verify the design of the product? How important in assuring that supplier's products and service conform to your specifications is the supplier's need to ensure that the quality policy is understood, implemented, and maintained? How important in assuring that supplier's products and service conform to your specifications is the supplier's need to investigate causes of non-conformance and take corrective actions? (Cronbach alpha 0.80)
ISO9000	A dummy variable indicating whether the firm is ISO 9000 certified based on the survey question: Is your firm ISO 9000 certified? (Y/N—1/0)
ProductDesign	This is a scaled response measuring the average of four related questions (all on a 5-point Likert scale assessment) of how the SME evaluates its focus on new product design and development based on the survey questions: How important in your firm's new product design and development activities is early supplier involvement? How important in your firm's new product design and development activities is simplification of component parts? How important in your firm's new product design and development activities is standardization of component parts? How important in the quality practices of your firm is considering manufacturability and assembly in the product design stage? (Cronbach alpha 0.85)
JITCostSaving	This is a scaled response measuring the average of three related questions (all on a 5-point Likert scale assessment) of how the SME evaluates its focus on cost savings through just-in-time production based on the survey questions: How important in your operations is the JIT principle of reducing set-up time? How important in your operations is the JIT principle of reducing inventory, which in turn frees up capital investment? How important in your operations is the JIT principle of reducing inventory to expose manufacturing and scheduling problems? (Cronbach alpha 0.78)
QualityFocus	This is a scaled response measuring the average of four related questions (all on a 5-point Likert scale assessment) of how the SME evaluates its focus on product quality based on the survey questions: How important in the quality practices of your firm is inspection? How important in the quality practices of your firm is designing quality into the product? How important in the quality practices of your firm is process improvement? How important in the quality practices of your firm is emphasis on quality instead of price in the supplier selection process? (Cronbach alpha 0.70)
CustomerSatisfaction	This is a scaled response measuring the average of eight related questions (all on a 5-point Likert scale assessment) of how the SME evaluates its focus on customer satisfaction based on the survey questions: How important with respect to improving customer service and satisfaction are your firm's ethical standards? How important with respect to improving customer service and satisfaction is your firm's ability to meet delivery due dates? How important with respect to improving customer service and satisfaction is your firm's effort in striving for continuous cost reduction? How important with respect to improving customer service and satisfaction is your firm's commitment to continuous improvement in products and processes? How important with respect to improving customer service and satisfaction is your firm's quality of products and services? How important with respect to improving customer service and satisfaction is your firm's determination of future customer expectations? How important with respect to improving

(*continued overleaf*)

Table 3. (*Continued*)

ID	Explanation
	customer service and satisfaction is your firm's being able to meet customers' changing needs? How important with respect to improving customer service and satisfaction is your firm's employing a customer satisfaction measurement system? (Cronbach alpha 0.86)
FirmSize	A composite variable measuring the average of two standardized variables: of firm size based on employee count, and of firm size based on gross U.S. sales.
UVA	A dummy variable indicating whether the firm is involved in an upstream strategic alliance based on the survey question: Does your firm have a strategic alliance with any of your suppliers? (Y/N—1/0)
LAMBDA	The Inverse Mill's Ratio of the probit regression in step one of a self-selection model (it estimates the correlation between ε and u; it is the ratio of the standard normal density function to the cumulative distribution function—see Greene, 1990).

position in the industry value chain. Third, there are *firm attribute* control variables (i.e., *FirmSize, SCM, Outsourcing, ISO9000*). These variables indicate previous choices of the firm that are relevant to firm performance (e.g., scale; certification; etc.). Fourth, there are the self-selection control variables—*UVA* and *LAMBDA*—that indicate the firm's choice to engage in upstream vertical alliances, and the control for the type of firm usually using UVAs, respectively.

Table 4 provides the descriptive statistics and the correlations for the two stages of the self-selection analysis. Nearly the full sample of 200 SMEs answered every survey question relevant to the variables. Nearly every variable covers its full range of values. Being a key supplier to upstream firms and getting suppliers to participate in the SME's innovating activities each has high correlation to the SME's choice to engage in UVA activity. A focus on customer satisfaction and a focus on product design have high correlation to the SME's combined measure of performance, *PerformanceOutcome*.

The self-selection analysis

A *self-selection framework* (see Figure 1) provides the basis for analysis of SME–UVA fit because

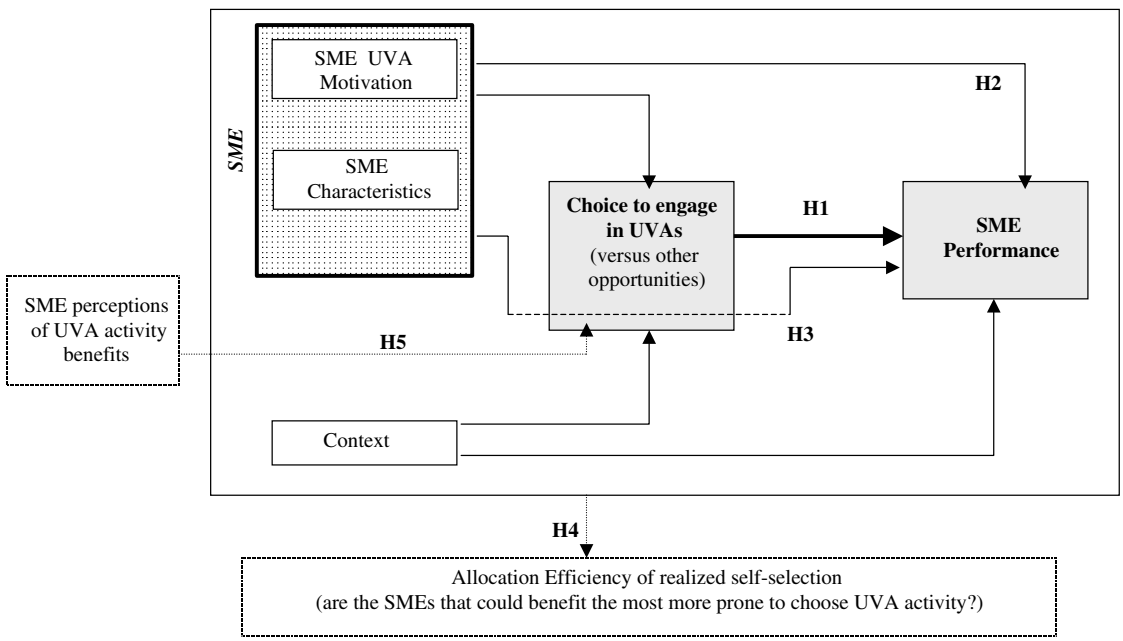

Figure 1. Illustration of the relationships between SMEs and UVA activity

Table 4. Descriptive statistics

Variable	Mean	S.D.	Minimum	Maximum	Cases
IndustryPosition(upstream)	0.2700	0.4451	0	1	200
IndustryPosition(midstream)	0.4500	0.4987	0	1	200
IndustryPosition(downstream)	0.2800	0.4501	0	1	200
SCM	0.5650	0.4970	0	1	200
Outsourcing	0.4740	0.6467	−1	1	192
SupplierTimeliness	4.3655	0.7749	1	5	197
SupplierFlexibility	3.9188	0.8941	1	5	197
SupplierParticipation	3.5202	1.1738	1	5	198
SupplierSize	2.5102	1.0253	1	5	196
SupplierJust In Time	3.1378	1.2306	1	5	196
SupplierImportance	3.6181	1.0420	1	5	199
SupplierCommitment	3.6742	0.8940	1	5	198
SupplierInformation	3.0500	0.9987	1	5	200
FirmasKeySupplier	0.8050	0.3972	0	1	200
SupplierProximity	2.6818	1.1287	1	5	198
FirmSize	0.0000	0.8317	−1.0494	4.4584	200
UVA—upstream vertical alliance	0.5101	0.5012	0	1	198
SupplierConformity	4.0493	0.8863	1	5	196
ISO9000	0.5025	0.5013	0	1	199
ProductDesign	3.2963	1.0668	1	5	196
JITCostSaving	3.5771	1.0431	1	5	199
QualityFocus	3.7454	0.8380	1	5	199
CustomerSatisfaction	4.0878	0.6872	1.8750	5	200
LAMBDA—Inverse Mill's Ratio	0.0000	0.7377	−2.1211	1.5399	179
MarketShareOutcome	3.4673	1.0238	1	5	199
ROAOutcome	3.4061	0.9245	1	5	197
QualityOutcome	4.1768	0.7363	1	5	198
CompetitivePositionOutcome	3.7940	0.8365	2	5	199
CustomerServiceOutcome	3.9848	0.8459	1	5	198
PerformanceOutcome	3.7641	0.6190	1.8	5	199
UVAActivity	0.6733	0.5497	−1	1	101
MarketSharePerception	3.3299	1.1154	1	5	97
ProfitPerception	3.6186	0.8949	1	5	97
QualityPerception	3.8144	0.9718	1	5	97
CostPerception	3.6633	0.9733	1	5	98
CustomerServicePerception	3.9184	0.9380	1	5	98

Variable	*MarketShare Outcome*	*ROA Outcome*	*Quality Outcome*	*Competitive PositionOutcome*	*Customer ServiceOutcome*
MarketSharePerception	0.380				
ProfitPerception		0.191			
QualityPerception			0.250		
CostPerception				0.080	
CustomerServicePerception					0.266

$p < 0.05$ for any correlation above value 0.200

UVA is a strategic choice of the SME and because some of the factors that affect the choice are also likely to affect the SME's performance directly. The basic self-selection framework requires three elements: (1) consideration of the factors that affect the strategic choice; (2) consideration of factors that affect the performance outcome; and (3) consideration of the outcomes, both in terms of whether the firms choose the focal strategy and in terms of what the ultimate performance is. This framework alone is sufficient to ascertain *whether* there is a fit between SMEs and UVA activity

Table 4. (contd). Descriptive statistics (main correlation tables)

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1	*SCM*													
2	*Outsourcing*	0.007												
3	*SupplierTimeliness*	0.176	0.091											
4	*SupplierFlexibility*	0.150	0.030	0.485										
5	*SupplierParticipation*	0.092	0.054	0.295	0.563									
6	*SupplierSize*	0.191	0.095	−0.012	0.026	0.088								
7	*SupplierJustInTime*	0.199	0.101	0.205	0.245	0.304	0.217							
8	*SupplierImportance*	0.173	0.109	0.182	0.200	0.360	0.168	0.432						
9	*SupplierCommitment*	0.259	0.197	0.400	0.316	0.435	0.235	0.617	0.415					
10	*SupplierInformation*	0.245	0.211	0.242	0.348	0.489	0.291	0.478	0.513	0.596				
11	*FirmasKeySupplier*	0.169	−0.043	−0.051	0.018	0.141	0.066	0.053	0.091	0.078	0.177			
12	*SupplierProximity*	−0.132	0.217	−0.027	0.035	0.233	0.030	0.253	0.231	0.098	0.338	0.121		
13	*FirmSize*	0.165	−0.002	0.079	0.098	0.083	0.153	0.100	0.051	0.150	0.201	0.114	0.074	
14	*UVA*—upstream vertical alliance	0.203	0.150	0.090	0.123	0.262	0.012	0.180	0.178	0.228	0.198	0.264	0.153	0.241

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	*SCM*															
2	*Outsourcing*	−0.010														
3	*SupplierConformity*	0.154	0.119													
4	*ISO9000*	0.161	0.062	0.257												
5	*ProductDesign*	0.101	0.232	0.513	0.089											
6	*JITCostSaving*	0.143	0.132	0.504	0.225	0.518										
7	*QualityFocus*	0.102	0.205	0.580	0.302	0.599	0.492									
8	*CustomerSatisfaction*	0.103	0.131	0.548	0.218	0.576	0.520	0.678								
9	*FirmSize*	0.165	0.001	0.015	0.075	0.160	0.210	0.093	0.080							
10	*UVA*—upstream vertical alliance	0.234	0.128	0.160	0.111	0.146	0.169	0.172	0.208	0.254						
11	*MarketShareOutcome*	0.033	−0.060	0.110	−0.029	0.074	0.065	0.025	0.123	0.159	0.096					
12	*ROAOutcome*	0.061	0.062	0.151	0.060	0.194	0.075	0.103	0.207	0.085	0.168	0.467				
13	*QualityOutcome*	0.032	0.024	0.395	0.018	0.293	0.290	0.367	0.491	−0.028	0.124	0.304	0.319			
14	*CompetitivePositionOutcome*	0.037	−0.037	0.200	0.019	0.337	0.145	0.273	0.380	0.095	0.076	0.479	0.462	0.406		
15	*CustomerServiceOutcome*	0.015	0.051	0.313	−0.039	0.315	0.258	0.329	0.500	−0.017	0.188	0.185	0.222	0.479	0.459	
16	*PerformanceOutcome*	0.051	0.008	0.315	0.007	0.330	0.223	0.291	0.459	0.092	0.183	0.719	0.715	0.672	0.791	0.641

$p < 0.05$ for any correlation above value 0.140

(i.e., whether, controlling for self-selection, UVA activity has a positive, negative or benign effect on SME performance). To this basic framework we add two further considerations: whether SME management perceptions drive the self-selection and whether the realized self-selection has the SMEs that could most benefit from UVA activity as the ones engaging in it most.

When SMEs make strategic choices, such as whether to engage in UVA activity, they do so rationally rather than randomly. An SME makes the choice based on a fit between its characteristics (e.g., its motives and capabilities) and the environment. However, if researchers compare alternative strategic choices without self-selection controls, then they do so implicitly assuming that firms choose randomly. Empirical findings supporting a particular decision's effects may be misleading when that implicit assumption over random choice does not hold (Masten, 1993; Shaver, 1998).[4] For example, when only high-performing SMEs choose to engage in UVAs, then UVA activity alone is likely to be a misleading indicator of SME performance if such selection is not controlled for. UVA activity will appear to explain firm performance instead of the true cause—the underlying SME characteristics. Thus, in order to truly and accurately assess the performance effects of the strategic choice to engage in UVA activity, we must control for self-selection.

We use a self-selection model based on Heckman (1979) and Greene (1981):

$$Y = \beta' X + \delta C + \varepsilon \quad (1)$$

$$C^* = \Gamma' W + u \quad (2)$$

where

$$C = 1 \text{ if } C^* > 0, \text{ and } C = 0 \text{ if } C^* \leq 0 \quad (3)$$

In Equation 1, Y indicates a vector of firm performance measures; X indicates a matrix of explanatory and control variables influencing firm performance; C indicates a vector of *0–1* dummy variables for alliance activity; and ε indicates the error vector. Equation 2 depicts the selection process, where W is a matrix of explanatory variables, accounting for alliance activity; and u indicates the error vector.

The *ex ante* indeterminacy of whether OLS will overestimate or underestimate δ requires the correction for self-selection. Underestimation may occur when ineffective firms disproportionately choose UVAs in order to compensate for their shortcomings in innovation, giving the appearance that UVA activity is detrimental to performance. Overestimation may occur when effective firms disproportionately choose UVAs in order to leverage their innovation, giving the appearance that UVA activity is overly beneficial to performance.

Heckman's two-stage estimation model provides the required self-selection control. A standard maximum likelihood probit model estimates Equation 2, while OLS estimates Equation 1. The variable that adjusts for the self-selection bias—*LAMBDA*—is calculated from the probit model, and is included in the regressors of Equation 1. *LAMBDA* is an estimate of the correlation between ε and u; it is the ratio of the standard normal density function to the cumulative distribution function (i.e., the inverse Mill's ratio; see Greene, 1990). The OLS estimation adjusts for heteroscedasticity introduced by using *LAMBDA* in Equation 1 through methods explained in Greene (1990: 744–748).

Two concerns arise when using the self-selection methodology: an identification problem and a sensitivity problem. We selected variables so that most of the explanatory variables differed between the first-stage probit model and the second-stage selection model (see Maddala, 1983) to reduce the identification problem. The consistency of the results across different performance measures addresses the second concern regarding the model's sensitivity to alternative specifications.

RESULTS OF SELF-SELECTION ANALYSIS OF THE BENEFITS OF UVA ACTIVITY TO SMEs

Table 5 provides the results of the self-selection analysis. At the left is the summary of the probit regression, revealing which SME characteristics correlate with the choice to engage in UVA activity. To the right are six sets of matched regressions where the self-selection corrected OLS and uncorrected OLS analyses each provides results. Each analysis reveals whether UVA activity and specific

[4] Such findings may be valid only either by accident, or when the unlikely event that the complete set of performance-affecting factors that compare the focal strategic choice is incorporated into the model generating the findings.

Table 5. The self-selection corrected modified OLS analysis (paired with regular OLS analysis for comparison)

Dependent variable / Variable	Probit *UVA*	Selection *MarketShare Outcome*	OLS *MarketShare Outcome*	Selection *ROA Outcome*	OLS *ROA Outcome*	Selection *Quality Outcome*	OLS *Quality Outcome*	Selection *Competitive PositionOutcome*	OLS *Competitive PositionOutcome*
SCM	0.443[a]	−0.203	−0.047	−0.118	−0.007	−0.037	−0.035	−0.159	−0.026
	(0.227)	(0.180)	(0.152)	(0.162)	(0.140)	(0.101)	(0.095)	(0.144)	(0.119)
Outsourcing	0.332[b]	−0.142	−0.052	−0.067	0.031	−0.060	−0.041	−0.204[a]	−0.144
	(0.167)	(0.133)	(0.116)	(0.119)	(0.106)	(0.075)	(0.073)	(0.106)	(0.091)
SupplierTimeliness	−0.390								
	(0.161)								
SupplierFlexibility	−0.764								
	(0.161)								
SupplierParticipation	0.269[b]								
	(0.125)								
SupplierSize	−0.154								
	(0.111)								
SupplierJustInTime	0.079								
	(0.120)								
SupplierImportance	0.080								
	(0.123)								
SupplierCommitment	0.117								
	(0.181)								
SupplierInformation	−0.176								
	(0.160)								
FirmasKeySupplier	0.761[c]								
	(0.285)								
SupplierProximity	0.076								
	(0.111)								

Table 5. (*Continued*)

Variable \ Dependent variable	Probit *UVA*	Selection *MarketShare Outcome*	OLS *MarketShare Outcome*	Selection *ROA Outcome*	OLS *ROA Outcome*	Selection *Quality Outcome*	OLS *Quality Outcome*	Selection *Competitive PositionOutcome*	OLS *Competitive PositionOutcome*
FirmSize	0.367[c]	0.104	0.200[b]	−0.058	0.059	−0.058	−0.048	−0.021	0.064
	(0.132)	(0.115)	(0.094)	(0.103)	(0.085)	(0.065)	(0.059)	(0.092)	(0.074)
SupplierConformity		0.159	0.105	0.019	0.063	0.121[a]	0.146[b]	−0.008	−0.016
		(0.111)	(0.113)	(0.103)	(0.103)	(0.071)	(0.071)	(0.090)	(0.089)
ISO9000		−0.083	−0.160	0.017	0.026	−0.215[b]	−0.226[b]	−0.082	−0.085
		(0.153)	(0.159)	(0.143)	(0.146)	(0.097)	(0.099)	(0.124)	(0.125)
ProductDesign		0.008	−0.026	0.139	0.166[a]	−0.024	−0.031	0.206[c]	0.206[c]
		(0.094)	(0.099)	(0.088)	(0.091)	(0.060)	(0.062)	(0.076)	(0.078)
JITCostSaving		−0.077	−0.062	−0.110	−0.104	−0.007	0.006	−0.142[a]	−0.093
		(0.095)	(0.094)	(0.088)	(0.087)	(0.059)	(0.059)	(0.077)	(0.074)
Quality		−0.387[c]	−0.250[a]	−0.086	−0.180	0.106	0.042	−0.014	0.008
		(0.135)	(0.130)	(0.132)	(0.125)	(0.860)	(0.081)	(0.110)	(0.102)
CustomerSatisfaction		0.312	0.364[b]	0.234	0.285[a]	0.432[c]	0.451[c]	0.372[c]	0.402[c]
		(0.158)	(0.161)	(0.151)	(0.152)	(0.100)	(0.101)	(0.128)	(0.127)
UVA		1.161[b]	0.108	1.084[b]	0.220	0.120	0.067	0.809[b]	0.013
		(0.502)	(0.154)	(0.451)	(0.142)	(0.286)	(0.097)	(0.401)	(0.121)
LAMBDA		−0.692[b]		−0.542[a]		−0.029		−0.519[b]	
		(0.312)		(0.281)		(0.180)		(0.250)	
N	179	174	182	172	180	173	181	174	182
adj R^2		0.088	0.044	0.060	0.037	0.272	0.253	0.165	0.142
Chi-sq. *F*	43.88	2.28	1.71	1.84	1.58	5.94	6.12	3.64	3.51
signif. value *p*-value	0.000[c]	0.009[c]	0.069[a]	0.041[b]	0.101	0.000[c]	0.000[c]	0.000[c]	0.000[c]

[a] $p < 0.10$; [b] $p < 0.05$; [c] $p < 0.01$

SME characteristics correlate with an SME performance measure. The OLS pairs illustrate whether self-selection has a significant effect and, if so, in which direction.

A number of variables correlate to the SME choice of UVA activity. The motivation-related variable *SupplierParticipation* is significant, implying that the SME's focus on innovation, specifically through product development and value analysis with the partner, is an important factor in whether UVA activity is chosen. Additionally, a context-related variable (i.e., *IndustryPosition*—not shown in Table 4) and all firm attribute controls (i.e., *FirmSize, SCM, Outsourcing, FirmasKeySupplier*) are significant factors in whether the SME chooses to ally upstream.

UVA activity significantly correlates to several measures of SME performance (i.e., market share, ROA, competitive position and combined measures). The self-selection control—*LAMBDA*—is also significant in each of these regressions and acts in the opposite direction (i.e., indicating that those SMEs that actually chose UVA activity that were also the most likely to choose UVA activity would have experienced superior performance without it). In the regressions, often other variables like the context-related variable (i.e., *IndustryPosition*), the firm strategy variables (e.g., *CustomerSastisfaction*), and the firm attribute controls (e.g., *ISO9000*) are also significant in explaining SME performance outcomes.

In the indication of the significance of the effect of UVA activity, the uncorrected OLS mostly differs from the corrected regression. Where the self-selection corrected regressions imply significant performance benefits to UVA activity, the regular regression implies none; and, where the regular regression implies a significant benefit, the self-selection corrected regression implies none. Neither regression implies quality-related performance benefits of UVA activity for SMEs. In sum, the results provide partial support for Hypotheses 1 and 2.

Figure 2 summarizes the tests relevant to Hypothesis 3. Figure 2 is a 2×2 matrix comparing SMEs that do and do not engage in UVA activity on one dimension, and SMEs that do

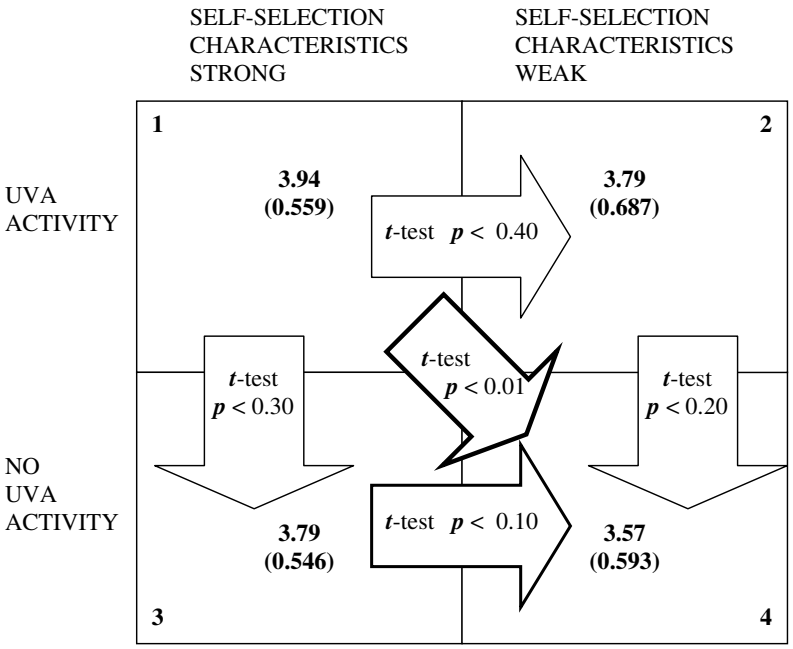

Figure 2. Self-selection characteristics and UVA activity effects on SME performance. 1. Each square is a quadrant (see bold number at its outside corner), and indicates the *PerformanceOutcome* measure average with standard deviation in parentheses. 2. All performance measures showed a significant *t*-test result (i.e., $p < 0.10$) for quadrant 1 vs. quadrant 4. 3. The *ROAOutcome* and *CompetitivePositionOutcome* performance measures also showed significant *t*-test results for quadrant 3 vs. quadrant 4. 4. The *ROAOutcome* performance measure showed a significant *t*-test result for quadrant 2 vs. quadrant 4

and do not have characteristics that are associated with choosing UVA activity (i.e., SMEs with probit values over and under 0.50, respectively) on the other dimension. SMEs with both the characteristics and the activity performed better than SMEs with only one or none. Essentially, that reveals self-selection characteristics and UVA activity are complementary for the SME. The comparisons shown are means difference *t*-tests comparing sample means across quadrants. Note that the complementarity between the UVA activity and the self-selection characteristics is of the diminishing returns kind. The results partially support Hypothesis 3.

GENERATION OF THE SELF-SELECTION BASIS HYPOTHESES

Based on these self-selection analysis results, we can now explore two further related issues in our second research question. The first issue is whether the SMEs that could benefit most from UVA activity were most likely to engage in it. The second issue concerns the role that SME management perceptions have in self-selecting the UVA activity.

The fourth hypothesis addresses the first issue, but is actually a consequence of the previous results. We explain it as a consequence first and then we support it in the literature after.

The previous results indicate:

1. that there are benefits to SMEs in general from engaging in UVA activity (Hypothesis 1);
2. that the SMEs more likely to engage in UVA activity embodied certain characteristics—the *self-selection characteristics*—and that these characteristics were more likely to drive superior firm performance even without UVA activity (Hypothesis 2);
3. that self-selection characteristics and UVA activity complement each other (i.e., the SMEs with *both* the characteristics and UVA activity performed better than SMEs with one or none) but do so in a diminishing returns fashion (i.e., the SME's benefit from the additional factor is *less* than the benefit from either single factor alone) (Hypothesis 3).

These results imply that those SMEs with greater levels of self-selection characteristics—the SMEs more likely to engage in UVA activity—benefit less (due to the diminishing returns result) than other SMEs; hence the UVA activity is inefficient from a social benefits point of view in that more benefits could be hypothetically generated by shifting the UVA activity to those SMEs with lower levels of those characteristics.

The literature also supports this notion that the SMEs more likely to engage in UVA activity benefit less than other SMEs. Explanations and evidence indicate that weaker SMEs are less likely to choose UVA activity while stronger SMEs are more likely to choose UVA activity. On one hand, there are several reasons why weaker SMEs are less likely to choose UVA activity. The weaker SMEs are more worried about loss of independence in an alliance (Torres, 2002), and they lack alliance experience (Pangarkar, 2003) and trust in partners. The weaker SMEs also have lower beliefs in mutual benefits (Dainty *et al*., 2001) from the alliance, and are more worried about selection problems and lost opportunity costs (Nelder and Skandalakis, 1999). Furthermore, weaker SMEs also have a relative lack of bargaining power and slack resources (Gomes-Casseres, 1997), in addition to possibly lacking the awareness of, and the competencies relevant to, alliance activity. On the other hand, the stronger SMEs are more likely to choose UVA activity because of relatively more optimistic cost expectations (Torres, 2002), greater resource flexibility, more seasoned managers, and greater leverage-able resources. The fourth hypothesis follows:

> *Hypothesis 4: The most needy SMEs will not be the ones that engage in UVA activity. The population of SMEs engaging in alliance activity will not favor those that could benefit most from such activity.*

We now need to explain the phenomenon of why the SMEs that would benefit more from UVA activity are not pursuing that activity as vigorously as the SMEs that will benefit less from UVA activity. Two alternative explanations are that: (1) the former are constrained from engaging in UVA activity; and, (2) the latter perceive greater benefits from UVA activity.

Examining the empirical results thus far provides no evidence for any specific cut-off point in the value of any UVA self-selection variable used. Essentially, there does not appear to be any

obvious constraint on the SMEs that did not pursue UVA activity that precluded their engaging in UVA activity. The range of variable values is essentially the same for both the firms that selected UVA activity and those that did not (NB: not reported in the results). This lack of empirical support for a constraint is consistent with theory. Alliances in particular should be more attractive to firms in search of access to specific resources that are too weak to use an alternative method. That weakness could be in size, constraining the firm from alternatives like acquisitions. Or, that weakness could be in legitimacy, constraining the firm from alternatives like the spot market (e.g., where the SME may have to pay more or accept a contract with worse payment terms because the firm has yet to gain the trust of suppliers).

Thus, we assume that the explanation does *not* lie in constraints on the weaker SMEs. Instead, we pursue the explanation for the phenomenon by exploring SME perceptions of UVA benefits. It is well established in the literature that strategic decisions, such as self-selection into alliance activity, are based on management perceptions (Das, 2003; Maule and Hodgkinson, 2003; Ryan *et al*., 2000; Waller and Chow, 1985). It is also well established in the literature that there is a significant possibility that such perceptions are inaccurate (Das, 1986; Mezias and Starbuck, 2003; Sharma and Lambert, 1994). There has been little research into the strategic decision processes of SMEs (Busenitz and Barney, 1994). The little research there is, though, suggests that SMEs are less comprehensive in strategic decision-making processes. For example, SMEs are more open to mistakes due to biased perceptions and the use of heuristics (Hill and Levenhagen, 1995; Ogbuehi and Longfellow, 1994; Smith *et al*., 1988). Busenitz and Barney (1994) and Hill and Levenhagen (1995) infer that SME decision context characteristics—complexity, uncertainty, high velocity—actually require the managers to use heuristics to cope. As a result, SMEs are open to a number of decision biases. Some of these decision biases help explain why certain SMEs are likely to overestimate the benefits from UVA activity.

Consider the biases that falsely give otherwise stronger SMEs the perception that UVA activity benefits them relatively more. Representativeness (Busenitz and Barney, 1994), attribution (O'Donnell *et al*., 2002), and hindsight biases (Bukszar and Connolly, 1988) can all act to generate a false impression on the SME. SMEs that would perform better with or without UVA activity may get the false impression that it is the UVA activity that makes them perform better rather than other factors. Additionally, the subtlety of the concept of self-selection itself—that certain firm characteristics that would otherwise lead to better performance also lead the firm to choose alliance activity—is likely to be lost on many SME managers. The result is that SMEs with better self-selection characteristics falsely attribute their performance to what they think are the relatively greater benefits they get from engaging in UVAs. Fueling these misperceptions may be additional characteristics of the stronger SMEs, such as hubris and overconfidence based on previous success. Due to all of these factors, the stronger SMEs have the impression that they can better leverage alliance activity than weaker SMEs. The fifth hypothesis follows:

> *Hypothesis 5: The SMEs that are actually less likely to benefit less from alliance activity will perceive greater benefits than the SMEs that are more likely to benefit from alliance activity.*

ADDITIONAL VARIABLES

We describe the additional variables[5] required to test the final hypotheses below. Table 6 provides a detailed description of these variables. These variables consist of the SME manager's perceptions of how well the UVA is helping with that SME's market share, profitability, product quality, costs, and customer service (i.e., *MarketSharePerception, ProfitPerception, QualityPerception, CostsPerception, CustomerServicePerception*, respectively).

Table 4 provides the descriptive statistics for the additional variables. They all span the allowed value ranges. The table also indicates that all perceived effect variables (denoted by the *Perception* designation) are significantly correlated with

[5] Please note that these are perceptions of how an activity affects performance rather than perceptions of performance. While we agree that both sets of perceptions may be inaccurate, it is standard to assume, and has been supported in the literature, that survey data regarding firm performance are sufficiently accurate. We argue that perceptions of relationships between activities and outcomes are less likely to be accurate, especially when self-selection is present, as in the case here.

Table 6. Variables regarding SME perceptions

ID	Explanation
UVA Activity	A three-value variable (−1/0/1) indicating the trend in upstream alliance activities based on the survey question: Has there been an increase (+1), a decrease (−1), or no change (0) in the number of your firm's alliances with suppliers over the last 3years?
MarketSharePerception	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME perceives how much the upstream vertical alliance is helping the firm's market share based on the survey question: How successful is your supplier alliance activity in terms of increasing your firm's market share?
ProfitPerception	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME perceives how much the upstream vertical alliance is helping the firm's profitability based on the survey question: How successful is your supplier alliance activity in terms of increasing your firm's profits?
QualityPerception	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME perceives how much the upstream vertical alliance is helping the firm's product quality based on the survey question: How successful is your supplier alliance activity in terms of increasing your firm's quality level?
CostPerception	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME perceives how much the upstream vertical alliance is helping the firm's cost level based on the survey question: How successful is your supplier alliance activity in terms of lowering your firm's total costs?
CustomerServicePerception	This is a 5-point Likert scale assessment (1 = low, 5 = high) of how the SME perceives how much the upstream vertical alliance is helping the firm's customer service based on the survey question: How successful is your supplier alliance activity in terms of increasing your firm's customer service level?

Table 7. Projected SME performance scores of UVA-active SMEs vs. non-UVA-active SMEs (where projections are based on coefficients from corrected OLS analysis of non-UVA-active SMEs)

	MarketShare Outcome		ROA Outcome		Quality Outcome		CompetitivePosition Outcome		CustomerService Outcome	
	UVA	None	UVA	None	UVA	None	UVA	None	UVA	None
Mean	3.5653	3.3892	3.3881	3.1590	4.1075	4.0675	3.9121	3.6913	3.8263	3.7496
Variance	0.2503	0.2542	0.2701	0.1856	0.1345	0.1421	0.2979	0.1967	0.2470	0.2310
n	101	97	101	97	101	97	101	97	101	97
d.f.		196		192		195		191		196
t-statistic		2.4666[b]		3.3819[c]		0.7559		3.1293[c]		1.1031

[a] $p < 0.10$; [b] $p < 0.05$; [c] $p < 0.01$

their outcome variable counterparts (denoted by the *Outcome* designation) with the exception of the correlation of *CostsPerception* with *CompetitivePositionOutcome*.

RESULTS OF INEFFICIENCY AND PERCEPTIONS IN SELF-SELECTION

Table 7 provides the results of the analysis of Hypothesis 4: it compares the projected performance outcome measures of SMEs engaged in UVAs (101 firms) with those not engaged (99 firms). We calculate the projections by applying the coefficients from a self-selection OLS analysis on only the non-UVA active SMEs. Essentially, the UVA-active SME performance was projected to be what it would have been *without* actually engaging in the alliance activity, but controlling for the effects of the characteristics that made the SME more prone to choosing an alliance. The UVA-active SMEs consistently scored on average higher projected performance outcomes, with statistical significance for the market share, ROA,

Table 8. Probit scores (from first stage of self-selection model) of UVA-active SMEs that had perceptions of greater UVA benefits vs. those that had perceptions of lesser UVA benefits to performance

Perception score:	MarketShare Perception		Profit Perception		Quality Perception		Cost Perception		CustomerService Perception	
	4,5	1,2,3	4,5	1,2,3	4,5	1,2,3	4,5	1,2,3	4,5	1,2,3
Mean	0.6637	0.5922	0.6609	0.5738	0.6527	0.5693	0.6477	0.5777	0.6509	0.5538
Variance	0.0357	0.0419	0.0376	0.0401	0.0333	0.0491	0.0365	0.0434	0.0373	0.0403
n	38	51	50	39	57	32	58	32	64	26
d.f.		83		81		55		59		45
t-statistic		1.7032[a]		2.0651[b]		1.8119[a]		1.5712[x]		2.1029

[a] $p < 0.10$; [b] $p < 0.05$; [c] $p < 0.01$; [x] $p < 0.10$ for 1-tail *t*-test

and competitive position performance measures. The interpretation is that although the absolute effect of UVA activity would be the same for SMEs both more and less likely to choose UVA activity (i.e., the coefficient on the *UVA* variable is the same for the entire sample), the *relative effect* would be greater for those SMEs less likely to choose UVA activity.[6] Hence, there exists an interpreted inefficiency in the selection of such activity; Hypothesis 4 is partially supported.

Table 8 provides the results of the analysis of Hypothesis 5: it compares the probit probability scores of the SMEs with high levels of perceived effects to the scores of the SMEs with lower levels. The table indicates that SMEs with the perceptions of greater performance effects of UVA activity were more likely to choose UVA activity. The inclusive cut-off point for the higher levels of perception variables was the score of 4 (out of the 5 point scale). We based the analysis on the sample of firms that actually did engage in UVA activity—101 of the 200 SMEs—as these were the only firms that provided their perceptions of how their alliances were affecting performance. The probit scores (from the first stage of the self-selection analysis) are consistently higher for the SMEs that perceive greater benefits from UVA activity across all performance measures, and are statistically significant except for the *CostsPerception* variable. Thus, SME perceptions of greater benefits, although inaccurate, help drive self-selection of alliance activity; Hypothesis 5 is partially supported.

DISCUSSION

Figure 1 depicts the framework of an analysis that primarily investigates whether UVA activity is beneficial to UVAs and secondarily investigates whether possibly inaccurate perceptions drove the self-selection of SMEs into alliance activity. In the figure, the outside-the-main-box factors indicate that the hypotheses relevant to them were tested after the main model—i.e., primary—analysis. We discuss the results below.

Hypothesis 1 is partially supported by the results. Controlling for self-selection effects, UVA activity correlates with benefits for SMEs in a number of performance measures, significantly for *MarketShareOutcome, ROAOutcome, CompetitivePositionOutcome*, and *PerformanceOutcome*. Essentially, the benefits of UVA activity are being revealed in outcome terms rather than in terms of the basis for such outcomes (e.g., a quality or customer service basis for a differentiation advantage based on). Supplier alliances appear to provide a *means of leveraging* SME differentiation advantages—making them more efficient and effective—but *do not confer* those advantages on the SMEs.

Curiously, without the self-selection correction, only the *CustomerServiceOutcome* measure is significantly positively affected by UVA activity. This is the complete opposite result of when self-selection is controlled for because it appears

[6] We also ran (but did not formally report) self-selection corrected OLS for subsamples: for those SMEs with probit probability scores above 0.5 (i.e., the stronger SMEs) and for those with scores below. We found that for *all* of the performance outcome measures the coefficient on the UVA activity indicator variable was *higher* for the weaker SMEs, significantly so for the *PerformanceOutcome, MarketShareOutcome, ROAOutcome*, and *CompetitivePositionOutcome* measures. This result reveals that the *absolute effect* of UVA activity on the weaker SMEs is greater than that effect on the stronger SMEs, strongly supporting Hypothesis 4.

that UVA activity is beneficial to the basis for advantage but not the measure of that advantage in performance terms. Such misperceptions regarding the importance of and the firm's success at providing differentiation are consistent with the literature on SME management perceptions (O'Donnell *et al*., 2002; Sharma and Lambert, 1994). So, it is not surprising that SME managers might mistake UVAs as a basis for new advantages (i.e., which is the uncorrected OLS result) rather than as leveraging mechanisms of current advantages (i.e., which is the self-selection corrected OLS result).

Hypothesis 2 is partially supported by the results. Controlling for self-selection effects, several SME characteristics that influence the choice to engage in alliance activity were correlated with benefits for SMEs in a number of performance measures, significantly for *MarketShareOutcome, ROAOutcome, CompetitivePositionOutcome*, and *PerformanceOutcome* (as indicated by the effect of the *LAMBDA* variable in the corrected OLS regressions). Constituting the self-selection control, *LAMBDA*, are variables in the probit analysis measuring size (*FirmSize*), supply chain relationship commitment (*SCM, Outsourcing, FirmasKeySupplier*), and the SME's focus on supplier participation (*SupplierParticipation*). Larger SMEs may be able to enjoy more scale and scope economies, leverage more managerial experience, and have access to more slack resources than smaller SMEs, and hence perform better. SMEs with more commitment to the supply chain management may have more experience to leverage, more network resources to leverage, and more potential downstream demand than other SMEs, and hence perform better. SMEs that place more importance on supplier participation in innovation may have a greater emphasis on learning and updating to be able to perform better. Again, as in Hypothesis 1, it appears that such SME characteristics help the final outcome measures—help the SME leverage an advantage—rather than help the SME get the differentiation basis itself.

Hypothesis 3 is partially supported by the results. The UVA activity and the self-selection characteristics are complementary, but in a diminishing returns manner. Most performance measures, whether final outcomes or differentiation bases, showed a significant increase when both the UVA activity and the SME characteristics that favor selection of that activity were present vs. when only one or none of these two items were present. However, each item alone bestowed substantial benefits on the SME, implying some substitution possibilities between the two. The complementarity is logical. When both the ability to ally (the SME characteristics) and the outlet to ally (the UVA) exist, then the combination should produce better results than either alone, or none. The reality that either alone also provides significant benefits is explained by what each item represents. The alliance represents a flexible way of accessing a number of benefits, even when a firm is relatively weak. The SME self-selection characteristics represent a set of resources that can be leveraged through alternative modes, such as acquisitions, internal ventures, and contractual supply relationships. The result that the relationship between the characteristics and the alliance activity is decreasing returns is probably driven by the infrequency of increasing returns opportunities. Many such opportunities are either restricted by regulation in the vertical alliance context (Spengler, 1950), or they are hard to protect given the ability of rivals to also engage in similar alliances.

Hypothesis 4 is partially supported by the results. UVA activity entails fewer benefits for the SMEs that are more likely to select it. There are several issues to consider when addressing this phenomenon. First, the result implies that theoretically there is room for a welfare improvement if the weaker SMEs could be persuaded to engage in alliance activity. However, that new activity does not guarantee increased welfare because of reactions that could harm such potential improvements, like the exploitation of such weak SMEs by unscrupulous partners. Second, there may be crowding out effects to consider if the supply of UVA partners is limited (i.e., one may need to account for the lost alliances of other SMEs when certain alliances are promoted over others). Third, the current performance may be a function of those weaker SMEs not engaging in UVA activity, giving the advantage to stronger SMEs. By taking the advantage away and leveling the playing field, there may be fewer benefits and more costs. Fourth, there are several welfare issues unaccounted for in this partial analysis, including the costs of alliance failure and SME failure, and whether some SME benefits are consumer costs, such as those arising from collusive activities among alliance partners.

Hypothesis 5 is partially supported by the results. SMEs more likely to engage in UVA activity perceived greater benefits from that activity than the SMEs less likely to engage in alliances. Additionally, though not reported, the former group had increased their recent UVA activity. They increased their UVA activity because of its greater perceived benefits in market share and customer service. Thus, it appears SME self-selection into UVA activity is significantly correlated with, to the point of being based on, SME perceptions of the benefits of that activity. That self-selection is an issue because the SME perceptions of benefits from UVA activity may not be accurate. This may be an area for policy makers and educators to help SMEs. Without that help, many SMEs are unlikely to seek the relevant research or afford the consultants that could correct such misperceptions.

LIMITATIONS

There are a number of limitations to this analysis. Characteristics of the data, including missing items and the usual concerns relevant to surveys, limit the range of tests available to address the research questions. The data are based on a survey with a relatively low response rate, which may limit representativeness. Applying the results to new contexts, for example those industries with weak APICS and ISM representation, may not be prudent. Further controls, such as those measuring other factors relevant to SMEs, like founder background (Park and Krishnan, 2001), would help in deepening the results, as would additional performance measures (e.g., UVA outcome quality measures) and additional perception measures (e.g., perceptions of UVA benefits from non-UVA-active SMEs; SME perceptions of the interdependent relationship of UVA activity and firm characteristics on firm performance). The analysis is also missing an *endogenization* of the cycle, from results to perceptions to choice back to results and so on; that is left for future work.

CONCLUSIONS

We analyze how upstream vertical alliance (UVA) activity affects the performance of small and medium-sized enterprises (SMEs); in addition, we also analyze how SME perceptions of the relationship influence the choice to engage in UVA activity. We find that UVA activity does benefit SME performance when self-selection effects are controlled for, and does so by leveraging SME advantages rather than by creating any new core differentiation advantages. We also find that SME perceptions appear to drive the self-selection of UVA activity rather than the absence of any factors that could logistically constrain an SME from engaging in that activity. Moreover, we find that the SME perceptions of UVA benefits are inaccurate. Those SMEs likely to benefit less from such activity perceive greater benefits than SMEs likely to benefit more, with the potentially socially inefficient result that the former engages in UVA activity more than the latter.

These results contribute to the SME literature, the alliance literature, and the self-selection literature. We provide evidence that upstream alliances benefit SMEs, even when such firms are relatively weak in scale and supply chain management. We provide evidence on how alliance activity benefits SMEs—through leveraging differentiation advantages rather than generating them. We provide evidence for what drives self-selection—the perceptions of SME managers. While the literature does establish that perceptions do influence strategic decision-making, and separately that perceptions are often inaccurate, there is little if any research addressing perceptions in self-selection *per se*, and none showing that perceptions are consistent with empirical results when self-selection is *not* controlled for. We look forward to future work that can examine the cycle of perceptions–choices–results–updated perceptions, etc., by endogenizing the model and determining methods to break such a cycle when that cycle leads to outcomes where the most appropriate firms are not the ones choosing a particular strategic activity.

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