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Regional diversification and firm performance

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Abstract

This study examines how regional diversification affects firm performance. The results indicate that regional diversification has linear and curvilinear effects on firm performance. Regional diversification enhances firm performance linearly up to a certain threshold, and then its impact becomes negative. The results also show that firms of developed countries maximize their performance when they operate across a moderate number of developed regions and a strictly limited number of developing regions. This explains why internationalization by most international firms is regional rather than global.

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INTRODUCTION

Globalization, in the sense of increased economic interdependence among nations, has been widely discussed among academic researchers and business managers. Obviously, multinational enterprises (MNEs) are the drivers of globalization. However, existing studies indicate that most MNEs are "regional" rather than "global". For example, in his landmark study *The Regional Multinationals*, Rugman (2005) finds that most of the world's 500 largest MNEs, which account for more than 90% of the world stock of foreign direct investment (FDI) and over half of world trade, are regional rather than global. The vast majority of them are home-region based, and derive an average of 80% of their sales intra-regionally. This phenomenon poses an interesting question: Does globalization mean evenly or unevenly distributed geographic expansion? New theories are needed to explain the predominance of home region activity or regionalization, and to test the regional dimension of international expansion.

The phenomenon of regionalization not only poses challenges to the conventional definition of globalization; it also provides a possible solution to a long-lasting debate in the internationalization studies. In the international expansion literature there is a consensus that international expansion brings both benefits and costs (Campa & Kedia, 2002; Tallman & Li, 1996). The benefits include economies of scale and scope, risk spreading, the reduction of revenue fluctuations, and an increase in market power (Lu & Beamish, 2004), whereas the costs result from trade barriers, the liability of foreignness, the liability of newness, and the coordination and administration of the differences between countries (Gomes & Ramaswamy, 1999). However, there is still debate on

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which of these consequences has the most impact on firm performance, and on whether the benefits of diversification outweigh the costs. Empirical studies have shown conflicting results. Some studies have reported that international diversification offers more benefits than costs, and thus improves firm performance (Delios & Beamish, 1999). Other research, by contrast, has indicated that the benefits and costs cancel each other out (Morck & Yeung, 1991), or that the costs are greater than the benefits, which causes firm performance to suffer (Denis, Denis, & Yost, 2002; Geringer, Tallman, & Olsen, 2000). We believe these empirical conflicts are due mainly to the inaccurate measurement of costs associated with internationalization. Many existing studies use "multinationality", which is the percentage of activities (e.g., sales revenues and profits) that is derived from countries in which a firm has operations, or the number of countries that a firm has entered, to measure a firm's level of internationalization (see Table 1). However, such measurements can be problematic, as they neglect the differences between overseas markets. For example, cultural and trade barriers between the US and Canada are much lower than those between the US and China, and thus a Canadian firm will experience much lower operation costs in the US than in China. Therefore, to measure accurately the costs and benefits that are associated with international expansion, we need to differentiate the various countries or markets that a firm has entered. Regionalization can be the optimal option to achieve such purposes, as countries within a given region can be relatively similar, in relation to those across regions, in terms of culture, economic development, and psychic distance. For example, a firm operating in 10 countries that are concentrated in a single region may have lower operation costs (e.g., for administration and control) than a firm operating in the same number of countries widely "spread across different regions. Therefore the expansion of most MNEs is regional rather than global: that is, globalization implies regional diversification rather than balanced, evenly distributed global diversification (Rugman, 2003, 2005).

This study uses regions or regional economies to measure firm internationalization and its costs and benefits. Regions are defined as areas that have similar cultures, customer needs, living standards, and levels of economic development (Berry, 2004). According to the World Bank (1995), there are 10 such global regions: the European Union, North America, other developed countries, other Western European countries, East Asia and the Pacific, other European and Central Asian countries, Latin America and the Caribbean, the Middle East and North Africa, South Asia, and Sub-Saharan Africa. The first four regions can be placed in the "All Developed Countries" category and the last six in the "All Developing Countries" category.

To gain a deeper insight into the relationship between firm internationalization and firm performance, we take the following three approaches. First, we classify firms as high, medium, or low diversifiers based on the entropy measure of regional diversification. This approach provides a direct way to observe and compare the performance of firms that have different levels of regional diversification. Second, we explore both the linear and the curvilinear effects of regional diversification after controlling for firm and industry factors. Finally, we assess regions that are likely to improve firm profitability significantly. The combination of these approaches enables us to obtain a complete picture of the effects of regional diversification on firm performance.

HYPOTHESIS DEVELOPMENT

This study is based mainly on the resource-based view of the firm and transaction cost theory. The resource-based view is built upon the heterogeneity of firm resources, and argues that firms need to develop valuable, unique, and hard-to-imitate resources and capabilities to succeed (Barney, 1986, 1991). International diversification provides a mechanism for firms to overcome market imperfections in different countries or regions and thus gain access to different resources (Hitt, Hoskisson, & Kim, 1997; Morck & Yeung, 1991; Thomas & Eden, 2004). These resources include production factors, demands, experiences, distribution facilities, and reputation. Internationalizing firms can exploit foreign resources on their own or use the resources of foreign partners, but whichever method is used, international diversification provides new and different resources. An MNE will gain from continued international expansion as long as its proprietary assets retain their value, rarity, inimitability, and nonsubstitutability (Goerzen & Beamish, 2003).

In contrast, the transaction cost perspective highlights the limits of international expansion, which include the opportunism of partners, the costs of coordination and administration, the liability of foreignness and newness, barriers to

Table 1 Previous literature on international market diversification and the association between firm performance and international market diversification

Author(s) and year	*Measurements*[a]	*Performance indicators*	*Empirical findings*[b]
(a) Linear			
Brewer (1981)	FETE	Stock return	(−)
Buckley, Dunning, and Pearce (1978, 1984)	FSTS	ROA	(0)
Bühner (1987)	FSTS	Market return	(+)
Errunza and Senbet (1981)	FATA, FETE, FSTS	Excess return	(+)
Errunza and Senbet (1984)	AFS, FSTS, NFS, Entropy measure	Excess return	(+)
Fatemi (1984)	FSTS	Risk-adjusted return (ROE)	(0)
Geringer et al. (2000)	FSTS	ROA, ROS, sales growth	(−)
Geyikdagi and Geyikdagi (1989)	FBTB	Beta	(+)
Grant (1987)	FSTS	ROA, ROE, ROS	(+)
Grant et al. (1988)	FSTS	ROA, ROE, ROS	(+)
Haar (1989)	FSTS	ROA	(0)
Jung (1991)	FSTS	(After-tax net income)/(Total assets)	(+)
Kim and Lyn (1987)	FDI	Excess market value; Tobin's Q	(+)
Kohers (1975)	FATA, FETE, FETN, FSTS	Cost of capital	(0)
Kumar (1984)	FSTS	ROA, ROS	(0)
Michel and Shaked (1986)	FSTS	Risk-adjusted return	(−)
Miller and Pras (1980)	NNS	SD of ROS	(+)
Morck and Yeung (1991)	NNS, NFS	Market value	(0)
Riahi-Belkaoui (1996)	FSTS	ROA	(+)
Sambharya (1995)	FSTS, FATA	ROA, ROS, ROE	(0)
Shaked (1986)	FSTS	SD of ROE, Beta	(0)
Siddharthan and Lall (1982)	FSTS	Sales growth	(−)
Tallman and Li (1996)	FSTS, NNS	ROS	(+)
Vernon (1971)	FSTS, FATA, FETE, FETN	ROI, ROS	(+)
(b) Curvilinear (inverted U-shaped)			
Contractor et al. (2003)	Sum of FSTS, FETN and FOTO	ROA, ROS	
Daniels and Bracker (1989)	FATA	ROA, ROS	
Geringer, Beamish, and daCosta (1989)	FSTS	ROA, ROS	
Gomes and Ramaswamy (1999)	FSTS, FATA, NNS	Cost of sales/total sales, ROA	
Hitt et al. (1994)	NNS	ROA, ROS	
Hitt et al. (1997)	Entropy measure	ROA	
Qian (1997, 2002)	FSTS	ROA, ROE	
Ramaswamy (1995)	FATA	ROA, ROS, ROVA	
Riahi-Belkaoui (1998)	FSTS	ROA	
Ruigrok and Wagner (2003)	FSTS	ROA	
Sullivan (1994)	FSTS, FATA, NNS	ROA, ROS	

[a]FSTS, foreign sales/total sales; FATA, foreign assets/total assets; FETN, number of foreign employees/total number of employees; FETE, foreign earnings/total earnings; FBTB, foreign business/total business; FOTO, Number of foreign offices/total number of offices; NNS, number of nations in which firm has foreign subsidiaries; NFS, number of subsidiaries abroad; FDI, foreign direct investment; AFS, absolute foreign sales.
[b]Findings: +, positive relationship; −, negative relationship; 0, no relationship.

market entry and exit, and inflexibility (Hitt et al., 1997). These costs result partly from the diversity between countries, which adds to the risk of foreign operations (Rindfleisch & Heide, 1997; Rugman & Verbekc, 2004), and therefore high levels of international diversification may be detrimental to firm profitability (Geringer et al., 2000).

Low to Moderate Regional Diversification

Low levels of regional diversification can be defined as the restriction of business operations to a couple of regions, such as a firm's home country region and one other. Low levels of regional diversification incur low transaction costs, because the differences between countries within a limited number of regions are relatively small. However, such a diversification posture restricts the opportunity for firms to spread their operations across a reasonable number of countries, which results in low operational efficiency. The fixed costs and overheads of headquarters operations and large R&D outlays cannot be easily spread out (Contractor, Kundu, & Hsu, 2003), and foreign operations create a large minimum administrative overhead burden. If this burden is spread over just a handful of countries within a region, then there will be a high overhead burden per country (Contractor et al., 2003). Further, it is difficult for firms to achieve certain important objectives and benefits, such as economies of scale and scope (Grant, Jammine, & Thomas, 1988), learning experience (Barkema & Vermeulen, 1998), the scope to extend the product cycle (Contractor et al., 2003), the ability to preempt or match competitors (Mitchell, Roehl, & Slattery, 1995), the possibility of exercising global market power (Grant, 1987), incentives to develop innovations (Hitt et al., 1997), and cross-subsidization, price discrimination, and arbitrage potential (Palich, Cardinal, & Miller, 2000). Firms also have to deal with relatively few competitors and customers at low levels of diversification, and thus have a narrower range of experience and narrower mental models because they confront a limited range of challenges (Barkema & Vermeulen, 1998). Managers are unable to spot problems because they receive only a narrow range of information, and their vision is thus much more constrained (Barkema & Vermeulen, 1998). In addition, the restrictions on business within a region limit a firm's access to valuable and different resources in other regions, which hurts the firm's performance in the long run if conditions change in the limited regions within which it operates (Miller & Chen, 1994).

When firms diversify moderately across a few more (two or three) regions, they improve their opportunity to select better markets and increase their market size and business volume. Operational efficiencies are improved accordingly, and firms find it easier to realize the aforementioned benefits. Moderate regional diversification provides a chance for firms to gain access to different location-specific resources, such as production factors and seasonal demands, which help to build up a unique competitive advantage. For example, the combination of various location-specific production factors can help firms to minimize both production and distribution costs. Moderate regional diversification does not incur high transaction costs, as firms have only to manage the differences between a few regions. This helps firms to learn over time, and improves communication between business units (Kogut & Zander, 1993). It also helps firms to reduce managerial, technological, and coordination complexities, and to ease the transfer and sharing of marketing techniques, human resources, and technologies (Markides & Williamson, 1994). Likewise, organizational structures and corporate control mechanisms need only small adjustments when firms are dealing with a small number of foreign settings (Ruigrok & Wagner, 2003).

Moderate regional diversification also helps firms to enhance their level of business synergy. With larger market sizes, moderate regional diversification can also help firms to implement cross-subsidization of knowledge, price discrimination, and arbitrage (Palich et al., 2000). Knowledge-based resources that have been accumulated in similar environments can be combined and integrated relatively easily to create new competencies (Eisenhardt & Martin, 2000), and firms have a greater growth potential without significant negative exposure to differences in customer behavior and competition intensity (Grant, 1987). Therefore we postulate the following:

> Hypothesis 1: The relationship between regional diversification and profitability is linear and positive when regional diversification is low to moderate.

Moderate to High Regional Diversification

Firms that diversify heavily into various different regions usually encounter greater difficulties in dealing successfully with environmental complexity (Qian & Li, 2002). They must contend with the increasingly difficult prospect of managing a multicultural, multi-location workforce that serves distinctly different customer markets, and must navigate through a maze of formidable constraints that are imposed by the sheer number of locations in which operations have been established (Gomes & Ramaswamy, 1999). Hence a broad regional spread increases managerial constraints and negatively influences cross-border administration costs (Geringer et al., 2000). These difficulties are further aggravated by cultural problems (Grant, 1987; Thomas & Eden, 2004; Zaheer, 1995). Transaction cost theory argues that the cultural diversity that arises from operations in different marketplaces brings with it numerous problems of communication, coordination, control, and motivation (Kogut & Zander, 1993).

Furthermore, dealing with different market environments in different regions causes an increasing strain on top management, as the institutional foundations in the various regions are highly dynamic and may shift rapidly (Hitt et al., 1997). Put another way, the initiatives and benefits of diversification are often counteracted by a lack of management experience and expertise (Qian & Li, 2002). A wide geographic distribution also makes it difficult for firms to exploit the synergies between countries in different regional markets (Markides, 1995), which can be very costly because alterations or adjustments in products and processes will need to be made before firms can adapt to new market environments and meet government specifications. It is also difficult for firms that diversify heavily to transfer resources or assets, such as brand image, between countries in different regions (Solberg, 2000). Because of these dynamics, both the marginal costs of control and coordination and inefficiencies increase rapidly as firms move further and further away from their familiar environments.

Organizations can become too complex when they increase the proportion of foreign businesses that they have in a great number of different regions, and learning is hampered by information overload (Barkema & Vermeulen, 1998). Such large and complex operations across different regions are barely able to survive the competition in high-velocity markets in which unpredictable and nonlinear changes frequently occur (Eisenhardt & Martin, 2000). The centralized system of such organizations is too slow to respond to market changes, because the information flow between the hierarchical layers within the firms is inefficient (Hitt et al., 1997). However, decentralized systems also have problems. Decentralization can lead to resource waste, because business units in different regions cannot share resources, but have to duplicate and repeat the same functions or activities (Sambharya, 1995). Moreover, decentralization may trigger "civil wars" between business units in different regional markets (Solberg, 2000). Thus the strategy of diversifying widely in a number of regional markets is likely to be detrimental to firm performance. Hence we postulate the following:

Hypothesis 2: The relationship between regional diversification and profitability is curvilinear and negative when regional diversification is moderate to high.

Selection of Regions to Diversify

The resource-based view of the firm indicates that firms will increase their competitive advantage if they can gain access to different resources and combine them with their core competencies (Prahalad & Hamel, 1990). Such core competencies can be difficult to duplicate if competitors are missing even one of the ingredients (Alvarez & Busenitz, 2001). Moreover, different resources complement and strengthen each other. Operations in different regions provide opportunities for firms to obtain location-specific resources. Location-specific resources refer not only to cheap, quality inputs and low production costs and levels of current or potential demand, but also to the opportunity to learn from demanding customers and leading competitors (Porter, 1990). Developing regions provide abundant low-cost production factors, whereas developed regions offer demanding customers and leading competitors (Qian, 2000). Despite the benefits that can be realized by diversifying into different developed and developing country regions simultaneously, however, transaction cost theory indicates that there are also substantial costs associated with adaptation to environmental differences. The risks involved in operating in different countries or regions can also be substantial. Such risks include currency volatility, economic fluctuations and deteriorating fiscal status, balance of payments, and external debt (Cho, 1988).

Geographic regions are substantially different in socio-economic environment (Qian, 2000). According to the World Bank (1995), there are six developing (country) and four developed (country) regions. The former include East Asia and the Pacific, European and Central Asia, Latin America and the Caribbean, the Middle East and North Africa, South Asia, and Sub-Saharan Africa, while the latter include the European Union, Other Western European Countries, North America, and Other Developed Countries. In terms of market potential, infrastructure, and economic development, differences between the developing regions are substantial. Among the developing regions, East Asia and the Pacific appears to be the region that possesses the most favorable location-specific advantages. According to the World Bank (2002), the average growth of GDP, external trade, personal consumption, and domestic investment in the East Asia and Pacific region are the highest in the world, and inflation and external debt remain the lowest. In contrast, other developing regions have experienced a relatively slow or even negative economic growth (especially European and Central Asia and sub-Saharan Africa), much higher inflation (especially Latin America and the Caribbean), and greater external debt (especially Latin America and the Caribbean and South Asia) (World Bank, 2002).

In contrast, the differences between the developed regions are much smaller than those found in the developing regions (World Bank, 2002). In other words, locational factors and economic environments vary among developed regions, but the variance is not substantial. If firms of developed countries operate across a moderate number of developed country regions and a strictly limited number of developing country regions, then they gain great benefits. They can enjoy large market demands and learn from tough competitors and demanding customers in the developed regions. Diversification into a moderate number of developed country regions provides a reasonable market size in which firms can achieve large economies of scale and scope. Further, they can enjoy low-cost production factors in the developing regions. Diversification within a strictly limited number of developing regions also exposes firms to limited risks and differences. However, if firms diversify into various developing country regions, they may incur much higher costs, which could outweigh the benefits that are obtained. Moreover, developing country regions have similar production factors, and the overlap between resources is unlikely to improve competitive advantages. Significant socio-economic differences among developing regions may lead to high levels of risk and difference, thereby substantially increasing transaction costs. Therefore we postulate the following:

> Hypothesis 3: Firms of developed countries can maximize their performance if they diversify into a moderate number of developed country regions and a strictly limited number of developing country regions.

METHODOLOGY

The sample for this study is drawn from the largest US firms on the *Fortune* 500 List. The period of study is the 5-year period from 1996 to 2000. Following the definition of Stopford and Wells (1972) of an MNE, we select firms that have operations in six or more countries. The final sample comprises 189 firms.[1]

Description of Variables

Regional diversification. Researchers and organizations have been grouping countries into global regions for the past few decades. In the 1980s, the majority of studies recognized only two different geographic market regions: domestic (usually the US) and foreign (the rest of the world). Later, there were more regional groupings. Grant (1987) identified three geographic areas: Europe, North America, and the rest of the world. Hitt et al. (1997) classified foreign markets into four global regions: Africa, Asia and Pacific, Europe, and the Americas. Kim, Hwang and Burgers (1989) defined international market areas by grouping countries into six relatively homogeneous global market areas: North America (the US and Canada); the European Community and its associates; Japan and other developed (industrialized) countries; developing (industrializing) countries; less developed countries; and centrally planned economies. The first three are developed regions and the last three are less developed regions. Later, Kim, Hwang and Burgers (1993) grouped countries into seven global regions. Berry (2004, 2006) classified foreign markets into two different global market regions: advanced (developed) and developing, each consisting of various sub-regions (three and four respectively).

The way in which these researchers categorize regions is similar, to a great extent, to the way in which the World Bank (1995) categorizes regions. However, the World Bank has developed a finer classification of developing regions based on the differences between them. These differences include not only the level of economic development, but also political, social, and financial factors such as the types of institution, level of political risk, and intellectual property protection. In this study, we followed the World Bank (1995) classification system and grouped countries into 10 global regions. The differences between countries or regions in terms of political, social, and financial factors are important as they have a great impact on internationalizing firms' transaction costs (Cho, 1988).

Following prior studies (e.g., Barkema & Vermeulen, 1998; Tallman & Li, 1996), we used the number of countries in which the firm established subsidiaries rather than sales derived from the host country to measure foreign operations. We selected this measurement for the following two reasons. First, FDI is the highest commitment that firms make to international markets, and it usually takes the form of foreign subsidiaries. Second, using the sales criterion does not control for intermediate goods exported from the home country and resold by subsidiaries (Geringer et al., 2000; Tallman & Li, 1996).

We measure a firm's regional diversification using the entropy measure, which not only measures the extent to which a firm's activities are spread across similar foreign countries within regions, but also quantifies the dispersion of a firm's activities across dissimilar global market regions. As in Hitt et al. (1997), the entropy measure of regional diversification is defined as

$$\mathrm{RD} = \sum_{i=1}^{m} P^i In(1/P^i) \qquad (1)$$

where ?' is the number of countries where a firm had its subsidiaries to regional market *i*, and $In(1/P^i)$ is the weight that is given to each global market region. The measure considers both the number of regions in which a firm operates and the relative importance of each region to all market regions. The higher the value of RD, the greater is the level of regional diversification of a firm.

Information regarding a firm's foreign operations can be found in directories that list a firm's foreign subsidiaries and the location of these subsidiaries. The directories include the *Directory of Corporate Affiliates*, the *Directory of American Firms Operating in Foreign Countries*, and *Who Owns Whom* (North America). They consistently report a firm's foreign operations over time. Other information, such as the value of sales or assets or number of employees, can also be found in these sources, though not as consistently. For this study, we consulted each volume of the *Directory of Corporate Affiliates* and the *Directory of American Firms Operating in Foreign Countries* for the years 1996 through 2000. We categorized and coded the location of subsidiaries into the different regions specified by the World Bank (1995).

Performance. Following previous studies (e.g., Delios & Beamish, 1999; Geringer et al., 2000; Hitt et al., 1997), we define firm performance using the accounting-based measures of return on assets (ROA) and return on sales (ROS). Originally, return on equity (ROE) was also considered as a possible measure of firm performance. However, in the end, it was ruled out because of its sensitivity to capital structure differences (Hitt et al., 1997). All of the observations are included regardless of whether the firm registered a profit or loss in a particular year. ROA and ROS are measured as the after-tax profits (before extraordinary items) divided by total assets and sales revenue.

Control variables. Following previous studies (e.g., Barkema & Vermeulen, 1998; Geringer et al., 2000; Hitt et al., 1997; Kim et al., 1993; Markides, 1995; Tallman & Li, 1996), we control for a number of variables that may also influence firm performance, including multinationality, firm size, firm age, firm leverage, firm risk, R&D intensity, product scope, and industry effect.[2]

Multinationality reflects the scale of foreign operations, and may significantly affect firm performance. In 1995, *World Investment Report* (UNCTAD, 1995) introduced a composite index of multinationality that assesses the degree to which MNEs are engaged in foreign activities compared with their domestic activities. The index is calculated as the average of three ratios: foreign sales as a percentage of total sales, foreign assets as a percentage of total assets, and the number of foreign employees as a percentage of total employees (Ietto-Gillies, 1998). We follow this composite index of multinationality.

Firm size represents the physical and financial resources of a firm, and is frequently used as a proxy for competitive positioning within an industry (Qian, 2002). We measure firm size using the actual number of employees that are working in a firm transformed into natural logarithms. Firm age is included in the analysis because previous studies suggest that it influences the radical innovations and international operations of a firm (Riahi-Belkaoui, 1996). Firm age is measured as the actual duration of existence of a firm since the starting year of its operations. R&D intensity captures a firm's endowment of unique technological knowledge, and is an important determinant of firm performance (Ettlie, 1998). We compute a firm's average annual expenditure on R&D and divide it by average sales revenue to derive the measure of R&D intensity. Firm leverage gages the extent to which non-equity capital is used to finance the assets of a firm, and is measured by long-term debt as a proportion of total capital. Firm risk denotes the degree of hazard that is encountered (Kim et al., 1993), and is included because risk profiles can have a great impact on firm performance (Markides, 1995). A firm's level of risk is gauged by taking the standard deviation of firm profitability (both ROA and ROS). Product scope measures the width of a firm's operations. There are both advantages and disadvantages to operating within narrow and wide product segments (cf. Hill & Jones, 1998; Hitt et al., 1997), and in this study the entropy measure is used to gauge the scope of a product based on its Standard Industrial Classification (SIC). The entropy measure is

$$PS = \sum_{i=1}^{n} P^{ji} In(1/P^{i}) \qquad (2)$$

where P^{ji} is defined as the share of segment i in group j of the total sales of the group, and $In(1/P^{i})$ is the weight that is given to each segment within the same two-digit industry group. Industry effect is included as a control variable because the structural characteristics of industries affect the average profits of a firm (Grant et al., 1988). We use industry dummies to represent each firm's primary two-digit industry group.

Model Selection

Because the data set in this study has both a time series dimension (5 years) and a cross-sectional dimension (189 firms), we use the panel data technique. Our sample thus consists of 945 data points (companies-years). The advantage of using a panel data set is that the sample size is usually quite large, which means that it should be very informative about the parameters that are to be estimated, and it permits the observation, description, or classification of organizational phenomena in such a way that processes can be identified and empirically documented (Kimberly, 1976). However, panel data can have different hierarchical structures, either static or dynamic. A firm's behavior may have dynamic characteristics that cannot be explained by static panel models (Hu, 2002).[3] Therefore we use a dynamic model in which the lagged dependent variables are often used as explanatory variables (Arellano & Bond, 1991).

The most important step in panel data analyses is model selection. The estimation of the panel data equation depends on the assumption that is made about the intercept and slope of the model. We first investigated whether the parameters of the dependent variable Y_{it} were constant for all of the cross-sectional units and periods. The panel data model involves the following three situations, depending on both the intercept and the slope. In situation 1, both the intercept and the slope are the same ($\alpha_i=\alpha_j$, $\beta_i=\beta_j$): therefore it is a pooled regression model. In situation 2, the slope is the same but the intercept is different ($\alpha_i\neq\alpha_j$, $\beta_i=\beta_j$), and thus it is a variable intercept model. In Situation 3, both the intercept and the slope are different ($\alpha_i\neq\alpha_j$, $\beta_i\neq\beta_j$), and thus it a variable coefficient model. The results indicate that the panel data fit nicely into Situation 2.[4]

Meanwhile, we also have to determine the order of lags for the dependent variable. It is important to ensure enough freedom for sufficient estimation (Hsiao, 2003). As this study covered only 5 years, we first set the first-order lagged dependent variable into the model and then compared its mean square error (m.s.e.) with that of the high-order lagged models. The results indicate that there is no difference between them.[5] This suggests that the use of the first-order model is appropriate as its coefficient fully reflects all past information synthetically.

The model of the relationship between firm performance and the main explanatory variables takes the following form:

$$\begin{aligned} Y_{it} &= \alpha + \lambda Y_{it-1} + \beta_1 RD_{it} + \beta_2 RD_{it}^2 + \beta_3 RD_{it}^3 \\ &\quad + \sum_{j=1}^{9} \omega_j PRE_{jt} + \eta_i + \varepsilon_{it} \qquad (3) \\ &|\lambda|<1;\ t=1,2,\ldots,T;\ i=1,2,\ldots,N \end{aligned}$$

where the subscripts i and t refer to firm and time, respectively; α is the public constant; λ, β_1, β_2, and β_3 are the public coefficients of the corresponding variables; PRE_j ($j=1, 2, \ldots, 9$) represents the nine predetermined control variables; ω_j is their corresponding public coefficient; η_i is the unobserved individual specific effect, and ε_{it} is the error term of the ith cross-sectional unit. After the model has been determined, it is equally important to ascertain the model's proper estimation.

We also have to confirm whether this dynamic variable intercept model has fixed effect (FE) or random effect (RE) characteristics or specifications. Following Hausman's (1978) approach, we identified that the dynamic variable intercept model functions have fixed effect characteristics.[6] As the firm-specific effect η_i cannot be observed, this might cause estimator bias. Therefore, to eliminate the firm-specific effect η_i, we estimate the first difference of Equation (3) as follows:

$$\begin{aligned} \Delta Y_{it} &= \alpha + (\lambda-1)\Delta Y_{it-1} + \beta_1 \Delta RD_{it} + \beta_2 \Delta(RD_{it}^2) \\ &\quad + \beta_3 \Delta(RD_{it}^3) + \sum_{j=1}^{9} \omega_j \Delta PRE_{jt} + \Delta\varepsilon_{it} \qquad (4) \end{aligned}$$

where A is the first difference of the corresponding variable. From the difference, we eliminate the firm-specific effect as in Equation (4), which can be estimated using instrumental variables.

We applied the generalized method of moments (GMM) estimation method to a panel data set. The GMM estimation method has been most appropriate for dynamic models, not only because it overcomes the endogeneity of the regressors, but also because it does not need to make a complete specification of the probability distribution of the data: that is, it solves the problems associated with autocorrelation from time-series estimates and heteroscedasticity from cross-sectional estimates. The results from GMM estimation are therefore more reliable.

RESULTS

Hypotheses 1 and 2 predict both linear and curvilinear effects when firms are at different levels of region diversification (low, moderate, and high), Accordingly, the sample firms are classified into one of those three categories depending on their RD levels.[7] If RD is not less than 0.7, the firm is regarded as a high regional diversifier (HRD), whereas if RD is not more than 0.3, the firm is treated as a low regional diversifier (LRD). A firm with a strategy that falls between these two categories - that is, one that has an RD that ranges from 0.3 to 0.7 - is regarded as a medium regional diversifier (MRD). We test both Hypothesis 1 and Hypothesis 2 using two sample groups: firms with low/medium levels of regional diversification, and firms with medium/high levels of regional diversification.

Table 2 provides the descriptive statistics and intercorrelations for all of the quantitative variables in this study. Preliminary analysis reveals low intercorrelations among these variables, which suggests that multicollinearity is not a serious problem.[8]

Firms with Low/Medium Levels of Regional Diversification

The three separate models that are shown in Table 3 are used to test Hypothesis 1. Model 1 is the basic model, and includes the effects of all of the control variables. Based on Model 1, we add the RD in Model 2, and add both the RD and the square term of RD (RD^2) to form Model 3.

Before empirical tests are conducted, we need to make sure that all the orthogonal conditions hold - the condition that the GMM model is valid (Arellano & Bond, 1991). The GMM estimator uses instrumental variables to estimate parameters, so we still need to test the validity of instrumental

Table 2 Means, standard deviations, and correlations for the quantitative variables[a]

Variables	*Means*	*s.d.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1. Profitability	3.253 (4.126)	0.311 (0.282)								
2. Regional diversification	0.365	0.182	0.221** (0.257)***							
3. Firm size	7.517	8.026	0.0950 (0.108)	0.074 (0.069)						
4. Firm age	24.03	8.29	0.077 (0.089)	0.086 (0.098)	0.105 (0.113)					
5. Firm risk	0.377[b] (0.423)[c]	1.405 (1.702)	−0.185† (−0.212)*	−0.170† (−0186)†	0.021 (0.033)	0.016 (0.018)				
6. R&D intensity	7.157	4.113	0.243** (0.275)***	0.166† (0.178)†	0.083 (0.100)	0.076 (0.092)	0.038 (0.045)			
7. Multinationality	0.295	0.112	0.232** (0.264)**	0.124 (0.136)	0.061 (0.071)	0.049 (0.058)	−0.193† (−0.200)†	0.170† (0.184)†		
8. Firm leverage	0.713	0.486	0.087 (0.093)	0.053 (0.066)	0.031 (0.033)	0.018 (0.026)	0.082 (0.089)	0.061 (0.069)	0.021 (0.024)	
9. Product scope	1.338	1.239	0.109 (0.115)	0.102 (0.109)	0.092 (0.099)	0.051 (0.056)	0.068 (0.076)	0.073 (0.080)	0.051 (0.064)	0.012 (0.019)

[a]The upper numbers in the cells are correlations using ROA, and numbers in the parentheses are correlations using ROS.
[b]Measured by standard deviation of ROA.
[c]Measured by standard deviation of ROS.
†$p<0.10$ level; *$p<0.05$ level; **$p<0.01$ level; ***$p<0.001$ level.

Table 3 Performance of firms with low/moderate regional diversification

Variables	*Model 1*		*Model 2*		*Model 3*	
	ROA	*ROS*	*ROA*	*ROS*	*ROA*	*ROS*
Performance (*t*−1)	0.0873	0.0937	0.0905	0.0969	0.0854	0.0912
	(0.0746)	(0.0735)	(0.0762)	(0.0750)	(0.0759)	(0.0741)
Firm size	0.0649	0.0822	0.0677	0.0841	0.0623	0.0802
	(0.0554)	(0.0642)	(0.0568)	(0.0651)	(0.0546)	(0.0638)
Firm age	0.0561	0.0723	0.0583	0.0739	0.0536	0.0705
	(0.0524)	(0.0622)	(0.0539)	(0.0620)	(0.0518)	(0.0627)
Firm risk	−0.1619†	−0.1888*	−0.1633†	−0.1925*	−0.1602†	−0.1859*
	(0.0894)	(0.0845)	(0.0901)	(0.0862)	(0.0889)	(0.0836)
R&D intensity	0.2368**	0.2542***	0.2393**	0.2569***	0.2335**	0.2517***
	(0.0813)	(0.0780)	(0.0797)	(0.0788)	(0.0804)	(0.0773)
Multinationality	0.2226**	0.2461***	0.2248**	0.2483***	0.2204**	0.2433***
	(0.0777)	(0.0761)	(0.0784)	(0.0770)	(0.0766)	(0.0758)
Firm leverage	0.0653	0.0741	0.0671	0.0768	0.0632	0.0725
	(0.0702)	(0.0684)	(0.0712)	(0.0697)	(0.0675)	(0.0690)
Product scope	0.0921	0.1028	0.0939	0.1069	0.0909	0.1005
	(0.948)	0.216)	(0.620)	(0.119)	(0.667)	(0.132)
Industry effect	0.1521†	0.1758*	0.1547†	0.1793*	0.1502†	0.1721*
	(0.0857)	(0.0806)	(0.0859)	(0.0814)	(0.0843)	(0.0789)
Regional diversification			0.2359**	0.2633***	0.2329**	0.2608***
			(0.0809)	(0.0829)	(0.0797)	(0.0836)
Regional diversification squared					−0.1053	−0.1206
					(0.0884)	(0.0996)
Wald chi-square	173.06	175.62	172.38	175.32	173.69	176.02
p-value	0.0389	0.0291	0.0372	0.0264	0.0280	0.0211
Sargan test of over-identifying restrictions (p-value)	0.1473	0.1348	0.1828	0.1598	0.2411	0.2057
First-order serial correlation (p-value)	0.6368	0.5438	0.6737	0.5636	0.6664	0.5832
No. of sample	770	770	770	770	770	770

†$p<0.10$ level; *$p<0.05$ level; **$p<0.01$ level; ***$p<0.001$ level.

variables. As shown in the results of Table 3, the p-values of the Sargan test of over-identifying restrictions for the three models are larger than the 0.05 level, which suggests that the null hypothesis is accepted and the instrumental variables chosen in the models are valid. Moreover, the p-values of the first-order serial correlation test for the three models are also larger than the 0.10 level, thus indicating that the error term is not first-order serially correlated.[9]

Model 1 in Table 3 shows that some of the control variables that are specified in this model have an effect on firm profitability. First, the three variables (R&D, multinationality, and industry effect) have significant regression coefficients at various statistical levels. In particular, the first two variables have highly significant and positive effects on both ROA ($p<0.01$) and ROS ($p<0.001$). Second, the firm risk variable is negative and significant for both the ROA ($\beta=-0.1619$, $p<0.10$) and the ROS ($\beta=-0.1888, p<0.05$) performance measures. Finally, the remaining control variables (firm size, firm age, firm leverage, and product scope) are insignificant even at the 0.10 level, and thus exert a minimal influence. These results are consistent across the other models.

Hypothesis 1 hypothesizes that firm performance will vary positively and linearly with the degree of regional diversification before it reaches the medium level. An examination of the statistical evidence in Model *2* confirms our prediction, with the results being positive and highly significant (ROA: $\beta=0.2359$, $p<0.01$; ROS: $\beta=0.2633$, $p<0.001$). When the square term of RD (RD^2) is added into Model 3, though the coefficient of the linear term (RD) is still positive and significant, that of the square term turns out to be negative and insignificant (ROA: $\beta=-0.1053$, n.s.; ROS: $\beta=-0.1206$, n.s.). The result further supports Hypothesis 1. Taken together, the findings from Models 2 and 3 suggest that the linear specification is superior to the non-linear specification. Meanwhile, the sign and the significance level of all control variables in Model 3 are similar to those of the previous two models (Models 1 and 2). As indicated in both the Wald chi-square (χ^2) statistic and p-value, each of the models is highly significant.

Firms with Medium/High Levels of Regional Diversification

Hypothesis 2 states that firm performance will decrease when a firm moves from medium to high levels of regional diversification. We use the same three separate models (Table 4) to test it. Similarly, Model 1 includes all control variables only. Model 2 adds only the linear term of regional diversification (RD), while Model 3 further adds the square terms of RD (RD^2). The square term of RD describes the situation in which a firm has high levels of regional diversification. If an inverted U-shape relationship between regional diversification and firm performance exists, then the coefficient of RD^2 should be negative and significant.

Again, the GMM estimation is valid as the p-values of both tests (i.e., the Sargan test and the first-order serial correlation test) are highly significant as shown in Table 4.

As shown in Model 1, both the sign and the significance level for these control variables are similar to those in Table 3. In Model 2, the linear term of RD is positive and significant (ROA: $\beta=0.1549$, $p<0.10$; ROS: $\beta=0.1871$, $p<0.05$). However, in Model 3, while the linear term of RD is still positive and significant, as in Model 2, the square term of RD appears to be negative and highly significant (ROA: $\beta=-0.2291$, $p<0.01$; ROS: $\beta=-0.2507$, $p<0.001$). The result thus confirms Hypothesis 2. Again, both the Wald chi-square (χ^2) statistic and p-value indicate that each of the models is highly significant.

Table 4 Performance of firms with moderate/high regional diversification

Variables	*Model 1*		*Model 2*		*Model 3*	
	ROA	*ROS*	*ROA*	*ROS*	*ROA*	*ROS*
Performance ($t-1$)	0.0841	0.0906	0.0875	0.0927	0.0826	0.0886
	(0.0743)	(0.0722)	(0.0754)	(0.0735)	(0.0719)	(0.0708)
Firm size	0.0614	0.0773	0.0636	0.0797	0.0603	0.0741
	(0.0529)	(0.0608)	(0.0550)	(0.0622)	(0.0519)	(0.0592)
Firm age	0.0531	0.0672	0.0555	0.0693	0.0512	0.0648
	(0.0505)	(0.0549)	(0.0518)	(0.0597)	(0.0492)	(0.0572)
Firm risk	−0.1752†	−0.1973*	−0.1789†	−0.2017*	−0.1723†	−0.1941*
	(0.0978)	(0.0896)	(0.0989)	(0.0910)	(0.0966)	(0.0883)
R&D intensity	0.2321**	0.2485***	0.2346**	0.2513***	0.2307**	0.2461***
	(0.0800)	(0.0769)	(0.0808)	(0.0774)	(0.0793)	(0.0759)
Multinationality	0.2351**	0.2582***	0.2383**	0.2619***	0.2326**	0.2554***
	(0.0824)	(0.0817)	(0.0835)	(0.0818)	(0.0807)	(0.0812)
Firm leverage	0.0582	0.0679	0.0608	0.0717	0.0563	0.0656
	(0.0633)	(0.0647)	(0.0660)	(0.0671)	(0.0615)	(0.0639)
Product scope	0.0941	0.1065	0.0966	0.1091	0.0918	0.1042
	(0.0740)	(0.0794)	(0.0752)	(0.0804)	(0.0731)	(0.0783)
Industry effect	0.1555†	0.1819*	0.1587†	0.1843*	0.1523†	0.1806*
	(0.878)	(0.0839)	(0.0890)	(0.0841)	(0.0862)	(0.0830)
Regional diversification			0.1549†	0.1871*	0.1516†	0.1827*
			(0.0825)	(0.0847)	(0.0818)	(0.0836)
Regional diversification squared					−0.2291**	−0.2507***
					(0.0794)	(0.0803)
Wald chi-square	128.25	128.73	128.08	128.77	127.88	128.08
p-value	0.0466	0.0439	0.0412	0.0377	0.0365	0.0356
Sargan test of over-identifying restrictions (p-value)	0.4928	0.1400	0.5328	0.1781	0.5740	0.2274
First-order serial correlation (p-value)	0.5948	0.5793	0.5753	0.5714	0.6141	0.5910
No. of sample	770	770	770	770	770	770

†p<0.10 level; *p<0.05 level; **p<0.01 level; ***p<0.001 level.

Selection of Regions to Maximize Performance

The testing of Hypothesis 3 is accomplished by conducting multifactor analysis (*post hoc* multiple comparisons of the cell mean) to investigate how two variables - that is, diversification into developing country regions (DN) and developed country regions (DD) - interact at each level to jointly influence firm performance. The rationale behind this is that the effect of one factor should differ depending on the level of the other factor, and vice versa. Before conducting the analysis, however, we must divide the firms into different groups based on the median of DN and DD, respectively, and also meet some statistical requirements.[10]

We use the tri-sectional quantile method, which divides the series of observations into three groups or sections. Because the method has an elaborate division of the median, it enables the determination of two tri-sectional points (applied to both grouping and non-grouping situations) through which the three groups can be well established (Evans, Hastings, & Peacock, 2000). Therefore it has the advantage of exploring the internal structure of the population and determining within-group boundaries in statistical grouping (Hyndman & Fan, 1996). Moreover, it also enables us to effectively conduct various tests (e.g., MANOVA and *post hoc* multiple comparisons). Accordingly, we classify firms into three different groups - low, medium, or high - according to their level of DN and DD.

Three different levels of DN are established: not more than two regions, three to four regions, and more than four regions. In this study, they are referred to as low DN (LDN), medium DN (MDN), and high DN (HDN), respectively. Three levels are also established for DD: one region, two to three regions, and four regions. They are designated as low DD (LDD), medium (MDD), and high DD (HDD), respectively. Altogether, there are nine different combinations of DN and DD. We fix each of the factors at each level, and then examine the effects of the changes in the other factor on firm performance. Tables 5 and 6 report the results for both ROA and ROS of the *post hoc* and multiple comparisons tests for these different groups.

When DD is fixed at a high or a low level, there is no performance difference among the groups. The results that are shown in Panel A (ROA: F=0.55, p=0.579; ROS: F=1.75, p=0.188) and Panel C (ROA: F=0.33, p=0.721; ROS: F=1.16, p=0.324) clearly indicate insignificant differences among the groups. Moreover, the results from each group comparison (t-statistic) are all statistically insignificant. However, in Panel B, when DD is fixed at a medium level, the overall performance across the three groups is statistically significant (ROA: F=39.02, p=0.000; ROS: F=17.10, p=0.000). The firms in Group 6 (MDD/LDN) performed significantly better than the firms in both Group 4 (MDD/HDN) and Group 5 (MDD/MDN).

We change the angle of analysis by fixing DN at different levels (Panels D-F). In both Panel D (DN is fixed at a high level) and Panel E (DN is fixed at a medium level), the overall models are not statistically significant: ROA (F=0.36, p=0,698; F=1.51, p=0.235); and ROS (F=1.15, p=0.328; F=0.58, p=0.564). These results indicate that there is no difference among the three groups. Similarly, the results from each group comparison are all statistically insignificant. In Panel F, in which DN is fixed at a low level (EDN), however, the situation is completely different - significant differences in performance do exist among the three groups (ROA: F=50.40, p=0.000; ROS: F=10.72, p=0.000). The firms in Group 17 (LDN/MDD) significantly outperformed the firms in both Group 16 (LDN/HDD) and Group 18 (LDN/EDD).

Clearly, it is not effective when the level of DN is either medium or high, or when the level of DD is either low or high. A low DN and a medium DD is the best combination, as firms with the LDN/MDD combination performed significantly better than firms with other combinations. Therefore the results lend strong support to Hypothesis 3: that is, firms can maximize their performance if they diversify into a moderate number of developed country regions and a strictly limited number of developing country regions.

DISCUSSION AND CONCLUSION

This study examines how different degrees of regional diversification affect firm performance and how firms select regions to maximize their performance. It reveals several important findings. First, evidence from this study confirms that most MNEs are regional rather than global: that is, their internationalization is not globally balanced but regionally focused. More important, the study tests and confirms the rationale behind such predominance of regional diversification - diversification within regions has lower costs than diversification across regions. In other words, internationalization costs vary, depending on internationalization between regions or within regions.

Second, relations between regional diversification and firm performance can be linear or curvilinear.

Table 5 *Post hoc* multiple comparisons (ROA)

	Coeff.	*Std. err.*	*t-value*	*Sig. t*	*Lower – 95%*	*CI. Upper*
Panel A						
(1) HDD/HDN HDD/MDN (2)	−0.07168	0.29364	−0.24412	0.80852	−0.66721	0.52385
(1) HDD/HDN HDD/LDN (3)	−0.29626	0.29364	−1.00893	0.31974	−0.89179	0.29927
(2) HDD/MDN HDD/LDN (3)	−0.22457	0.29364	−0.76481	0.44937	−0.82011	0.37095
Test of significance: F=0.55 (p=0.579)						
Panel B						
(4) MDD/HDN MDD/MDN (5)	−0.24401	0.29364	−0.83100	0.41145	−0.83955	0.35151
(4) MDD/HDN MDD/LDN (6)	−2.35842	0.29364	−8.03168	0.00000	−2.95396	−1.76290
(5) MDD/MDN MDD/LDN (6)	−2.11441	0.29364	−7.20068	0.00000	−2.70994	−1.51888
Test of significance: F=39.02 (p=0.000)						
Panel C						
(7) LDD/HDN LDD/MDN (8)	0.06469	0.29364	0.22030	0.82688	−0.53084	0.66022
(7) LDD/HDN LDD/LDN (9)	0.23125	0.29364	0.78754	0.43612	−0.36428	0.82678
(8) LDD/MDN LDD/LDN (9)	0.16656	0.29364	0.56724	0.57407	−0.42897	0.76209
Test of significance: F=0.33 (p=0.721)						
Panel D						
(10) HDN/HDD HDN/MDD (11)	−0.24848	0.29364	−0.84623	0.40301	−0.84402	0.34704
(10) HDN/HDD HDN/LDD (12)	−0.09709	0.29364	−0.33067	0.74281	−0.69263	0.49843
(11) HDN/MDD HDN/LDD (12)	0.15139	0.29364	0.51556	0.60931	−0.44414	0.74692
Test of significance: F=0.36 (p=0.698)						
Panel E						
(13) MDN/HDD MDN/MDD (14)	−0.42082	0.29364	−1.43311	0.16045	−1.01635	0.17471
(13) MDN/HDD MDN/LDD (15)	0.03927	0.29364	0.13376	0.89434	−0.55625	0.63481
(14) MDN/MDD MDN/LDD (15)	0.46009	0.29364	1.56687	0.12589	−0.13543	1.05561
Test of significance: F=1.51 (p=0.235)						
Panel F						
(16) LDN/HDD LDN/MDD (17)	−2.31065	0.29364	−7.86899	0.00000	−2.90618	−1.71512
(16) LDN/HDD LDN/LDD (18)	0.43041	0.29364	1.46580	0.15138	−0.16511	1.02595
(17) LDN/MDD LDN/LDD (18)	2.74107	0.29364	9.33479	0.00000	2.14554	3.33660
Test of significance: F=50.40 (p=0.000)						

Notes: (1) HDD/HDN: high DD/High DN; (2) HDD/MDN: high DD/medium DN; (3) HDD/LDN: high DD/low DN; (4) MDD/HDN: medium DD/high DN; (5) MDD/MDN: medium DD/medium DN; (6) MDD/LDN: medium DD/low DN; (7) LDD/HDN: low DD/high DN; (8) LDD/MDN: low DD/medium DN; (9) LDD/LDN: low DD/low DN; (10) HDN/HDD: high DN/high DD; (11) HDN/MDD: high DN/medium DD; (12) HDN/LDD: high DN/low DD; (13) MDN/HDD: medium DN/high DD; (14) MDN/MDD: medium DN/medium DD; (15) MDN/LDD: medium DN/low DD; (16) LDN/HDD: low DN/high DD; (17) LDN/MDD: low DN/medium DD; (18) LDN/LDD: low DN/low DD.

Regional diversification has a positive and linear effect on firm performance up to a medium level. Above that level, the positive effect begins to diminish, and eventually become negative. In other words, the effects of regional diversification on firm performance are manifest in two stages. Regional diversification enhances firm performance up to a certain threshold, beyond which firm performance begins to decline (negative slope) when the degree of regional diversification increasesfurther.

Third, firms of developed countries can maximize their performance if they diversify into a moderate number of developed country regions and a strictly limited number of developing country regions. In terms of market potential, infrastructure, and economic development, differences are substantial between developing regions. Accordingly, the costs and the risks can be substantial if firms operate across developing regions. In addition, developing countries provide similar resources. Hence the costs outweigh the benefits if firms of developed countries diversify into a number of developing country regions.

Finally, the effects of some control variables deserve special attention. This study indicates that

Table 6 *Post hoc* multiple comparisons (ROS)

	Coeff.	*Std. err.*	*t-value*	*Sig. t*	*Lower – 95%*	*CL upper*
Panel A						
(1) HDD/HDN – HDD/MDN (2)	–0.03813	0.31184	–0.12230	0.90334	–0.67057	0.59429
(1) HDD/HDN – HDD/LDN (3)	–0.52324	0.31184	–1.67793	0.10202	–1.15567	0.10919
(2) HDD/MDN – HDD/LDN (3)	–0.48510	0.31184	–1.55563	0.12854	–1.11753	0.14733
Test of significance: F=1.75 (p=0.188)						
Panel B						
(4) MDD/HDN – MDD/MDN (5)	–0.33587	0.31184	–1.07707	0.28861	–0.96830	0.29656
(4) MDD/HDN – MDD/LDN (6)	–1.72011	0.31184	–5.51608	0.00000	–2.35254	–1.08768
(5) MDD/MDN – MDD/LDN (6)	–1.38424	0.31184	–4.43901	0.00008	–2.01667	–0.75181
Test of significance: F=17.10 (p=0.000)						
Panel C						
(7) LDD/HDN – LDD/MDN (8)	0.46489	0.31184	1.49083	0.14472	–0.16754	1.09733
(7) LDD/HDN – LDD/LDN (9)	0.14663	0.31184	0.47022	0.64104	–0.48580	0.77906
(8) LDD/MDN – LDD/LDN (9)	–0.31826	0.31184	–1.02061	0.31425	–0.95070	0.31417
Test of significance: F=1.16 (p=0.324)						
Panel D						
(10) HDN/HDD – HDN/MDD (11)	0.18375	0.31184	0.58926	0.55937	–0.44868	0.81618
(10) HDN/HDD – HDN/LDD (12)	–0.28570	0.31184	–0.91621	0.36565	–0.91814	0.34673
(11) HDN/MDD – HDN/LDD (12)	–0.46945	0.31184	–1.50547	0.14093	–1.10189	0.16297
Test of significance: F=1.15 (p=0.328)						
Panel E						
(13) MDN/HDD – MDN/MDD (14)	–0.11398	0.31184	–0.36551	0.71687	–0.74641	0.51845
(13) MDN/HDD – MDN/LDD (15)	0.21732	0.31184	0.69692	0.49033	–0.41511	0.84976
(14) MDN/MDD – MDN/LDD (15)	0.33130	0.31184	1.06244	0.29511	–0.30113	0.96347
Test of significance: F=0.58 (p=0.564)						
Panel F						
(16) LDN/HDD – LDN/MDD (17)	–1.01312	0.31184	–3.24889	0.00251	–1.64555	–0.38069
(16) LDN/HDD – LDN/LDD (18)	0.38416	0.31184	1.23194	0.22596	–0.24827	1.01660
(17) LDN/MDD – LDN/LDD (18)	0.39728	0.31184	4.48083	0.00007	0.76485	2.02972
Test of significance: F=10.72 (p=0.000)						

Notes: (1) HDD/HDN: high DD/High DN; (2) HDD/MDN: high DD/medium DN; (3) HDD/LDN: high DD/low DN; (4) MDD/HDN: medium DD/high DN; (5) MDD/MDN: medium DD/medium DN; (6) MDD/LDN: medium DD/low DN; (7) LDD/HDN: low DD/high DN; (8) LDD/MDN: low DD/medium DN; (9) LDD/LDN: low DD/low DN; (10) HDN/HDD: high DN/high DD; (11) HDN/MDD: high DN/medium DD; (12) HDN/LDD: high DN/low DD; (13) MDN/HDD: medium DN/high DD; (14) MDN/MDD: medium DN/medium DD; (15) MDN/LDD: medium DN/low DD; (16) LDN/HDD: low DN/high DD; (17) LDN/MDD: low DN/medium DD; (18) LDN/LDD: low DN/low DD.

R&D spending, multinationality, and industry effects have significantly positive effects on firm performance, while firm risks have significantly negative effects on firm performance. This implies that the inverted U-shaped relationship between regional diversification and firm performance may vary in shape and height depending on these characteristics of firms. For example, some firms may be able to shift the curve upward and to the right if they have the technological and innovative capability to create and maintain their competitive advantage in different regional markets. The variance in the shape and height of the inverted U-shaped curve may also depend on industry characteristics. Because of possible industry effects, some firms will increase their profit performance through reasonably high levels of regional diversification, whereas others will increase their performance only when their regional diversification is relatively low. It should be noted that firm size, firm age, firm leverage, and product scope do not have significant effects on the shape and height of the curve.

The identification of the effects of regional diversification on firm performance has important managerial implications. All firms, both large and small, suffer resource limitations, so they should allocate resources efficiently. In the last decade, firms have been using target operating ratios to allocate resources within the firms (Daniels & Bracker, 1989). Managers have little empirical information to guide them in controlling the scale and the scope of foreign operations. The effects of regional diversification identified in this study provide guidance for internationalizing firms to allocate resources across regions. The inverted U-shaped empirical results from this study imply that firms may stray into a sub-optimal performance zone. We have three possible explanations. First, it is difficult for firms to assess whether they are over-diversifying or under-diversifying regionally, as they may not have sufficient knowledge of the costs of regional over-diversification or under-diversification. Second, some firms may deliberately over-diversify regionally in the race for market share or market size in the hope that regional over-diversification will lead to long-term profits. Third, some firms are comfortable with their domestically based strategies and do not realize that under-diversification hurts profits.

MNEs that engage heavily in foreign operations must carefully monitor the costs and the benefits of their heavy diversification into different global market regions. MNEs have generally amassed rich and varied international experience from their long and active participation in foreign activities, but they may become distracted or misled by the sheer number of regions that provide market opportunities. Increasing environmental uncertainty and the rising sophistication of the capital markets as a result of increased regional conflicts can lead to an upward shift in the curve of the marginal costs of internationalization, and a downward shift in the curve of the marginal benefits of internationalization. In other words, these firms face high risk from over-diversification.

This study suffers from some limitations. First, it is unclear whether the findings that we have obtained from US MNEs can be applied to/the MNEs of other countries. In future studies, we will extend the sample size to include European and Asian (particularly Japanese) MNEs and compare the effects of their regional diversification on firm performance. Second, this study does not assess how other corporate characteristics, such as the level of available resources, firm-specific capabilities (e.g., experiential knowledge), and stages of corporate development (established versus growing firms), affect the effects of their regional diversification. Third, the majority of existing studies, including this one, use accounting measures, such as ROA, ROS, or ROE, as the dependent variables to measure firm performance. However, these ratios may not fully reflect firm value, and it is therefore critical to explore what alternatives can be employed to examine firm value.

NOTES

For a firm to be included in the sample, the requisite data for the entire 5-year period were required for the firm. Because there were some missing data on many of the firms during this period, we were left with a sample of 189 firms.

[2]There are 13 industry groups based on their Standard Industrial Classification (SIC). Firms are placed in the group that represents the greatest volume of their sales. The industries are: Beverages; Chemicals; Food; Paper and Wood Products; Electrical; Industrial and Farm; Office Equipment (with computers); Metal Products; Measurement, Scientific and Photographic Equipment; Motor Vehicles; Non-Electrical Machinery; Pharmaceuticals; and Textiles.

[3]Firm performance (e.g., ROA and ROS) has, for example, self-accumulation characteristics that tend to be dynamic, as its past level is related to its current level (Bond, Klemm, Newton-Smith, Syed, & Vlieghe, 2002).

[4]Accordingly, two hypotheses are proposed. Hypothesis 1: Both the slope and the intercept are the same at different cross-sectional units and periods. Hypothesis 2: The slope is the same but the intercept is different at different cross-sectional units and periods. Apparently, if we accept Hypothesis 1, then it is unnecessary to conduct further tests. If we do not, then we have to test Hypothesis 2 to ensure that the slope is equal. If Hypothesis 2 is rejected, then we can be sure that our panel data fall into Situation 3, in which both the intercept and the slope are different. We used the F-statistic (both F_1 and F_2) to test Hypothesis 1 and Hypothesis 2 for model 4 of all sample firms. The observed F_1 value of 1.256 exceeds the critical F value that is obtained from the F table [$F(375, 556)=1.127$], while the F_2 value of 0.886 does not exceed the critical value F [$F(181,556)=1.162$] at the 10% level. Hypothesis 2 is therefore accepted, which implies that the panel data fit nicely into Situation 2, whereas Hypothesis 1 is rejected. Hence the model specified should be a dynamic variable intercept model.

[5]The results (both chi-square and p-value of chi-square) indicate that the three models are statistically significant, and the level of significance for the first-

order lagged model is almost the same as for both the second-order and third-order lagged dependent models.

	Residual	Chi-square	p-value of chi-square
First-order lagged model	0.97312	268.49	0.0000
Second-order lagged model	0.96946	270.21	0.0000
Third-order lagged model	0.96213	271.05	0.0000

[6]The Hausman test is a multi-purpose test designed to compare two estimators that present the following contrast. Hypothesis 0: Both estimators are consistent, but the first estimator is efficient. Hypothesis 1: Only the second estimator is consistent. This test is widely used to compare between fixed effects and random effects in the analysis of panel data. If H_0 is to hold, then there should be no systematic difference between the coefficients of the efficient estimator. If the two models display a systematic difference in the estimated coefficients, then we have reason to doubt the assumptions on which the efficient estimator is based. The formal representation of the test statistic is

$$c = (b_{FE} - b_{RE})'[SE^2(b_{FE}) - SE^2(b_{RE})]^{-1}(b_{FE} - b_{RE})$$

which is asymptotically distributed as a chi-square with degrees of freedom equal to the rows of each coefficient vector. If its p-value is smaller than the 0.05 significant level, we have to reject the null hypothesis, which means the acceptance of the fixed effect model and the invalidity of the random effect model. In our study, the test statistic [chi-square (12)] equals 32.60. The Hausman specification test indicates that the p-value is 0.001, which is clearly smaller than the 0.05 level, thus favoring the fixed effect model.

[7]This classification is based on the medium of the entropy measure of RD (cf. Qian, Wang, Li, & Yang, 2000).

[8]Moreover, we conducted an additional regression diagnosis using the variance-inflating factor (VIF) to determine whether there was any multicollinearity among the variables. The results (the highest value of VIF=1.04) further confirm that multicollinearity is not a major concern in this study.

[9]We test whether the orthogonal conditions hold using both the Sargan test of over-identifying restrictions and the p-values of the first-order serial correlation test. The Sargan test is a test of the validity of instrumental variables (or a test of the overidentifying restrictions). In the first test, the null hypothesis is that the instrumental variables are uncorrelated to a specified set of residuals. If the hypothesis is accepted, the instrument variables are valid. In the second test, the null hypothesis is that the error term is not first-order serially correlated. If the p-value is larger than the 0.05 level, the hypothesis is accepted, and thus the estimation is reliable.

[10]A strict procedure is followed to ensure that the strict analytical assumption of the homogeneity of variability is met: that is, that the error variance of the dependent variable is equal across the groups (Maxwell & Deianey, 1990), If the error variance is different within each group, then there is an increased probability of the occurrence of a Type I error, which would thus affect the power of the statistical test (Wiicox, 1987). Accordingly, we conducted the univariate homogeneity of variance test to see whether our data meet the assumption of the homogeneity of variability. The results are significant: ROA[Cochran C(4, 9)=0.412, p=0.014; Bartlett–Box $F(8, 1166)=2.49$, p=0.011] and ROS[Cochran C(4, 9)=0.426, p=0.013; Bartlett-Box $F(8, 1166)=3.303$, p=0.002]. All of the statistics indicate that the assumption is fully met.

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