Strategic Management Journal
Strat. Mgmt. J., **30**: 99–116 (2009)
Published online 10 November 2008 in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/smj.724
Received 4 October 2006; *Final revision received 8 July 2008*

THE RELATIONSHIP BETWEEN PRODUCT AND INTERNATIONAL DIVERSIFICATION: THE EFFECTS OF SHORT-RUN CONSTRAINTS AND ENDOGENEITY

M.V. SHYAM KUMAR*
Lally School of Management and Technology, Rensselaer Polytechnic Institute, Troy, New York, U.S.A.

We examine the relationship between growth along the product and international dimension in the short run. We argue that while the presence of fungible intangible resources and economies of scope may create opportunities for a firm to expand along both dimensions, the effect of short-run constraints may lead to a trade-off and a negative association between the two dimensions. In addition, we suggest that rather than being independent, decisions concerning the extent of growth along the two dimensions are likely to be made simultaneously and endogenously by firms after taking into consideration the availability of various resources. We test these propositions by observing a sample of 1,299 firms over the period of 1993–1997. Our results show strong evidence of endogeneity and a negative association between growth along the two dimensions. These findings provide important support for theories of firm growth that have long held that firms are limited in the number of opportunities they can exploit in the short run by various constraints. Copyright © 2008 John Wiley & Sons, Ltd.

INTRODUCTION

Product and international diversification[1] constitute two alternatives for firms to grow and utilize their resources (Ansoff, 1965). To the extent that both forms of diversification build on existing resources and capabilities, growth along one dimension is likely to be systematically related to growth along the second dimension. This line of reasoning carries two important implications. First, if both forms of diversification are based on economies of scope in fungible intangible resources (Teece, 1980, 1982; Hennart, 1982) such as technical, marketing, and production know-how, and common dynamic capabilities such as the ability to manage diverse subunits (Hitt, Hoskisson, and Kim, 1997), growth along one dimension is likely to be positively associated with growth along the second dimension. On the other hand, if diversification along the two dimensions is subject to short-run constraints such as the limits arising from replicating and transferring tacit, causally ambiguous competencies (Teece, 1977; Zander and Kogut, 1995; Szulanski, 1996; Martin and Salomon, 2003a, 2003b), and absorptive capacity (Cohen and Levinthal, 1990; Vermeulen and Barkema, 2002), firms may be forced to trade off growth along the two dimensions leading to a negative association (Caves, 1975). Thus the relationship between growth along the two dimensions provides important insight into whether short-run

Keywords: diversification; endogenous growth; performance; corporate strategy; international expansion; resource-based view
*Correspondence to: M.V. Shyam Kumar, Lally School of Management and Technology, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY 12180, U.S.A. E-mail: kumarm2@rpi.edu
[1] Following Ansoff (1965) and Rumelt (1974), throughout this research we use the term 'diversification' to refer to the process of entry and expansion in noncore businesses and foreign markets. Correspondingly we use the term 'diversity' to refer to the state of heterogeneity attained at a particular point in time as a result of past entry and expansion choices.

constraints play a more influential role in strategic choices compared to incentives to expand such as economies of scope.

The second important implication is that since they are based on existing resources and capabilities, decisions concerning the extent of growth along the two dimensions are likely to be made simultaneously and endogenously by firms rather than independently. Hence, from a methodological standpoint, examining the relationship between the two dimensions calls for approaches that take into account this simultaneity and endogeneity, and failure to correct for this aspect may result in potential biases in estimating the relationship.

In this research we examine how growth along the product and international dimension are interrelated with each other in the short run. Previous research studying the relationship between the two diversification dimensions has mainly examined cross-sectional associations at a particular point in time (e.g., Caves, 1975; Denis, Denis, and Yost, 2002; Pearce, 1993; Sambharya, 1995; Swedenborg, 1979; Wolf, 1977). However this research has produced inconsistent results with some studies finding a positive association and others a negative association. Given their cross-sectional design, these studies also do not highlight the effects of short-run constraints on diversification choices and the resulting tradeoffs. Apart from this research, a second strand of studies has specifically examined the nature of the relationship between growth along these two dimensions. But even in this research the results have been contradictory. In an early study, Bertin (1972) found a weak negative association. More recently Denis *et al*. (2002) found a positive relationship. These latter studies however do not correct for endogeneity in their empirical approaches.[2]

[2] Two further points are worth noting. First there has been an extensive body of research examining factors influencing a firm's growth along each of these dimensions separately. In the product diversification literature these studies include Montgomery and Hariharan (1991), Merino and Rodriguez (1997), and Silverman (1999). In the international diversification literature this research includes Caves and Mehra (1986). These studies however do not examine the interrelationship between growth along the two dimensions. Relatedly, some studies have examined the collective impact of product and international diversity on firm performance (e.g., Geringer, Beamish, and daCosta, 1989; Kim, Hwang, and Burgers, 1988; Tallman and Li, 1996; Hitt *et al*., 1997; Nachum, 2004). But while this research highlights that the two dimensions may have an interactive effect on performance, it too does not directly test their interrelationship in the short run.

The article proceeds as follows: in the next section we outline various theoretical arguments concerning how growth along the product and international dimension are likely to be interrelated with each other. In doing so we specifically highlight the incentives and constraints that firms experience as they attempt to expand along these two dimensions. In the following section we describe our methods and measures while discussing in detail the need for considering potential endogeneity between the two dimensions. In the next section we present our results, and finally we conclude with a discussion and implications.

THEORETICAL BACKGROUND

Beginning with Penrose (1959), resource-based view (RBV) theorists have argued that firms diversify to exploit economies of scope in various resources (Teece, 1980, 1982; Panzar and Willig, 1981; Tanriverdi and Venkatraman, 2005). These resources may include tangible resources, such as plant and equipment. More importantly, economies of scope arise from intangible resources such as technical, marketing, and production know-how, and various types of competencies and capabilities. When the transfer of these resources across arms-length contracts is subject to market frictions, then diversification becomes an efficient alternative (Buckley and Casson, 1976; Hennart, 1982; Teece, 1982; Morck and Yeung, 1991). In addition, to the extent that these resources are fungible and transferable across product and international markets, their presence provides incentives for a firm to diversify along both dimensions and exploit various opportunities.

But while economies of scope provide incentives to diversify along the two dimensions, firms are also subject to various short-run constraints that may limit the number of opportunities they can exploit along these dimensions within a certain time period. These constraints may be strong enough that they may force a tradeoff between the two dimensions leading to a negative association (Caves, 1975). At least two constraints become important in the process of exploiting intangible resources. The first pertains to transferring existing tacit knowledge to various markets. The second pertains to learning and absorption of new knowledge, since exploiting existing knowledge often entails an exploration element as a firm adapts

DOI: 10.1002/smj

its competencies to various markets (March, 1991; Winter and Szulanski, 2001). Both these factors may lead to a tradeoff since there are limits to how much a firm can undertake in terms of these activities in the short run.

Rather than being fungible in nature, intangible resources often tend to be 'sticky' (Nelson and Winter, 1982; Szulanski, 1996) and difficult to transfer across markets. As a result, the process of replicating these resources consumes a substantial amount of managerial time and effort and may sometimes entail costs that may significantly erode value from scope economies (Teece, 1977). An important reason why the replication and transfer of intangible resources requires substantial managerial effort is that often these resources involve a tacit component (Teece, 1977; Kogut and Zander, 1992). The paradox here is that the very resources that confer competitive advantage in various markets also tend to be causally ambiguous in nature (Barney, 1991) where the precise reasons for their success are incompletely understood. This not only leads to barriers to imitation for competitors, but also makes replication within the organization difficult as transferor and transferee subunits are forced to develop a deeper understanding of the underlying causal relationships (Zander and Kogut, 1995; Szulanski, 1996; Rivkin, 2001; Martin and Salomon, 2003b). Further, intangible resources, especially know-how such as production, marketing, and technical skills, also tend to be mainly experience based making these skills difficult to codify in manuals and in blueprints (Nelson and Winter, 1982; Kogut and Zander, 1993). As a result their replication often necessitates close contact between transferors and potential recipients so that the know-how can be effectively 'taught' to the recipients (Kogut and Zander, 1993; Szulanski, 1996). The consequence is that beyond a point attempts to simultaneously transfer intangible resources to various markets lead to what Teece (1980) calls a congestion factor in the form of 'over-extended scientists, engineers, and manufacturing/marketing personnel' (Teece, 1980: 231–232), which constrains the number of diversification opportunities a firm can exploit. Thus, contrary to being fungible, value-creating intangible resources often cannot be applied infinitely to various opportunities within a short time period due to their tacit nature leading to constraints and tradeoffs between the diversification dimensions.

Previous studies provide important evidence to highlight that the transfer and replication of tacit intangible resources acts as a constraint on diversification. Zander and Kogut (1995) showed that the degree of codifiability of the underlying knowledge had a negative impact on the speed of transfer of an innovation to foreign locations. This finding implies that as the tacitness of a technology increased, it reduced the rate of international expansion of firms. In a related vein, Martin and Salomon (2003b) showed that as the tacitness of a technology increased, the propensity to set up manufacturing abroad initially increased. Beyond a point however, the propensity decreased. The latter finding suggests that valuable tacit know-how initially created foreign expansion opportunities, but beyond a point these opportunities were outweighed by the costs of transfer of the technology to overseas locations. Using a sample of eight leading organizations, Szulanski (1996) examined factors influencing the transfer and replication of best practices across subunits within these organizations. He finds that apart from considerations such as the 'not invented here syndrome,' an important impediment to internal replication was the causal ambiguity surrounding a particular best practice.

While the transfer of tacit knowledge acts as an important constraint on diversification, successful replication and exploitation of intangible resources also involves a significant learning and exploration element. As various scholars have noted (e.g., Nelson and Winter, 1982), the process of replication rarely involves applying existing formulae and business models to new markets without modification. In order to exploit its competencies successfully, a firm must also adapt them to the specific idiosyncrasies and characteristics of the target market. Winter and Szulanski (2001) are explicit about the role of learning and exploration in replication:

> Although replicators [such as McDonald's] are becoming one of the dominant organizational forms of our time, they have been neglected by scholars interested in organizations. As a result of this neglect, replication is typically conceptualized as little more than the exploitation of a simple business formula. Such a view clouds the strategic subtlety of replication by side-stepping the exploration efforts to uncover and develop the best business model as well as the ongoing assessment that precedes large-scale replication of it' (Winter and Szulanski, 2001: 730).

Extending these arguments to diversification, as a firm expands to exploit economies of scope often it needs to discover the traits of the target market that are critical for success and the attributes of existing competencies that are worth replicating and applying to this particular market (or what Winter and Szulanski [2001 : 730] term as the 'Arrow core'). The traits of the target market that are critical include characteristics of customers, information pertaining to competitors and suppliers, understanding of host governments, institutions and cultures, etc. The need for discovering these traits and modifying existing competencies is well recognized by international management scholars who have argued that local adaptation and learning are critical to successful foreign expansion (Bartlett and Ghoshal, 1989; Mitchell, Shaver and Yeung, 1992; Zaheer, 1995; Delios and Beamish, 1999). A similar point has also been noted in the context of product diversification by scholars who have suggested that imposing existing dominant logics on new businesses can have detrimental performance consequences (Prahalad and Bettis, 1986), and that effective product diversification often requires developing new capabilities and practices specific to the target business (Markides and Williamson, 1994).

The importance of learning and discovering the critical traits of the target market at the time of diversification suggests that another constraint that may prevent a firm from expanding across the two dimensions simultaneously is its absorptive capacity (Cohen and Levinthal, 1990; Vermeulen and Barkema, 2002). Formally defined absorptive capacity is the ability of the firm to absorb new knowledge, assimilate it, and apply it to commercial ends.

There are various reasons why absorptive capacity (or more importantly the lack thereof) acts as a constraint on diversification (Kumar and Seth, 2001). First, absorptive capacity depends upon the cognitive capacities of individual managers to learn and absorb knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002). Thus, to the extent that these capacities are limited and managers are boundedly rational, the firm may be unable to absorb knowledge with respect to certain markets at a particular point in time even if it has scope economies. Second, and relatedly, absorptive capacity is also influenced by the slack available in managerial resources (Penrose, 1959; Teece, 1982; Mahoney and Pandian, 1992). The greater the slack, the lower the opportunity costs in diverting managerial resources toward learning at the time of diversification. Once again, however, the amount of slack available is limited in the short run since new managers cannot be hired at an infinite rate from labor markets (Penrose, 1959). As a result, the quantum of knowledge a firm can absorb is constrained, which in turn inhibits its simultaneous expansion across the two dimensions over a certain period (Vermeulen and Barkema, 2002).

It is important to note that absorptive capacity plays a dual role in the sense that once it has been developed by past investments in areas such as research and development (R&D) (Cohen and Levinthal, 1990), it may act as an incentive for a firm to grow and exploit opportunities over the next period. In this respect it is similar to other types of intangible resources such as technical know-how and brand names. However given the fact that managers are boundedly rational and are limited in their cognitive capacities, absorptive capacity also becomes a valuable resource that is inelastic and is not freely available within the firm (Cohen and Levinthal, 1990; Kumar and Seth, 2001). As a result it restricts the number of opportunities a firm can avail itself of in the short run, leading to a tradeoff between the two dimensions.

Empirical evidence with regard to the limits posed by learning and absorptive capacity on diversification is provided by various studies. Barkema and Vermeulen (1998) showed that as product diversity increased, there was a greater propensity for firms to expand abroad through a greenfield subsidiary rather than an acquisition. They argued that this is because diversity enhances the ability to absorb knowledge by providing a rich and more varied background, which eases cognitive limits and enables the firm to develop its own complementary knowledge pertaining to a market. Goerzen and Beamish (2003) found that asset dispersion across foreign markets increased performance, but high levels of environmental dissimilarity across these markets decreased performance. They suggested that this is because high levels of environmental dissimilarity make it costly for the multinational enterprise to learn and respond to local demands, thereby stretching its absorptive capacity. Vermeulen and Barkema (2002) found that the rate at which a firm expanded abroad negatively moderated the relationship between its international scope and profitability. They interpreted this finding to imply that a faster rate of

DOI: 10.1002/smj

expansion makes it difficult for a firm to effectively learn from international markets and potentially causes it to exceed its absorptive capacity. In terms of product diversification, the importance of absorptive capacity and learning as a constraint is highlighted by studies that have consistently found that unrelated expansion is costly and less profitable than related expansion (Ramanujam and Varadarajan, 1989). While unrelated expansion may provide opportunities to exploit generic skills (Montgomery and Wernerfelt, 1988) and financial resources (Tanriverdi and Venkatraman, 2005), the value created by such expansion is often offset by the higher costs of absorbing knowledge, thereby making it less profitable on average compared to related expansion.

In sum, the above arguments suggest firms will be constrained in the short run both in terms of transferring tacit knowledge as well as in terms of absorbing new knowledge from various markets (March, 1991; Anand and Delios, 2002). As a result, as managerial resources become utilized in pursuing growth along any one dimension (either in transferring tacit knowledge or in learning), the amount of resources available for growth along the second dimension becomes limited. This may potentially lead to a tradeoff between the two dimensions. Hence:

Hypothesis 1: Growth along the product dimension will be negatively associated with growth along the international dimension in the short run.

In contrast with Hypothesis 1, which pertains to the effects of short-run constraints on diversification choices, there are various arguments to suggest there may also be a positive association between growth along the two dimensions. First, if economies of scope in a fungible knowledge base and intangible resources underlie the two forms of diversification, a firm may find profitable growth opportunities along both dimensions in a particular period. To the extent that the firm is able to overcome constraints in terms of the transfer of tacit knowledge and learning, it may be in a position to diversify simultaneously along both dimensions and exploit these opportunities. Second, as some authors have suggested, the two forms of diversification may also build on various common dynamic capabilities (Chandler, 1991; Hitt, Hoskisson, and Ireland, 1994; Hitt *et al*., 1997). Thus, for example, by virtue of diversifying along one dimension, a firm may develop capabilities to manage diverse subunits through well-defined transfer pricing mechanisms. In addition, a firm may also develop efficient routines to allocate scarce resources, such as financial resources and human capital (Burgelman, 1983), and other structural mechanisms, such as a multidivisional structure (Hitt *et al*., 1994), which may facilitate coordination and learning across multiple markets. Relatedly, a firm may develop acquisition capabilities and joint venture capabilities. These capabilities may also be fungible as certain skills may be common to both dimensions such as valuation, partner selection, and post-merger integration. Finally, a firm may acquire product development capabilities and architectural competencies (or the ability to reconfigure linkages among components; Henderson and Clark, 1990) in the process of diversifying along one dimension, and once developed these capabilities may be utilized along the second dimension to modify products to specific market conditions.

If economies of scope in these common capabilities and fungible resources exert a stronger influence than short-run constraints, then the two growth dimensions may be positively associated and may reinforce each other. This leads to the following alternate hypothesis:[3]

Hypothesis 1-alt: Growth along the product dimension will be positively associated with growth along the international dimension in the short run.

Hypothesis 1 and Hypothesis 1-alt offer contrasting predictions about the relationship between growth along the product and international dimension in the short run. Thus while support for Hypothesis 1 implies that the effect of short-run constraints is stronger, support for Hypothesis 1-alt implies that the impact of fungible resources and economies of scope is more influential as firms expand along the two dimensions over a particular

[3] It is important to note that by definition the two diversification dimensions would be positively associated with each other when a firm introduces new products in new foreign locations. However the degree to which such expansion occurs in the short run may be limited compared to other forms of growth, considering that the firm has to undertake two levels of learning simultaneously (product and geographic). Hence as such we do not expect that this type of growth would necessarily bias results in favor of Hypothesis 1-alt compared to Hypothesis 1.

period. The next section turns to the methods used to test these alternate hypotheses.

METHODS

In order to test our hypotheses the empirical strategy we adopted paralleled previous studies in the Penrosean and RBV tradition (e.g., Shen, 1970; Caves and Mehra, 1986; Montgomery and Hariharan, 1991; Chatterjee and Wernerfelt, 1991; Gander, 1991; Silverman, 1999). In these studies the typical approach has been to predict the extent of growth and diversification of a sample of firms over a particular time period, usually a period of around four years, as a function of the firm's resources at the beginning of that period. The basic idea is that firms are in a state of dynamic equilibrium with resources at time t determining the new equilibrium attained at time $t + \Delta t$ (Montgomery and Hariharan, 1991). Our objectives in this research are similar to those in these studies in the sense that after controlling for the impact of various resources we are interested in understanding whether the extent of growth along one dimension is negatively or positively associated with the extent of growth along the second dimension as firms strive to attain a new equilibrium. In doing so, we also correct for potential endogeneity between the two diversification dimensions.

Given this empirical strategy, we first needed to decide on a suitable sample of firms and a time period to examine the extent of growth along the two diversification dimensions. Below we outline the procedures employed toward these objectives.

Data sources, sample and time frame

The primary data source we used to test our hypotheses was Standard & Poor's Compustat database. While Compustat has been widely employed in previous diversification research, there is an important aspect related to the data that needs to be taken into consideration. Traditionally in Compustat's business segment file, product segment data are reported based on the Financial Accounting Standards Board's (FASB) Statements of Financial Accounting Standard(s) (SFAS) 14. This standard requires firms to report product segment data on an industry basis. But in 1997 the FASB issued SFAS 131, which requires firms to report product segment data based on their internal evaluation methods and resource allocation processes rather than on industries. As a result of SFAS 131, beginning in 1998 several firms started reporting a larger number of product segments than before, revealing a number of 'hidden diversifiers' (Berger and Hann, 2003). This change in reporting standard makes it difficult to compare product segment data pre- and post-1998. To deal with this problem, we based our analyses on SFAS 14 data (since it is based on industries rather than business units) and used 1997 as our cutoff year. As a precautionary measure we did conduct a robustness check of our results with SFAS 131 product segment data in 1998 and found that our results remain substantively similar.

Once having decided on our cutoff year, following previous studies (e.g., Chatterjee and Wernerfelt, 1991) we used a four-year period to observe the amount of growth along the product and international dimension. Hence, the year 1993 served as the base year for selecting our sample of firms and as the starting point for our study. In selecting our sample, we first identified all U.S.-based firms in the manufacturing sector (Standard Industrial Classification [SIC] code 2000–3999) with sales greater than $50 million in 1993. Next we checked to see if there were data available for these firms in the Compustat geographic and business segment data files in 1993 and 1997. After eliminating firms with missing data, we were left with an initial sample of 1,299 firms. For these 1,299 firms we then collected data for various control variables (such as R&D intensity and advertising intensity; we discuss the role of these variables below). At this stage, we detected additional missing data in Compustat for a number of firms. Rather than subjecting our sample to attrition by dropping observations, we decided that the best approach would be to first use the full sample of 1,299 firms, and then to ascertain the robustness of our results for a reduced sample of firms for which data on control variables was available ($n = 690$).

Dependent variables

To test our hypotheses, we also needed to develop suitable measures for capturing the degree of growth and diversification along the product and international dimension over the four-year period 1993–1997. We used the following measures in our study:

DOI: 10.1002/smj

$$\mathbf{\Delta PD} = (\text{Noncore business sales in 1997 minus Noncore business sales in 1993})/\text{Total sales in 1993}$$

$$\mathbf{\Delta ID} = (\text{Foreign sales in 1997 minus Foreign sales 1993})/\text{Total sales in 1993}$$

where ΔPD is the extent of growth along the product dimension, and ΔID is the extent of growth along the international dimension. As discussed below, both these variables are dependent variables and are endogenous in our study. The two measures reflect the amount of growth undertaken by the firm in noncore businesses and foreign markets over the 1993–1997 period. Normalizing by size in 1993 gives an indication of how rapidly firms in the sample grew in relative terms over 1993–1997. In order to construct the ΔPD measure, we first identified the core business segment as the segment with the largest sales in 1993 and 1997. Sales of the remaining segments were aggregated to arrive at noncore business sales. Similarly, in order to construct ΔID, we retrieved foreign sales data from Compustat for the year 1997 and 1993 and the above measure was constructed.

It is important to note that the above two measures capture entry into new markets as well as increasing presence in existing noncore businesses/foreign markets over the 1993–1997 period. Ideally we would have liked to construct measures that captured only the number of new markets entered by the firm over the four-year period as well as the size of entry in each of these markets. But such detailed data were not available, especially for international expansion. From a theoretical standpoint, the fact that the measures may be capturing increasing presence in existing markets is consistent with our arguments. Thus even after a firm initially enters a particular product/international market, it is likely to face constraints in terms of replicating competencies and learning, which may lead to tradeoffs and supports the use of these measures.

Apart from this issue, our choice of the above two measures was also motivated by other important theoretical considerations. In this study our purpose is to understand when a firm grows along one dimension, to what extent this would impact its expansion along the second dimension. Addressing this question calls for measures that reflect the amount of growth and expansion along the product and international dimension rather than changes in diversity along the two dimensions. To appreciate this point further, consider the two measures of product and international diversity traditionally used in the literature, the Herfindahl index, and percent international sales. One alternative was to measure growth along the two dimensions by constructing change scores in these variables (Bergh and Fairbank, 2002). This approach involves taking differences in the Herfindahl index between 1997 and 1993, and correspondingly taking differences in percent international sales between 1997 and 1993 as measures of ΔPD and ΔID. But conceptually this approach is not suitable, and does not meaningfully capture growth along the two dimensions for the following reasons.

The Herfindahl index is based on the number of product segments as well as the distribution of sales across product segments (Gollop and Monahan, 1991). But since it depends upon both these components, in some instances it is possible that the index may actually decline over time even if a firm has increased its scope along the product dimension if the distribution of sales becomes more unequal. Hence while changes in the Herfindahl index may reflect changes in diversity, they may not accurately reflect the extent of growth along the product dimension, which is the construct of interest in this study. Similarly, percentage international sales captures the proportion of sales attributable to foreign operations, and has been used extensively to measure the extent of international operations at a particular point in time. But taking differences in percentage international sales does not reflect the degree to which a firm may have grown internationally over a particular period. This is because even if a firm's foreign sales have increased and it has expanded internationally, if its domestic sales grow at a faster rate, then percentage international sales would decline. Thus in such instances differences in percentage international sales would suggest negative growth along the international dimension despite an increase in presence in foreign markets.

In light of these various issues, in this study we chose the above measures of ΔPD and ΔID since it enables us to capture growth along the two dimensions in a relatively straightforward manner. As an illustration of this point, for the 1,299 firms in our sample the Herfindahl index of product diversity

DOI: 10.1002/smj

had values of 0.287 and 0.273 in 1993 and 1997 respectively. Correspondingly, the values for percentage international sales were 0.136 and 0.164. In contrast, the mean ΔPD value as measured above was 5.8 percent of 1993 sales and the ΔID value was 16.3 percent of 1993 sales. As these data suggest, while the Herfindahl index declined over time, firms in the sample did grow and increase their scope in noncore businesses as indicated by the positive value for the mean of the ΔPD variable.

Empirical approach

As noted at the outset, in testing our hypotheses a critical aspect that needs to be taken into consideration is that firms are likely to make decisions pertaining to how much to expand along the two dimensions simultaneously rather than independently after evaluating the availability of various resources. Thus rather being independent or unidirectional, the relationship between the two diversification dimensions (i.e., ΔPD and ΔID) is likely to be bidirectional with growth along one dimension influencing the amount of growth along the second dimension in a certain time period and vice versa.

In an ordinary least squares (OLS) specification that ignores this bidirectional relationship and takes expansion along any one dimension as the dependent variable and expansion along the second dimension as the independent variable, the error term is likely to be correlated with the endogenous right-hand side variable. This leads to biased and inconsistent parameter estimates (Johnston, 1972; Chatterjee and Singh, 1999; Salomon and Shaver, 2005). To elaborate further, in testing Hypotheses 1 and 1-alt we could have specified either of the following two equations:

$$\Delta PD_{t,t+4} = f(\Delta ID_{t,t+4},\ \text{control variables}_t,\ \text{identifying variables}_t) \quad (1)$$

$$\Delta ID_{t,t+4} = g(\Delta PD_{t,t+4},\ \text{control variables}_t,\ \text{identifying variables}_t) \quad (2)$$

Once having specified these equations, we could have estimated them independently using OLS and examined the coefficients of ΔPD and ΔID. But given the bidirectional relationship between the two dimensions and the possibility that they may mutually influence each other, an increase in the error term in Equation (1) would positively impact ΔPD, which in turn would influence ΔID in Equation (2) (either positively or negatively depending upon the relationship between ΔPD and ΔID). Thus ΔID would be correlated with the error term in Equation (1), and similarly ΔPD would be correlated with the error term in Equation (2). This violates the assumptions of OLS, and leads to biased coefficients for ΔID and ΔPD in Equations (1) and (2) respectively when they are estimated separately.

In light of these issues, to conduct our hypotheses tests it is necessary that we estimate Equations (1) and (2) simultaneously and correct for endogeneity. Once the two equations are estimated simultaneously, the sign of the coefficient of ΔID in Equation (1) and the sign of the coefficient of ΔPD in Equation (2) would tell us how the two dimensions are interrelated and would provide a test of Hypotheses 1 and 1-alt.

Identifying and control variables

In conducting our hypotheses tests using equations of the form (1) and (2), another consideration was to find a set of variables that would enable identification of the two equations. Identification is required to obtain meaningful parameter estimates of structural equations estimated simultaneously. To ensure identification, it is necessary (but not sufficient) that in a particular equation the number of exogenous variables omitted are greater than or equal to the number of endogenous variables included less 1. In our case there were two endogenous variables in Equations (1) and (2) (ΔPD and ΔID). Thus it was necessary that Equation (1) have at least one exogenous variable not appearing in Equation (2) and vice versa. To address the identification requirement, the first set of variables we used were growth in the core business to identify Equation (1), and growth in the domestic market to identify Equation (2). These identifying variables represent the firm's nondiversified growth along the corresponding diversification dimension in each equation, and were measured as follows:

$$\Delta CORE = (\text{Core segment sales in 1997 minus Core segment sales in 1993}) / \text{Total sales in 1993}$$

$$\Delta\text{DOM} = (\text{Domestic sales in 1997 minus Domestic sales in 1993})/\text{Total sales in 1993}$$

The inclusion of these variables in estimating Equations (1) and (2) is justified not only from an identification standpoint, but also on theoretical grounds. From a theoretical standpoint firms are likely to allocate their available managerial resources at the beginning of a time period to both diversified and nondiversified growth (Penrose, 1959). Hence, the amount of nondiversified growth is an important factor that is likely to influence the extent of diversified growth that a firm can undertake over the corresponding period, and it is important to control for these effects in Equations (1) and (2) before testing the hypothesized relationships.[4]

Apart from the above identifying variables, a second set of identifying variables we used were the extent of product and international diversity measured at time t = 1993 in Equations (1) and (2). Product diversity (PDV) measured as the Herfindahl index in 1993 (the results were unchanged when we used the entropy index) was included as a control in Equation (1). Similarly, the extent of international diversity (IDV) was proxied by percentage international sales in 1993, and was used as a control in Equation (2). The objective behind using these variables was to control for preexisting levels of diversity on further diversified growth given that diversity may alleviate some of the constraints associated with learning and knowledge absorption (Barkema and Vermeulen, 1998).

In addition to these identifying variables, several additional controls were also included in Equations (1) and (2). The first was firm size, measured as log of sales in 1993. This control was added to account for any advantages that larger firms may have in expanding simultaneously along the two dimensions. Second, we also included industry controls based on a firm's core business. These controls were dummies at the two-digit SIC level. The purpose of these dummies was to control for any differences in the propensity to expand across products or geographic regions due to the inherent nature of the core industry. Third, R&D intensity (R&D) was added as a control for technical skills, measured as the ratio of R&D expense to sales in 1993. Similarly, advertising intensity ADV) was used to account for differences in marketing skills across firms, and was measured as the ratio of advertising expense to sales in 1993. These variables have been used extensively in previous diversification research, and in including these variables the idea was to control for any differential impact of these skills on product and international expansion. Capital intensity (CAP) was added as a control to account for differences in production skills, and was measured as gross property plant and equipment normalized by sales in 1993. Following previous studies (e.g., Caves, Porter, and Spence, 1980), we also controlled for the impact of managerial resources on both forms of diversification. Since data on managerial resources at the firm level are unavailable, we estimated this variable as follows:

$$\text{MGR} = (\text{Number of employees/Sales for the firm in 1993}) \times (\text{Core business average of managers to total employees}).$$

The core business average of managers to total employees was obtained from the Bureau of Labor Statistic's Occupational Employment Survey (cf. Farjoun, 1994; Chang, 1996), while the number of employees was obtained from Compustat. The purpose in using this variable was to control for any advantages that firms with high managerial intensity may have in expanding along the two dimensions, which may affect the hypothesized relationship. Finally we also included a control, net income in 1993 (NINC) to account for any effect financial resources may have on a firm's ability to expand along the two dimensions. Lack of financial resources may also cause firms to trade off growth between the two dimensions, and including net income as a control accounts for the potential effect of this constraint.

We estimated our structural equations using two-stage (2SLS) and three-stage least squares (3SLS). Our results are invariant across the two methods, and in what follows we present the 3SLS estimates

[4] By adding core and domestic growth as identifying variables, in essence we are treating them as exogenous in our estimations. Our rationale is that given their fundamental importance, firms are likely to decide how much to grow along these dimensions *before* allocating managerial resources to product and international diversification over a certain period. Thus, as such while they may impact the extent of diversification along the corresponding dimension, the reverse may not be true, which justifies treating them as exogenous and as controls.

DOI: 10.1002/smj

which are more consistent and asymptotically efficient compared to 2SLS.

RESULTS

Table 1 presents the descriptive statistics for the dependent and independent variables. Table 1 shows that core segment sales increased by 63.3 percent and domestic sales by 52.8 percent as indicated by the means of ΔCORE and ΔDOM respectively. These means were significantly greater than the means of ΔPD and ΔID, suggesting that firms in the sample mainly pursued nondiversified growth over the 1993–1997 period. Table 1 also shows the correlations between the various dependent and independent variables. While by and large the correlations are within the acceptable range, there was high colinearity between the ΔCORE and ΔDOM variables. Although these variables are identifying variables that enter into the two structural equations, (1) and (2), separately, one concern was that they may not be containing unique information and may be weak instruments. Partly this issue is addressed by the inclusion of additional identification variables in the form of PDV and IDV. We return to this point subsequently when we assess the robustness of our results. For the time being we note that the robustness tests indicated that the high colinearity between ΔCORE and ΔDOM did not bias our estimates.

Next, before estimating the two equations using 3SLS, we undertook the Durbin-Wu-Hausman (DWH) test (Davidson and Mackinnon, 1993) for endogeneity in our structural equations. The DWH test basically compares the parameters estimated by OLS with the parameters estimated by simultaneous equation methods. If there is no significant difference in the parameters, then the null hypothesis of exogeneity can be accepted and OLS can be used for estimation. The null hypothesis of exogeneity was strongly rejected in both equations ($p < 0.001$). Thus consistent with the arguments forwarded previously, there is evidence that firms make their expansion decisions along the two dimensions endogenously and simultaneously, and that this endogeneity significantly affects estimates of the relationship.

In support of this point, Column I in Table 2 presents the OLS estimates from estimating Equations (1) and (2) independently. In contrast, Column II presents the 3SLS coefficients obtained from estimating the two equations simultaneously. As a first step we used the full sample of 1,299 firms and estimated the equations without including the R&D intensity and advertising intensity variables since these variables were missing in a number of cases. Column I shows that when the equations were estimated using OLS, ΔID was positively correlated with ΔPD (upper panel), while ΔPD had an insignificant impact on ΔID (lower panel). In contrast with these results, as shown in Column II, when the equations were estimated simultaneously, the coefficient of ΔID was negative and significant in Equation (1). Similarly the coefficient of ΔPD was negative and significant in Equation (2). These findings have two implications. First they suggest that the effects of short-run constraints arising from the transfer of tacit knowledge and absorptive capacity were stronger than the effects of economies of scope and fungibility, leading to a tradeoff between the two dimensions. Hypothesis 1 was supported. Second, they also highlight the importance of taking into account endogeneity when estimating the relationship between growth along the two dimensions. Had we not taken into account endogeneity, based on the OLS results in Column I we would have concluded that there was a positive relationship between the two dimensions and that there was support for Hypothesis 1-alt rather than Hypothesis 1.

The control variables are by and large in the expected direction in the 3SLS estimates in Column II. Firm size is positive and significant in both equations indicating that larger firms enjoyed an advantage in terms of growth along the two dimensions. MGR was positive but just short of significant in the two equations ($p = 0.15$ and 0.14 two tailed, respectively) possibly because of the approximate measure used in this study. CAP was significant, indicating that production skills positively influenced growth along the two dimensions. The PDV and IDV variables were insignificant. This may be because as firms become extensively diverse along a particular dimension, the complexities introduced by diversity may partly negate the learning benefits leading to an insignificant coefficient. Finally, the net income variable (NINC) while positive was also just short of significant in the two equations ($p = 0.16$ and 0.17 two tailed, respectively). Thus the presence of financial resources seemed to have weakly facilitated

Table 1. Summary statistics and correlations[a]

	Mean	SD	ΔPD	ΔID	ΔCORE	ΔDOM	PDV	IDV	SIZE	R&D	ADV	CAP	MGR	NINC
ΔPD	0.058	0.296	1.000											
ΔID	0.163	0.486	0.199 0.000	1.000										
ΔCORE	0.633	1.267	0.049 0.079	0.670 0.000	1.000									
ΔDOM	0.528	1.041	0.251 0.000	0.405 0.000	0.918 0.000	1.000								
PDV	0.287	0.425	0.051 0.067	−0.09 0.001	−0.195 0.000	−0.178 0.000	1.000							
IDV	0.136	0.18	0.001 0.994	0.136 0.000	−0.019 0.506	−0.086 0.002	0.081 0.004	1.000						
SIZE	5.925	1.485	0.001 0.984	−0.04 0.156	−0.159 0.000	−0.175 0.000	0.410 0.000	0.310 0.000	1.000					
R&D	0.046	0.126	0.026 0.431	0.078 0.019	0.095 0.004	0.092 0.006	−0.108 0.001	0.027 0.498	−0.073 0.020	1.00				
ADV	0.018	0.038	−0.027 0.385	−0.02 0.454	−0.049 0.121	−0.056 0.075	−0.025 0.435	0.082 0.010	0.056 0.074	0.01 0.87	1.00			
CAP	0.513	0.429	0.036 0.197	−0.02 0.397	−0.081 0.004	−0.077 0.006	0.178 0.000	0.055 0.050	0.239 0.000	0.03 0.37	−0.19 0.00	1.00		
MGR	0.051	0.033	0.039 0.170	0.131 0.000	0.077 0.007	0.044 0.128	0.030 0.291	0.094 0.001	−0.239 0.000	0.04 0.26	−0.07 0.03	−0.06 0.05	1.00	
NINC	56.6	333.1	.024 0.38	.005 0.85	−.027 0.32	−.029 0.29	.118 .000	.16 .000	.37 .000	−.03 0.27	.05 .10	.048 .08	.08 .003	1.00

[a] Significance of the correlation coefficient is indicated below.

DOI: 10.1002/smj

Table 2. Regression results [a]

	OLS estimates (I)	3SLS estimates			
		(II) Full sample (n = 1299)	(III) Reduced sample with controls (n = 690)	(IV) Reduced sample, Tobin's q > 1 firms (n = 465)	(V) Reduced sample without scope reduction firms (n = 520)
ΔPD equation					
ΔID	0.106***	−0.46***	−0.735***	−0.79***	−0.653***
ΔCORE	−0.033***	0.11***	0.240***	0.265***	0.181***
PDV	0.012	−4.2E-05	−1.2E-04	4.4E-04	0.021
SIZE	−0.004	0.014*	0.029**	0.033*	0.054***
MGR	−0.035	0.46	0.134	0.564	0.99+
CAP	0.029	0.059*	0.018	0.009	−0.012
NINC	3.33E-05	4.11E-05	3.57E-05	5.5E-05	1.42E-05
R&D			−0.09	−0.08	−0.096
ADV			0.183	0.294	0.275
ΔID equation					
ΔPD	0.039	−3.178***	−2.500***	−2.356***	−2.451***
ΔDOM	0.188**	0.321***	0.485***	0.495***	0.381***
IDV	0.371*	0.004	0.020	0.036	−0.007
SIZE	0.005	0.041*	0.057**	0.059**	0.118***
MGR	0.903	1.314	0.257	1.044	2.138+
CAP	0.033	0.168*	0.035	0.017	−0.023
NINC	1.12E-05	1.1E-04	7.17E-05	1.0E-04	2.44E-05
R&D			−0.193	−0.149	−0.205
ADV			0.362	0.541	0.588

[a] Coefficients of industry dummies not reported
+ indicates $p < 0.1$, two tailed
* indicates $p < 0.05$, two tailed
** indicates $p < 0.01$, two tailed
*** indicates $p < 0.001$, two tailed

growth along the two dimensions and may have eased the tradeoff effect to some extent.

Interestingly, while the coefficients of ΔID and ΔPD were negative, the coefficients of ΔCORE and ΔDOM were positively signed in the 3SLS estimates in Column II. Thus while the two forms of diversification were negatively associated with each other, core segment growth and domestic market growth were positively associated with the corresponding diversification dimension. One potential explanation for this result is that expansion in core and domestic markets is undertaken through relatively well-established routines (Nelson and Winter, 1982; Hannan and Freeman, 1989) and helps a firm minimize the risks associated with diversified expansion. For these reasons firms may be pursuing expansion along these dimensions simultaneously with diversification.

As a next step in our analysis, we reestimated the two structural equations after adding the R&D intensity and advertising intensity variables. Column III presents the results for the reduced sample of 690 firms for which there was complete data. The results remain similar to Column II with ΔPD exerting a negative influence on ΔID and vice versa. The two intensity variables were insignificant in both equations. This may be because on the one hand these variables may be conferring scope economies and creating diversification opportunities. On the other hand, sophisticated technical and marketing skills may also be difficult to replicate and exploit in various markets due to a tacit component, which may offset the positive effect (Martin and Salomon, 2003b).

While Columns II and III in Table 2 provide our main results, we also conducted various additional tests to examine whether the negative relationship observed holds in different subsamples and is sensitive to various assumptions. One concern we had was whether the negative relationship was consistent with efficiency, or whether it was an outcome of other factors such as nonvalue maximizing diversification. Lang, Stulz, and Walking (1991) argue that firms with Tobin's q lesser than one are likely to have fewer value maximizing diversification opportunities compared to firms with Tobin's q greater than one. Hence there is greater likelihood that diversification pursued by these former firms would be nonprofit maximizing. Column IV in Table 2 presents the results for the 465 firms in our sample with Tobin's q greater than one in 1993. Tobin's q was calculated as simple q (Perfect and Wiles, 1994; Brush, Bromiley, and Hendrickx, 2000). The results are similar to Columns II and III. Thus there continued to be a negative association between expansion along the two diversification dimensions in this subsample indicating support for Hypothesis 1.

Next we also examined to what extent our results were being influenced by firms reducing their scope over the 1993–1997 period, given that our arguments and hypotheses mainly pertain to firms that are increasing their scope. Firms may reduce their scope for a variety of reasons including over diversification in the past due to market inefficiencies and agency motives (Markides, 1995). Since the processes of scope reduction are distinct from processes of expansion, we eliminated firms in the sample that were reducing their scope along at least one dimension over the 1993–1997 period (i.e., ΔPD or ΔID < 0). Column V in Table 2 presents the results for the remaining 520 firms. The results were once again similar to Columns II and III.

While Column IV examines whether the negative association between the two dimensions is consistent with efficiency using Tobin's q at the beginning of the period, another way we approached this issue was we also estimated a third structural equation simultaneously along with Equations (1) and (2) with Tobin's q at the end of our observation period (i.e., 1997) as the dependent variable. The objective was to assess how growth along the two dimensions over the period 1993–1997 influenced the valuation of the firm at the end of that period. To identify the third structural equation we included change in leverage over the period 1993–1997 and excluded ΔCORE and ΔDOM. Table 3, Column II presents the results of estimating the third equation. Both ΔPD and ΔID were positively associated with performance. In the remaining equations (not reported) ΔPD and ΔID continued to be negatively associated. The results in Table 3 are in line with studies that suggest that at the margin diversification is likely to be positively associated with performance (Montgomery and Wernerfelt, 1988; Campa and Kedia, 2002) as firms derive added rents from exploiting intangible resources. Another pertinent issue on which these results shed light is that in allocating resources and deciding how much to grow along the two dimensions simultaneously, firms may be striving for *joint* optimization, but in the process they may be making suboptimal decisions with respect to growth along any one dimension (Chatterjee and Singh, 1999; Mudambi and Mudambi, 2002). This would have resulted in the coefficients of either ΔPD or ΔID being negative in the performance structural equation. The results in Table 3 however do not seem to support this argument, and it appears that firms in this sample seem to be optimizing growth along each dimension individually as well. It is worth noting that had the Tobin's q equation been estimated using OLS, our conclusions would have once again been different. Column I in Table 3 presents the OLS estimates of the performance equation. As shown, ΔPD had an insignificant coefficient in these estimations. Thus had we not taken into account simultaneity and endogeneity when estimating our performance equation, we may have concluded that product diversification does not enhance performance at the margin and that firms were suboptimizing along this particular dimension. Hence, correcting for endogeneity proved critical even when examining the performance implications of growth along the two dimensions.

Table 3. Performance equation (Dependent variable: Tobin's q in 1997) [a]

	OLS estimates (I)	3SLS estimates (II)
ΔPD	−0.001	1.28***
ΔID	0.41***	0.88***
ΔLEVERAGE	−0.78***	−0.91***
PDV	−0.18	−0.12
IDV	0.17	0.01+
SIZE	0.10**	0.08*
MGR	0.51	0.90
CAP	−0.37*	−0.40
R&D	2.67**	2.68***
ADV	1.70	1.41

[a] Coefficients of industry dummies not reported
+ indicates $p < 0.1$, two tailed
* indicates $p < 0.05$, two tailed
** indicates $p < 0.01$, two tailed
*** indicates $p < 0.001$, two tailed

Robustness checks

Apart from the results presented in Tables 2 and 3, we conducted a number of additional analyses to check the robustness of our results (these results are not reported and are available on request).

One important concern we had was whether the instruments we used in our estimation were doing a satisfactory job of identifying the two equations, especially given the high correlation between ΔCORE and ΔDOM. To explore whether this was affecting our results, we recalculated the ΔCORE and ΔDOM variables as change in core segment sales and domestic market sales. In other words, we took simple differences in core segment sales and domestic market sales between 1997 and 1993 and did not normalize them by sales in 1993. This reduced the correlation between the two variables substantially to 0.62 (compared to 0.92). The results remained unchanged for the full sample of 1,299 firms[5] when using the non-normalized variables.

Next, to further examine the impact of the high correlation between our instruments, we also undertook a size adjusted conditional likelihood ratio test described in Moreira (2003). This test uses adjusted critical values for hypothesis tests when the instruments are weak, and as Murray (2006) notes is the 'state of the art' for hypothesis testing under these conditions. The test was undertaken using Stata's *condivreg* command. The null hypothesis of no relationship between ΔPD and ΔID was strongly rejected by the size adjusted conditional likelihood ratio test. Further, the intervals of coefficients suggested by these tests confirmed that the relationship between growth along the two dimensions was negative, and the results were in line with the 3SLS estimates presented in Table 2.

We then undertook a test to see whether our choice of four years (1993–1997) as the time period to examine growth along the two dimensions was affecting our results. We chose a period of four years for our study since previous research has used similar time periods to study the impact of resources on diversification (e.g., Montgomery and Hariharan, 1991). To examine this point further, we retrieved data from Compustat for the intermediate years 1994, 1995, and 1996. We then constructed our dependent (ΔPD and ΔID) and independent (ΔCORE and ΔDOM) variables using changes between 1993–1994, 1993–1995 and 1993–1996. All other control variables were measured as before at the point in time 1993. The negative relationship continued to be observed when we conducted our analyses using the three separate time periods 1993–1994, 1993–1995, and 1993–1996.

Next, we also used the data from the interim years 1994, 1995, and 1996 to construct year-on-year changes in ΔPD and ΔID, and in ΔCORE and ΔDOM. We then estimated a two-stage least squared random effects model using Stata's *xtiverg* command to estimate Equations (1) and (2). For this analysis we had 2,760 firm-year observations (690 firms $\times$ four time periods, 1993–1994, 1994–1995, 1995–1996, and 1996–1997). Ideally we would have liked to measure our control variables also at these four points in time. Unfortunately however, as noted previously, there was considerable missing data. Consequently we treated the remaining controls as invariant for the time period 1993–1997 and estimated a random effects model (fixed effects models without the controls produced similar results). While this analysis is exploratory, the results once again remained unchanged.

In concluding this section, one point that needs to be highlighted is that the negative association we observed in our 3SLS estimations could also be the result of unobserved heterogeneity. Thus, for example, some firms may have a growth logic oriented toward international diversification as opposed to product diversification (Mishina, Pollock, and Porac, 2004). Other firms may be subject to institutional pressures, which may cause them to conform to competitors' diversification strategies and to systematically diversify along a particular dimension. Factors such as these may also lead to a tradeoff between growth along the two dimensions due to reasons other than short-run constraints. To some extent these effects are reduced by the use of first differences in our dependent variable (Plosser and Schwert, 1978) and are also partially controlled for in the random effects

[5] As a further test of this point, we also eliminated the ΔCORE and ΔDOM variables entirely and estimated Equations (1) and (2) by identifying them only with the two diversity variables (PDV and IDV). The results using only these identifying variables remained similar when we estimated the two equations for the subsample of firms that did not reduce their scope along either dimension. In these estimations PDV and IDV were significant and positive. Hence there was also some support for the positive effects of diversity in easing short-run constraints on growth in our analyses.

DOI: 10.1002/smj

model estimated above. Nevertheless, this particular limitation of our study needs to be acknowledged.

DISCUSSION AND CONCLUSION

The results of this study suggest that while firms may face various opportunities to expand and diversify due to economies of scope, the extent to which these opportunities can be exploited over a certain period is limited by short-run constraints. The effect of these constraints may be strong enough that it may overshadow the incentives arising from economies of scope due to fungible resources and common capabilities, leading to a negative association between growth along the two diversification dimensions. Since the work of Penrose (1959), it has been widely recognized in the strategy field that firms experience various constraints to expand due to factors such as the transfer of tacit competencies and learning. Despite the widespread acceptance of Penrose's (1959) theory, direct evidence pertaining to the effect of short-run constraints on firm growth has been mixed (see Tan and Mahoney, 2005 for a recent review). The present study provides empirical evidence in the context of diversification that firms are indeed limited in the amount of expansion they can undertake by various constraints. In doing so it provides important support for the Penrose effect, and for the notion that firms may be subject to an optimal growth rate in the short run.

In a related vein, the study also provides evidence that replicating and exploiting intangible resources absorbs a significant amount of managerial time and effort, which can constrain the firm's rate of expansion. While some previous studies have highlighted the fungibility of intangible resources and the opportunities they create, they have tended to underemphasize the specific challenges involved in replicating and exploiting these resources (Teece, Pisano, and Shuen, 1997). It is these challenges and idiosyncrasies that make diversification a complex process (Vermeulen and Barkema, 2002). From a normative standpoint the implication of our study is that managers need to be aware of these constraints and be cautious in terms of pursuing extensive diversification in both directions in the short run despite the presence of opportunities. Attempting to do so may have detrimental performance consequences, and it may make economic sense to focus on growth along one dimension while pursuing limited growth along the second dimension over a particular period.

Apart from this implication, in recent years there has also been an increasing concern in the strategy literature about the use of appropriate econometric techniques that correct for endogeneity. Studies have shown that failure to correct for endogeneity often leads to misleading conclusions about the impact of various strategies on firm performance (Shaver, 1998; Mudambi and Mudambi, 2002; Hamilton and Nickerson, 2003; Villalonga, 2004; Salomon and Shaver, 2005; Miller, 2006). Our research complements these studies and suggests that it is also necessary to correct for endogeneity when examining how various strategic choices are interrelated with each other. Given that these choices are made based on a firm's existing resources and capabilities, they are often likely to mutually influence each other and be simultaneously determined. Hence correcting for endogeneity becomes vital in gaining a better understanding about the interrelationships between these choices, as we have demonstrated in our study using product and international diversification. Had we not corrected for endogeneity and used OLS, we would have reached substantively different conclusions about the effect of short-run constraints and the relationship between the two diversification dimensions as well as their performance implications.

Future research could build on our study in various ways. First, future studies could examine whether the endogeneity and the negative relationship observed in this research is also evidenced in alternative samples and in non-U.S.-based settings. Such an investigation would reveal whether institutional factors play a role in influencing the relationship (Kogut, Walker, and Anand, 2002; Peng, Lee, and Wang 2005). Second, it would be useful to analyze to what extent endogeneity affects relationships between various components of product and international diversification (Mudambi and Mudambi, 2002), such as growth in related and less related businesses and exports and foreign direct investment (Salomon and Shaver, 2005). Third, future studies could also examine various contingencies and conditions under which the relationship between growth along the two dimensions turns positive. One possibility is that firms with well-developed capabilities and experience in

DOI: 10.1002/smj

terms of both product and international diversification may face fewer pressures to make tradeoffs between the two dimensions. As noted earlier, these firms may possess well-developed routines to manage subunits in diverse environments (Hitt *et al*., 1994), which may enable efficient utilization of managerial resources and simultaneous expansion along the two dimensions. In addition, firms with superior knowledge transfer capabilities (Martin and Salomon, 2003b) and learning capabilities (Zahra and George, 2002) in conjunction with acquisition and joint venture capabilities may also be able to exploit opportunities along the two dimensions simultaneously. These firms may be able to transfer their competencies and undertake the learning required to expand into various markets relatively rapidly, thereby ameliorating the tradeoff effect between the two dimensions. A third possibility is that the extent of growth undertaken along the two dimensions in the previous time period may also affect the relationship. Thus, for example, firms that have grown relatively slowly along the two dimensions in the previous period may face fewer pressures for tradeoffs in the current time period. Conversely firms that have grown rapidly along the two dimensions may face higher pressures for a tradeoff as fewer managerial resources are available in the current period. Exploring these different contingencies would help develop a deeper understanding of how firms make their strategic choices and grow along these two dimensions.

ACKNOWLEDGEMENTS

I would like to thank Anju Seth and Margarethe Wiersema for comments on an earlier version, and Editor Will Mitchell and two anonymous reviewers for invaluable guidance. The usual disclaimer applies.

REFERENCES

Anand J, Delios A. 2002. Absolute and relative resources as determinants of international acquisitions. *Strategic Management Journal* **23**(2): 119–134.

Ansoff IH. 1965. *Corporate Strategy*. McGraw Hill: New York.

Barkema HG, Vermeulen F. 1998. International expansion through start up or acquisition: a learning perspective. *Academy of Management Journal* **41**: 7–26.

Barney JB. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**: 99–120.

Bartlett CA, Ghoshal S. 1989. *Managing Across Borders: The Transnational Solution*. Harvard Business School Press: Boston, MA.

Berger PG, Hann R. 2003. The impact of SFAS no. 131 on information and monitoring. *Journal of Accounting Research* **41**: 163–223.

Bergh DD, Fairbank JF. 2002. Measuring and testing change in strategic management research. *Strategic Management Journal* **23**(4): 359–366.

Bertin G-Y. 1972. Foreign expansion and diversification of multinational firms. In *The Multinational Firm and the Nation State,* G. Paquet (ed). Collier Macmillan Canada: Toronto, ONT; 36–48.

Brush TH, Bromiley P, Hendrickx M. 2000. The free cash flow hypothesis for sales growth and firm performance. *Strategic Management Journal* **21**(4): 455–472.

Buckley PJ, Casson MC. 1976. *The Economic Theory of the Multinational Enterprise*. Macmillan: London, UK.

Burgelman RA. 1983. A process model of internal corporate venturing in the diversified firm. *Administrative Science Quarterly* **28**: 223–244.

Campa JM, and Kedia S. 2002. Explaining the diversification discount. *The Journal of Finance* **57**: 1731–1762.

Caves RE. 1975. *Diversification, Foreign Investment, and Scale in North American Manufacturing Industries*. Economic Council of Canada: Ottawa, ONT, Canada.

Caves RE, Mehra SK. 1986. Entry of foreign multinationals into U.S. manufacturing industries. In *Competition in Global Industries*, Porter ME (ed). Harvard Business School Press: Boston, MA; 449–481.

Caves RE, Porter ME, Spence MA, Scott JI. 1980. *Competition in the Open Economy: A Model Applied to Canada* (Harvard Economic Studies). Harvard University Press: Cambridge, MA.

Chandler AD Jr. 1991. The functions of the HQ unit in multibusiness firms. *Strategic Management Journal*, Winter Special Issue **12**: 31–50.

Chang SJ. 1996. An evolutionary perspective on diversification and corporate restructuring: entry, exit, and economic performance during 1981–89. *Strategic Management Journal* **17**(8): 587–611.

Chatterjee S, Singh J. 1999. Are tradeoffs inherent in diversification moves? A simultaneous model for type of diversification and mode of expansion decisions. *Management Science* **45**: 25–41.

Chatterjee S, Wernerfelt B. 1991. The link between resources and type of diversification: theory and evidence. *Strategic Management Journal* **12**(1): 33–48.

Cohen WM, Levinthal DA. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* **35**: 128–152.

Davidson R, Mackinnon JG. 1993. *Estimation and Inference in Econometrics*. Oxford University Press: New York.

Delios A, Beamish PW. 1999. Ownership strategy of Japanese firms: transactional, institutional, and experience influences. *Strategic Management Journal* **20**(10): 915–933.

Denis DJ, Denis DK, Yost K. 2002. Global diversification, industrial diversification, and firm value. *The Journal of Finance* **57**: 1951–1979.

Farjoun M. 1994. Beyond industry boundaries: human expertise, diversification and resource-related industry groups. *Organization Science* **5**: 185–199.

Gander JP. 1991. Managerial intensity, firm size and growth. *Managerial and Decision Economics* **12**: 261–266.

Geringer JM, Beamish PW, da Costa RC. 1989. Diversification strategy and internationalization: implications for MNE performance. *Strategic Management Journal* **10**(2): 109–119.

Goerzen A, Beamish PW. 2003. Geographic scope and multinational enterprise performance. *Strategic Management Journal* **24**(113): 1289–1306.

Gollop FM, Monahan JL. 1991. A generalized index of diversification: trends in U.S. manufacturing. *The Review of Economics and Statistics* **73**: 318–330.

Hamilton BH, Nickerson, JA. 2003. Correcting for endogeneity in strategic management research. *Strategic Organization* **1**: 51–78.

Hannan MT, Freeman J. 1989. *Organizational Ecology*. Harvard University Press: Cambridge, MA.

Henderson RM, Clark KB. 1990. Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly* **35**: 9–30.

Hennart JF. 1982. *A Theory of Multinational Enterprise*. University of Michigan Press: Ann Arbor, MI.

Hitt MA, Hoskisson RE, Ireland RD. 1994. A mid-range theory of the interactive effects of international and product diversification on innovation and performance. *Journal of Management* **20**: 297–326.

Hitt MA, Hoskisson RE, Kim H. 1997. International diversification: effects on innovation and firm performance in product-diversified firms. *Academy of Management Journal* **39**: 1084–1119.

Johnston J. 1972. *Econometric Methods* (2nd edn). McGraw-Hill: New York.

Kim WC, Hwang P, Burgers WP. 1988. Global diversification strategy and corporate profit performance. *Strategic Management Journal* **10**(1): 45–57.

Kogut B, Walker G, Anand J. 2002. Agency and institutions: national divergences in agency behavior. *Organization Science* **13**: 162–178.

Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* **3**: 383–397.

Kogut B, Zander U. 1993. Knowledge of the firm and the evolutionary theory of the multinational corporation. *Journal of International Business Studies* **24**: 625–645.

Kumar S, Seth A. 2001. Knowledge, absorptive capacity and the theory of the diversified firm. In *Academy of Management Proceedings*, Nagao D (ed). Washington, D.C.; E1–E6.

Lang LHP, Stulz RM, Walking RA. 1991. A test of the free cash flow hypothesis: the case of bidder returns. *Journal of Financial Economics* **29**: 315–336.

Mahoney JT, Pandian JR. 1992. The resource-based view within the conversation of strategic management. *Strategic Management Journal* **13**(5): 363–380.

March J. 1991. Exploration and exploitation in organizational learning. *Organization Science* **2**: 71–87.

Markides CC. 1995. Diversification, restructuring and economic performance. *Strategic Management Journal* **16**(2): 101–118.

Markides CC, Williamson PJ. 1994. Related diversification: core competences and corporate performance. *Strategic Management Journal*, Summer Special Issue **15**: 149–165.

Martin X, Salomon R. 2003a. Knowledge transfer capacity and its implications for the theory of the multinational corporation. *Journal of International Business Studies* **34**: 356–373.

Martin X, Salomon R. 2003b. Tacitness, learning, and international expansion: a study of foreign direct investment in a knowledge intensive industry. *Organization Science* **14**: 297–311.

Merino F, Rodriguez DR. 1997. A consistent analysis of diversification decisions with non-observable firm effects. *Strategic Management Journal* **18**(9): 733–743.

Miller DJ. 2006. Technological diversity, related diversification, and firm performance. *Strategic Management Journal* **27**(7): 601–619.

Mishina Y, Pollock TG, Porac JF. 2004. Are more resources always better for growth? Resource stickiness in market and product expansion. *Strategic Management Journal* **25**(12): 1179–1197.

Mitchell W, Shaver JM, Yeung B. 1992. Getting there in a global industry: impacts on performance of changing international presence. *Strategic Management Journal* **13**(6): 419–432.

Montgomery CA, Hariharan S. 1991. Diversified expansion in large established firms. *Journal of Economic Behavior & Organization* **15**: 71–89.

Montgomery CA, Wernerfelt B. 1988. Diversification, Ricardian rents, and Tobin's q. *RAND Journal of Economics* **19**: 623–632.

Morck R, Yeung B. 1991. Why investors value multinationality. *Journal of Business* **64**: 165–187.

Moreira MJ. 2003. A conditional likelihood ratio test for structural models. *Econometrica* **71**(4): 1027–1048.

Mudambi R, Mudambi SM. 2002. Diversification and market entry choices in the context of foreign direct investment. *International Business Review* **11**: 35–55.

Murray MP. 2006. Avoiding invalid instruments and coping with weak instruments. *Journal of Economic Perspectives* **20**: 111–132.

Nachum L. 2004. Geographic and industrial diversification of developing country firms. *Journal of Management Studies* **41**(2): 273–294.

Nelson RR, Winter SG. 1982. *An Evolutionary Theory of Economic Change*. Harvard University Press: Cambridge, MA.

Panzar JC, Willig RD. 1981. Economies of scope. *American Economic Review* **71**: 268–272.

Pearce RD. 1993. *The Growth and Evolution of Multinational Enterprise: Patterns of Geographical and Industrial Diversification*. Edward Elgar: Cheltenham, UK.

Peng MW, Lee S-H, Wang D. 2005. What determines the scope of the firm over time? A focus on institutional relatedness. *Academy of Management Review* **30**: 622–633.

Penrose ET. 1959. *The Theory of the Growth of the Firm*. Oxford University Press: Oxford, UK.

Perfect SB, Wiles KW. 1994. Alternative constructions of Tobin's q: an empirical observation. *Journal of Empirical Finance* **1**: 313–341.

Plosser CI, Schwert GW. 1978. Money, income and sunspots: measuring economic relationships and the effects of differencing. *Journal of Monetary Economics* **4**: 637–660.

Prahalad CK, Bettis RA. 1986. The dominant logic: a new linkage between diversity and performance. *Strategic Management Journal* **7**(6): 485–501.

Ramanujam V, Varadarajan P. 1989. Research on corporate diversification: a synthesis. *Strategic Management Journal* **10**(6): 523–551.

Rivkin JW. 2001. Reproducing knowledge: replication without imitation at moderate complexity. *Organization Science* **12**: 274–293.

Rumelt RP. 1974. *Strategy, Structure and Economic Performance*. Harvard Business School Press: Boston, MA.

Salomon R, Shaver JM. 2005. Export and domestic sales: their interrelationship and determinants. *Strategic Management Journal* **26**(9): 855–871.

Sambharya RB. 1995. The combined effect of international diversification and product diversification strategies on the performance of U.S.-based multinational corporations. *Management International Review* **35**(3): 197–218.

Shaver JM. 1998. Accounting for endogeneity when assessing strategy performance: does entry mode choice affect FDI survival? *Management Science* **44**: 571–585.

Shen TY. 1970. Economies of scale, Penrose-effect, growth of plants and their size distribution. *Journal of Political Economy* **78**: 702–716.

Silverman BS. 1999. Technological resources and the direction of corporate diversification: toward an integration of the resource-based view and transaction cost economics. *Management Science* **45**: 1109–1124.

Swedenborg B. 1979. *The Multinational Operations of Swedish Firms: An Analysis of Determinants and Effects*. Industrial Institute for Economic and Social Research: Stockholm, Sweden.

Szulanski G. 1996. Exploring internal stickiness: impediments to the transfer of best practice within the firm. *Strategic Management Journal*, Winter Special Issue **17**: 27–43.

Tallman S, Li J. 1996. Effects of international diversity and product diversity on the performance of multinational firms. *Academy of Management Journal* **39**: 179–196.

Tan D, Mahoney JM. 2005. Examining the Penrose effect in an international business context: the dynamics of Japanese firm growth in U.S. industries. *Managerial and Decision Economics* **26**: 113–127.

Tanriverdi H, Venkatraman N. 2005. Knowledge relatedness and the performance of multibusiness firms. *Strategic Management Journal* **26**(2): 97–119.

Teece DJ. 1977. Technology transfer by multinational firms: the resource costs of transferring technological know-how. *The Economic Journal* **87**: 242–261.

Teece DJ. 1980. Economies of scope and the scope of the enterprise. *Journal of Economic Behavior & Organization* **1**(3): 223–247.

Teece DJ. 1982. Towards an economic theory of the multiproduct firm. *Journal of Economic Behavior & Organization* **3**(1): 39–63.

Teece DJ, Pisano G, Shuen A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal* **18**(7): 509–533.

Vermeulen F, Barkema H. 2002. Pace, rhythm, and scope: process dependence in building a profitable multinational corporation. *Strategic Management Journal* **23**(7): 637–653.

Villalonga B. 2004. Does diversification cause the "diversification discount"? *Financial Management* **33**(2): 5–27.

Winter SG, Szulanski G. 2001. Replication as strategy. *Organization Science* **12**: 730–743.

Wolf BN. 1977. Industrial diversification and internationalization: some empirical evidence. *The Journal of Industrial Economics* **26**: 177–191.

Zaheer S. 1995. Overcoming the liability of foreignness. *The Academy of Management Journal* **38**: 341–363.

Zahra S, George G. 2002. Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review* **27**: 185–203.

Zander U, Kogut B. 1995. Knowledge and the speed of the transfer and imitation of organizational capabilities: an empirical test. *Organization Science* **6**: 76–92.

DOI: 10.1002/smj