An empirical examination of the direct and indirect effects of geographic diversification on stock market and financial performances of multinational corporations

Received 9 January 2017
Revised 14 March 2017
18 April 2017
Accepted 18 April 2017

Woohyun Cho
Department of Management and Marketing, University of New Orleans, New Orleans, Louisiana, USA
Jian-yu Fisher Ke
Department of Information Systems and Operations Management, California State University Dominguez Hills, Carson, California, USA, and
Chaodong Han
Department of e-Business and Technology Management, Towson University, Towson, Maryland, USA

Abstract

Purpose – Literature indicates that global geographic diversification (GD) has mixed effects on a multinational corporation's (MNC) performances. The purpose of this paper is to examine how an MNC's GD influences its stock market and financial performances directly and indirectly via operational performance (i.e. changes in inventory levels).
Design/methodology/approach – Using firm-level data collected from Compustat database for the period 2000-2011 and estimating a mediating regression model, the authors examine the direct and indirect effects of GD on an MNC's stock market (Tobin's *q*) and financial performances (ROA), with inventory level being a mediator. Additionally, the examination is implemented separately under two economic situations: financial crisis vs without financial crisis.
Findings – The results show that GD enhances an MNC's stock market performance, while deteriorating its financial performance in the presence of a financial crisis. In contrast, GD has little direct impact on an MNC's stock market and financial performances during periods without financial crisis. The indirect effects of GD are mediated by changes in inventory levels.
Practical implications – This study suggests that MNCs need to carefully weigh the benefits and costs of global strategy obtained through GD. The results also indicate that GD is highly appreciated by the stock market investors during economic downturns and tighter inventory management may further enhance firm values.
Originality/value – This paper is the first empirical research to estimate both direct and indirect effects of GD via inventory in the operations management literature, highlighting the value of GD depending on the different economic situations and echoing the role of operations in implementing GD.

Keywords Financial crisis, Mediating effect, Operational performance, Geographic diversification
Paper type Research paper

Introduction

The global financial crisis of 2008-2010, the most serious economic crisis since the Great Depression of the 1930s, caused significant demand shocks in global supply chains. As the world economy has become increasingly more integrated, leveraging operational flexibility

This research has benefited from support provided by a grant from the UW-Eau Claire College of Business and the UW-Eau Claire Office of Research and Sponsored Program.

International Journal of Physical Distribution & Logistics Management
Vol. 47 No. 6, 2017
pp. 495-515

0960-0035
DOI 10.1108/IJPDLM-01-2017-0015

has become a critical issue for multinational corporations (MNCs) to effectively respond to turbulent business environments. However, it remains unclear in the literature whether MNCs are able to take advantages of geographically diversified operations to mitigate the impacts of widespread demand shocks in the presence of a global financial crisis. For decades, offshoring productions in the emerging economies including China, India, and Vietnam have become more desirable and popular to MNCs because of low labor costs, cheap raw materials, and favorable foreign exchange rates (Ferreira and Prokopets, 2009). Other benefits of global production may include access to new local markets and the creation of new knowledge and new value (Handfield, 1994; Dunning, 1998; Cantwell, 2009; Ellram *et al.*, 2013). More importantly, by leveraging a portfolio of global production bases across borders, MNCs have been able to reduce overall operational risk and improve firm performance (Lee and Makhija, 2009; Christopher and Holweg, 2017).

Nevertheless, it is worth noting that the increasing number of transactions exchanged among internal and external business partners across borders may result in operational complexity and hence present enormous challenges (Meixell and Gargeya, 2005; Danese *et al.*, 2013) and incur cost burdens (Tong and Reuer, 2007). Given the benefits and risks associated with geographic diversification (GD) on a global scale, it is no surprise that existing studies of the impacts of GD have revealed mixed results. In this study, we set out to assess the true value of GD by addressing the factors underlying these mixed results as follows.

First, this study argues that the seemingly conflicting views of the impacts of GD on firm performance may be attributable to an oversight of the role of operational performance in mediating the relationship between GD and an MNC's performance. In fact, it is observed that the extant literature has not explicitly addressed the mediating role of operational performance (e.g. Allen and Pantzalis, 1996; Tang and Tikoo, 1999; Lee and Makhija, 2009; Belderbos *et al.*, 2014).

Second, from a contingency perspective, the impacts of GD may vary with different economic situations. For instance, research has suggested that GD may be more valuable due to its risk portfolio effect during economic downturns when compared with a stable economy (Lee and Makhija, 2009). The GD effects during a non-financial crisis may have been under-researched in the operations literature, although a firm's risk exposure may vary across heterogeneous economic situations. The scarcity of comparative analysis under both economic situations may have attributed to the ambiguous value of GD shown in the extant literature.

Third, major changes in firm's strategic decisions require a great amount of resources, which may lead to decreased short-term profit performance; in contrast, value adding strategic decisions may be favorably considered by stakeholders as an investment for boosting long-term performance (Chauvin and Hirschey, 1993; Dos Santos *et al.*, 1993). This study contrasts both short-term performance and long-term performance of GD.

Using global manufacturing firm information retrieved from the Compustat database over 2000-2011, this study empirically tests the indirect effects of GD on firm performance while addressing the three factors noted above. Our findings may help better measure the value of MNCs' GD and provide more insights for global supply chain managers.

The remainder of the paper is organized as follows: we develop hypotheses based on our survey of the existing GD literature, followed by data collection and research methodology. We then present regression results and discuss empirical findings. This study concludes with a summary of theoretical and managerial contributions, research limitations, and future research.

Literature review and hypothesis development

Recently, there has been a strong push for "bringing jobs back home" from an increasing number of multinational manufacturers and US politicians, resulting in a reignited discussion of insourcing (Hartman *et al.*, 2017). While re-shoring or right-shoring may be favored due to increased labor costs in emerging countries, lower energy costs in the USA, fluctuations in

foreign exchange rates, and concerns of intellectual property theft (Sirkin *et al.*, 2011; Tate *et al.*, 2014; Tate and Bals, 2017), MNCs should not overlook the benefits of GD enabled by multi-location strategy, especially in the presence of a financial crisis (Lee and Makhija, 2009).

Echoing Gray *et al.* (2013), GD is essentially a location decision, which may have significant implications for an MNC's performance (productions, marketing, research, finance, etc.). For example, with GD of production facilities, an MNC may be able to shift factors of production across borders and transfer resources within its global network (Kogut and Kulatilaka, 1994; Gutierrez and Kouvelis, 1995; Huchzermeier and Cohen, 1996; Rosenfeld, 1996). Further, recent literature on GD extends from production location decisions to an overall strategy of supply chain design and flexibility, which may include diversified locations of purchasing, production, and distribution (Kleindorfer and Saad, 2005; Choi and Krause, 2006; Tang, 2006).

GD and firm stock market performance

Organizational and strategy studies suggest that GD enables firms to reduce uncertainty and ultimately improve firm value due to the risk portfolio effect (Gerwin, 1993; Suarez *et al.*, 1995). Real options theory argues that MNCs have a distinct advantage over pure domestic firms due to the possession of a portfolio containing switching options. With switching options, MNCs are able to change their production locations quickly in response to environmental variations such as changes in foreign exchange rates and labor costs, hence reducing their exposure to risks (Kogut and Kulatilaka, 1994; Mello *et al.*, 1995; Tong and Reuer, 2007; Lee and Makhija, 2009; Qian *et al.*, 2010). Additionally, operating in more dispersed locations helps MNCs better respond to unpredictable changes in market demand and maintain a better risk portfolio. Hence, MNCs may be more appreciated by market investors compared with purely domestic companies.

Allen and Pantzalis (1996) and Tang and Tikoo (1999) found that MNCs are rewarded by stock market performance (e.g. Tobin's q) and cumulative abnormal return for the breadth of multi-nationality, measured by the number of foreign countries in which an MNC has operations. Tong and Reuer (2007) examined the performances of the overseas affiliations of US multinational manufacturing firms and found that international investments reduce the downside risk levels at a decreasing rate. In line with the existing literature, we hypothesize the direct effect of GD on the stock market performance as follows:

H1a. GD has a positive direct effect on an MNC's stock market performance.

GD and firm financial performance

While the effects of GD may be viewed positively by market investors from a strategic perspective, the international management literature suggests that the benefits of GD may be offset by transaction costs, coordination costs, and agency costs (Birkinshaw and Morrison, 1995; Huchzermeier and Cohen, 1996; Rosenfeld, 1996; Makino and Neupert, 2000; Belderbos *et al.*, 2014). Managing increased internal transactions and external transactions (vendors, governments, buyers, etc.) across multiple locations, especially among countries with different cultures, customs, regulations and languages, can be costly (Tong and Reuer, 2007).

Empirically, Qian *et al.* (2010) found an inverted U-shaped relationship existing between the overall level of GD and return on assets (ROA), indicating that too much GD beyond an optimum level may reduce ROA. Further, MNCs may have to incur additional expenses in mitigating supply chain risks. In general, MNCs with greater GD tend to have longer and more complex supply chains, which in turn are more vulnerable to supply chain disruptions and other risks (Hendricks and Singhal, 2009). In summary, GD is associated with high operational costs, leading to poorer financial performance. Therefore, we develop our hypothesis on the direct effect of GD as follows:

H1b. GD has a negative direct effect on an MNC's financial performance.

The mediating role of inventory

Inventory theory suggests that greater GD leads to higher inventory levels because of the square root law and a lower risk-pooling effect (Maister, 1976; Zinn *et al.*, 1989; Simchi-Levi *et al.*, 2008). The square root law predicts that inventory levels increase with the number of warehouse locations in the system. The risk-pooling theory suggests that for the same service level a decentralized system carries a higher inventory level than a centralized system because the sum of safety stock required across separate locations in a decentralized environment exceeds the total safety stock required in a centralized system (Ben-Zvi and Gerchak, 2012; Çömez-Dolgan and Tanyeri, 2015). Given that greater GD implies more dispersed operational locations (a more decentralized system), an MNC with greater GD needs to carry more safety stock to maintain the same customer service level, resulting in a higher average inventory level.

Further, empirical research has noted the impact of inventory on firm performance and suggested a curvilinear relationship between inventory level and firm stock market and financial performances (Han *et al.*, 2013; Eroglu and Hofer, 2014). On the one hand, inventory enables MNCs to achieve economies of scale in purchasing and production, increase product availability and buffer against uncertainties in demand and supply. Increasing inventory before reaching the optimum level will enhance both stock market and financial performances. On the other hand, a higher inventory level beyond the optimum point results in higher inventory holding costs, which may offset the benefits and hence reduce firm financial performance and may be further penalized by the stock market (Chen *et al.*, 2005; Hendricks and Singhal, 2009; Capkun *et al.*, 2009). Further, Eroglu and Hofer (2011) showed that leanness in inventory has an inverted U-shape relationship with firm financial performances. Therefore, there may exist a curvilinear relationship between inventory levels and firm stock market and financial performances.

Based on our reasoning, we argue that inventory may mediate the relationship between GD and firm performance. Previous empirical studies have found the mediating role of inventory between a firm's strategic decisions and performance (Huson and Nanda, 1995; Fullerton *et al.*, 2003; Hofer *et al.*, 2012; Mishra *et al.*, 2013), which suggest that the oversight of changes in inventory levels may have contributed to the seemingly conflicting views of the value of GD in affecting firm stock market and financial performances. Indeed, Allen and Pantzalis (1996) and Tang and Tikoo (1999) found a positive, linear relationship between GD and stock market performance, while Tong and Reuer (2007) reported a curvilinear relationship. The inconsistent results may have been caused by the omission of the indirect effects of inventory in their studies.

Given the positive relationship between GD and firm inventory level, and the curvilinear relationship between inventory level and firm performance, we hypothesize that GD has indirect effects on firm stock market performance and financial performance separately through inventory levels:

H2a. GD has an indirect effect on an MNC's stock market performance via inventory levels.

H2b. GD has an indirect effect on an MNC's financial performance via inventory levels.

Value of GD in the presence of a financial crisis

The bursting of the US housing bubble in 2007 triggered a global financial crisis, resulting in the collapse of worldwide financial institutions and stock markets, prolonged unemployment, shrunk consumer wealth, and eventually a global economic downturn (Business Wire, 2009). Generally speaking, when demand declines due to economic downturn, manufacturing firms may need to scale back their production volumes at facilities that have higher production costs and reduce inventories to maintain competitive cost structures.

Focusing on downside risk, Lee and Makhija (2009) found that the contribution of FDI-related flexibility (measured by changes in the intra-firm sales from the previous period) to a firm's value (Tobin's q) is negligible in a period of stability, but significant during a period of economic crisis. Recent studies have reported the same finding that

operational flexibility enabled by GD helps reduce the risk during the economic crisis (i.e. downside risk). For example, the impacts of operating flexibility on downside risk and its variance were demonstrated based on the similarities in cost structure and production platforms between a host country and the home country (Belderbos and Zou, 2009; Belderbos *et al.*, 2014) and based on unique industry characteristics (Andersen, 2012).

When the economy becomes more volatile across global regions during a financial crisis, the benefits of mitigated risks (risk portfolio) enabled by GD may become more prominent (Lee and Makhija, 2009; Chung *et al.*, 2013) and may be valued more by market investors. Thus, we hypothesize that an MNC with greater GD may have a better stock market performance than those with less GD during the financial crisis, *ceteris paribus*:

H3a. The positive direct effect of GD on an MNC's stock market performance is stronger in the presence of a financial crisis than without financial crisis.

In the presence of a financial crisis, the direct effect of GD on financial performance may change due to increased capital costs and organization alignment costs. As CNN reported, during the financial crisis banks had less money to lend and hence had to scale back credit limits (Dickler, 2008), resulting in higher borrowing costs for firms. As argued in *H1b*, maintaining geographically diversified operations is costly due to high costs of transactions with internal and external partners across borders. Moreover, MNCs are able to rely more on external financial resources and hence have higher debt ratios (Baker and Riddick, 2013) because their projects are often deemed less risky due to their diversified cash flows across borders compared to domestic companies. Accordingly, MNCs with greater GD are more likely to suffer from tighter credit limits during a financial crisis compared to the period without financial crisis, leading to additional capital costs.

Further, it may be costlier for geographically diversified MNCs to respond to frequent environmental changes during the financial crisis because market uncertainties increase with rising demand volatility across global regions. The environment-strategy-performance framework argues that a firm's quick and effective responses to changed environments are critical for firm survivals (Luo and Park, 2001), and such responses may be easier when implemented within a national context (Douma *et al.*, 2006). The responses made by MNCs may include exercising more frequent and localized short-term forecasting and, accordingly, aligning their operations with each regional market. In summary, the increased capital costs and alignment costs may offset the benefits of GD and hence negatively influence the overall financial performance of MNCs in the presence of a financial crisis. Thus, we propose the following hypothesis:

H3b. The negative direct effect of GD on an MNC's financial performance is stronger in the presence of a financial crisis than without financial crisis.

Model and data

Measurement of variables and model specification

Using inventory as a mediator, this study examines the direct and indirect effects of GD on firm stock market and financial performance as illustrated in Figure 1.

Previous empirical studies have proposed measures for GD in several ways such as FDI dispersion (Tong and Reuer, 2007; Lee and Makhija, 2009) and the size of sales and subsidies (Qian *et al.*, 2010). Notably, GD (Allen and Pantzalis, 1996; Tang and Tikoo, 1999) is measured by the number of foreign locations as the breadth of diversification and is found to have a significant effect on firm performance while the depth of GD measured by the number of subsidies per country has an ambiguous effect. In this study, we measure a firm's GD by counting the number of geographic regions where an MNC has committed capital investments according to its annual reports.

Eroglu and Hofer (2014) cited a variety of firm performance measures employed in the empirical operations management literature. In contrast with survey-based empirical research, which tends to use perceptual measures, archived-based empirical studies largely use two lines of measurement: stock-based market measures, including stock returns and Tobin's *q*; accounting-based financial measures, including return on sales, ROA, and return on equity (Kroes and Manikas, 2014).

In this study, we use two measures to capture different aspects of firm performance: a firm's stock market performance as appreciated by the investors (i.e. Tobin's *q*) and the financial performance for profitability (i.e. ROA). Tobin's *q*, the ratio of total market value of a firm over the replacement cost of its total assets, has become a common measure for a firm's stock market valuation, indicating the extent to which a firm's market value has increased relative to its asset value (Huang *et al.*, 2015; Rai *et al.*, 2015). Chen *et al.* (2005) used Tobin's *q* for firm performance when examining the impact of inventory levels. In contrast, ROA is often considered one of the best overall measures of firm operating and financial performance in financial economic studies (Barber and Lyon, 1996) and has been widely used in operations management studies (Fullerton *et al.*, 2003). Note that Modi and Mishra (2011) adopted both Tobin's *q* and ROA for performance of US based-manufacturing firms in their study.

Depending on the availability of data and research objectives, previous studies have considered various measures of inventory performance, including inventory days at the firm level (Chen *et al.*, 2005) and inventory in dollar amounts normalized by the cost of materials and value added at the industry level (Rajagopalan and Malhotra, 2001). In this study, inventory performance is measured by inventory-to-sales ratio (INV), which shows efficiency of inventory management. This relative measure reflects the amount of inventory used to realize a certain volume of sales. Therefore, a high inventory-to-sales ratio indicates a high level of inventory and, consequently, a less efficient inventory performance (Shah and Shin, 2007). Additionally, the squared term of the inventory-to-sales ratio is used to capture the curvilinear relationship, which may exist between inventory level and firm stock market and financial performances.

Mediating model

We present three relationships below to test the hypothesized mediating effects and explain the three-step mediating modeling processes proposed by Baron and Kenny (1986):

- Step 1: we develop a fixed-effect inventory model as shown in Model 1 (model specification will be discussed below), which regresses INV on GD and controls for other variables.
- Step 2: we include GD and control variables, but exclude INV, in the fixed-effect stock market performance model (Model 2-1) and the fixed-effect financial performance model (Model 3-1).

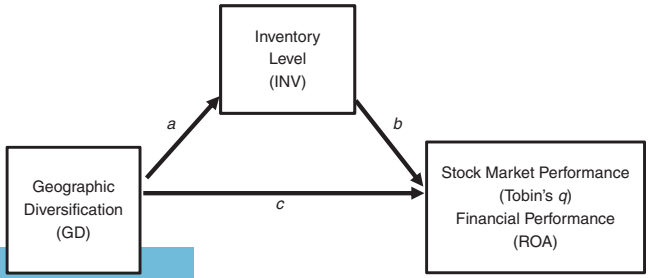

Figure 1.
Research model

- Step 3: given that the inventory literature indicates a curve linear relationship may exist between inventory and firm performances (Han *et al.*, 2013; Eroglu and Hofer, 2014), we include GD, INV, a squared term of inventory (INV_SQ), and control variables in the fixed-effect stock market performance model (Model 2-2) and the fixed-effect financial performance model (Model 3-2). The effects of GD on Tobin's *q* in Model 2-2 and the effects of GD on ROA in Model 3-2 are considered direct effects of GD (see path *c* in Figure 1). The indirect effects consist of two paths: one is the effect of GD on INV in Step 1 (see path *a* in Figure 1); the other is the effect of INV and INV_SQ on Tobin's *q* and ROA in Step 3 (see path *b* in Figure 1). To test the existence of a mediating effect, both direct and indirect effects are expected to be significant. The magnitude of the indirect effects is measured by comparing the coefficients of GD between Models 2-1 and 2-2 for the stock market performance model and those between Models 3-1 and 3-2 for the financial performance model.

The formulation of the models above is presented below. Following the model specifications in previous studies (Gaur *et al.*, 2005; Shah and Shin, 2007; Han *et al.*, 2008), we include the explanatory variable of research interest (GD) while controlling for other firm characteristics including size, capital intensity, and profitability to explain the variations in INV. As for the stock market performance model, we refer to the models proposed by Allen and Pantzalis (1996) and Lee and Makhija (2009). We include the explanatory variable of interest (GD) while controlling for the prior year's Tobin's *q*, firm size, debt-to-asset ratio, and advertising intensity to explain the variations in Tobin's *q*. The difference between the two stock market performance models (Models 2-1 and 2-2) is the inclusion of the inventory variable (INV) and its squared term (INV_SQ) in the second model. As far as the financial performance model is concerned, we refer to the specifications proposed by Qian *et al.* (2010) and include GD as the primary explanatory variable while controlling for prior year's ROA, firm size, debt-to-asset ratio, and advertising intensity to explain the variations in ROA. Similarly, the difference between the two financial performance models (Models 3-1 and 3-2) is the inclusion of the inventory variable and its squared term in the second equation. All three models are presented as follows.

Model 1: inventory level:

$$\begin{aligned}\text{INV}_{ij} = {} & a_0 + a_1\text{GD}_{ij} + a_2\text{Firm Size}_{ij} + a_3\text{Capital Intensity}_{ij} + a_4\text{Profitability}_{ij} \\ & + \text{Time Fixed Effects} + \text{Industry Fixed Effects} + \varepsilon_{ij} \end{aligned} \quad (1)$$

where *i* represents year and *j* represents firm.

Model 2: stock market performance

Model 2-1 (excluding inventory level):

$$\begin{aligned}\text{Tobin's } q_{ij} = {} & b_0 + b_1\text{GD}_{ij} + b_2\text{Last Year Tobin's } q_{ij} + b_3\text{Firm Size}_{ij} \\ & + b_4\text{Debt to Asset Ratio}_{ij} + b_5\text{Advertising Intensity}_{ij} \\ & + \text{Time Fixed Effects} + \text{Industry Fixed Effects} + \varepsilon_{ij} \end{aligned} \quad (2)$$

Model 2-2 (including inventory level):

$$\begin{aligned}\text{Tobin's } q_{ij} = {} & c_0 + c_1\text{GD}_{ij} + c_2\text{INV}_{ij} + c_3\text{INV\_SQ}_{ij} + c_4\text{Last Year Tobin's } q_{ij} \\ & + c_5\text{Firm Size}_{ij} + c_6\text{Debt to Asset Ratio}_{ij} + c_7\text{Advertising Intensity}_{ij} \\ & + \text{Time Fixed Effects} + \text{Industry Fixed Effects} + \varepsilon_{ij} \end{aligned} \quad (3)$$

Model 3: financial performance
Model 3-1 (excluding inventory level):

$$\begin{aligned}\text{ROA}_{ij} = {} & d_0 + d_1\text{GD}_{ij} + d_2\text{Last Year ROA}_{ij} + d_3\text{Firm Size}_{ij} \\ & + d_4\text{Debt to Asset Ratio}_{ij} + d_5\text{Advertising Intensity}_{ij} \\ & + \text{Time Fixed Effects} + \text{Industry Fixed Effects} + \varepsilon_{ij}\end{aligned} \quad (4)$$

Model 3-2 (including inventory level):

$$\begin{aligned}\text{ROA}_{ij} = {} & e_0 + e_1\text{GD}_{ij} + e_2\text{INV} + e_3\text{INV\_SQ} + e_4\text{Last Year ROA}_{ij} \\ & + e_5\text{Firm Size}_{ij} + e_6\text{Debt to Asset Ratio}_{ij} + e_7\text{Advertising Intensity}_{ij} \\ & + \text{Time Fixed Effects} + \text{Industry Fixed Effects} + \varepsilon_{ij}\end{aligned} \quad (5)$$

We summarized the measurements of our variables in Table I.

Data collection

This study analyzes annual operating and financial data for 1,509 multinational manufacturing companies collected from the Compustat database over the period 2000-2011. Based on Compustat's annual reports, we have collected and calculated an MNC's financial and operational characteristics, including: ROA, Tobin's *q*, revenue, profit ratio, inventory levels, capital expenditure, advertising expenses, and debt-to-asset ratio. In addition, in the Compustat Segments database, MNCs report the amount of capital investment in each of their global operating regions. As known, the recent global financial crisis was triggered by the bursting of the US subprime mortgage market in late 2007, subsequently resulting in a major economic downturn and a financial crisis in the USA and worldwide during 2008-2010. This study follows the Aruoba-Diebold-Scotti Business Conditions Index[1], produced by the US Federal Reserve Bank of Philadelphia (2015), to consider the fiscal years 2000-2007 and 2011 as periods of non-financial crisis, and the period of fiscal years 2008-2010 as financial crisis years.

Variables	Measurements
GD	Number of global regions where an MNC operates and has capital investments. For example, the USA is classified as one region while the classification of international geographic regions outside the USA may vary across firms
Tobin's *q*	Stock market performance, measured by the ratio of total market value of a firm over its total asset value
Return on asset (ROA)	Financial performance, measured by the ratio of net income over total asset value
Inventory level (INV)	The ratio of total inventory value over total sales (inventory-to-sales ratio)
Inventory level squared (INV_SQ)	Squared term of the inventory-to-sales ratio
Firm size	Natural logarithm of total sales
Capital intensity	Ratio of total capital expense over total sales
Profitability	Ratio of net income over total sales
Debt-to-asset ratio	Ratio of total debt over total asset
Advertising	Ratio of advertising expenses over total sales

Table I.
Measurements of variables

Results

Sample analysis

Table II reports the descriptive statistics of the variables used in the regression models during the periods of financial crisis and non-financial crisis. On average, firms had capital investments in the USA and another 3.25 global regions; interestingly, the number of global operating regions was larger during financial crisis years. While MNCs' stock market values on average decreased from 1.14 times the book value in the non-financial crisis years to 0.99 times in the financial crisis years, the capital intensity increased from 1.52 to 2.31 accordingly. The average of ROA deteriorated from −0.02 to −0.05 in the financial crisis years. During financial crisis years, firms carried more inventories due to slower sales. The profitability of MNCs showed significant deterioration, decreasing from −52 percent in the non-financial crisis years to −359 percent in the financial crisis years.

Table III presents the pairwise correlations among the variables used in the regression models. It appears that GD is positively correlated with firm size, implying that larger MNCs may be more capable of expanding global networks. Tobin's *q* shows a significant negative correlation with ROA. Except for the expected high correlation between INV and its square term (0.91), correlations among the variables appear to be in the normal range. Variance inflation factor tests show that none of the variables has high factors, indicating that multicollinearity may not be a serious concern for the current models.

Variable	Pooled sample Mean	Pooled sample SD	Sample with financial crisis Mean	Sample with financial crisis SD	Sample without financial crisis Mean	Sample without financial crisis SD
GD	4.25	2.56	4.44	2.86	4.18	2.43
Tobin's *q*	1.10	2.34	0.99	3.83	1.14	1.44
ROA	−0.02	0.43	−0.05	0.46	−0.02	0.42
INV	0.18	0.94	0.19	1.63	0.17	0.48
Last year Tobin's *q*	1.14	1.55	0.99	3.83	1.19	1.55
Last year ROA	−0.02	0.50	−0.05	0.43	−0.02	0.52
Firm size	6.45	2.02	6.56	2.03	6.41	2.02
Capital Intensity	1.73	24.57	2.31	35.69	1.52	18.91
Profitability	−1.35	46.34	−3.59	87.23	−0.52	11.77
Debt-to-asset ratio	0.16	0.21	0.16	0.21	0.17	0.21
Advertising	0.01	0.16	0.02	0.31	0.01	0.03
Observations	6,565		1,764		4,801	

Source: Compustat

Table II.
Descriptive statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Tobin's *q*	1.00											
(2) ROA	−0.12	1.00										
(3) GD	0.01	0.01	1.00									
(4) INV	0.00	−0.07	0.02	1.00								
(5) INV_SQ	0.02	−0.03	0.01	0.91	1.00							
(6) Last year Tobin's *q*	0.53	−0.09	−0.01	−0.00	−0.00	1.00						
(7) Last year ROA	−0.06	−0.30	0.01	−0.04	−0.02	−0.06	1.00					
(8) Firm size	−0.18	0.21	0.08	−0.10	−0.03	−0.14	−0.15	1.00				
(9) Capital intensity	0.00	0.00	−0.01	0.25	0.29	0.03	−0.02	−0.03	1.00			
(10) Profitability	−0.14	0.22	0.02	−0.19	−0.17	−0.08	0.04	0.08	−0.21	1.00		
(11) Debt-to-asset ratio	−0.02	−0.11	−0.06	−0.01	−0.01	−0.01	−0.08	0.20	−0.02	0.00	1.00	
(12) Advertising	0.06	−0.00	−0.09	−0.01	−0.01	0.03	0.00	0.04	−0.00	0.00	0.11	1.00

Table III.
Correlation table

Regression results

We estimate three sets of fixed effects models: Model 1 for inventory level, Model 2 for stock market performance (Tobin's *q*), and Model 3 for financial performance (ROA). The estimation results of Model 1 are presented in Table IV, which includes the results of three samples: the pooled sample with all years (Pooled), the financial crisis year subsample (Crisis), and the non-financial crisis year subsample (Ncrisis). Overall, a higher degree of GD is associated with a higher inventory-to-sales ratio at a significance level of 0.01 during our sample period (2000-2011). In the pooled sample, one more global region where an MNC operates is associated with a higher inventory-to-sales ratio by 0.0078 points. Note that the impact of GD on inventory levels is insignificant during the financial crisis period. Generally, the coefficients of all other variables show the expected signs. In Model 1_{pooled} and Model $1_{Ncrisis}$, both firm size and profitability show negative signs, suggesting that large firms have higher sales turnover than small firms, an indication of economies of scale with inventory management, and that inventory levels beyond the optimum point may be associated with lower profitability level.

Similarly, we present the results of the stock market performance models (Models 2-1 and 2-2), respectively, for the three samples (pooled, Crisis and Ncrisis), resulting in six estimations (2 submodels × 3 samples). The positive coefficient of GD in Model $2\text{-}2_{Pooled}$, the model with the inventory mediating effects being controlled for the pooled sample, is statistically significant and supports for *H1a*, implying that GD has a positive direct effect on an MNC's stock market performance. This result suggests that the more global regions where an MNC operates, the higher stock market value assessed by market investors.

Table VI presents the results of the financial performance models. The coefficient of GD of Model $3\text{-}2_{Pooled}$ is −0.0044 and statistically significant at 0.05, suggesting that one more global region where an MNC operates is associated with a lower ROA by 0.0044. It supports for *H1b* that GD has a direct negative effect on an MNC's financial performance in addition to the increased inventory holdings.

By following the three-step processes to test the mediating effect, we employed regression results obtained from the pooled samples reported in both Tables IV and V to test *H2a*. We first note in Table IV that GD has a significant effect on inventory level (coefficient of 0.0078 and significant at 0.001 in Model 1_{pooled}), fulfilling the requirement of Step 1. The results of Model $2\text{-}1_{Pooled}$ in Table V show that GD has a significant impact on stock market performance, meeting the requirement of Step 2. Finally, we compare the coefficients of GD in Model $2\text{-}1_{Pooled}$ and in Model $2\text{-}2_{Pooled}$ as presented in the pooled sample section of Table V. The coefficient of GD increases from 0.0403 in Model $2\text{-}1_{Pooled}$ to 0.0410 in Model $2\text{-}2_{Pooled}$ at a significance level of 0.01 in both models because of the inclusion of inventory, which has a negative impact on stock market performance, indicating that there is a partial mediating effect caused by inventory. It shows that the

DV = INV	Model 1_{Pooled}	Model 1_{Crisis}	Model $1_{Ncrisis}$
GD	0.0078*** (0.0027)	0.0067 (0.0057)	0.0084*** (0.0028)
Firm size	−0.0129*** (0.0035)	−0.0004 (0.0084)	−0.0227*** (0.0035)
Capital intensity	0.0018*** (0.0003)	−0.0064*** (0.0008)	0.0056*** (0.0004)
Profitability	−0.0159*** (0.0002)	−0.0191*** (0.0003)	−0.0057*** (0.0006)
Industry fixed effects	Included	Included	Included
Year fixed effects	Included	Included	Included
Number of Obs.	6,565	1,764	4,801
R^2	0.6704	0.8341	0.0992

Notes: Value in the parenthesis is standard deviation. ***$p < 0.01$

Table IV.
Inventory level model results

Table V. Stock market performance model results

DV = Tobin's q	Model 2-1$_{Pooled}$	Model 2-2 $_{Pooled}$	Model 2-1$_{Crisis}$	Model 2-2$_{Crisis}$	Model 2-1$_{Ncrisis}$	Model 2-2$_{Ncrisis}$
GD	0.0403*** (0.0104)	0.0410*** (0.0104)	0.1106*** (0.0299)	0.1136*** (0.0298)	0.0027 (0.0073)	0.0049 (0.0073)
INV		−0.1550* (0.0803)		−2.3600*** (0.6726)		−0.4175*** (0.0892)
INV_SQ		0.0037*** (0.0013)		0.0357*** (0.0098)		−0.0256*** (0.0053)
Last year Tobin's q	0.6054*** (0.0173)	0.6053*** (0.0173)	0.9650*** (0.0554)	1.0046*** (0.0563)	0.4672*** (0.0116)	0.4658*** (0.0115)
Firm size	−0.1080*** (0.0141)	−0.1099*** (0.0142)	−0.1879*** (0.0448)	−0.2087*** (0.0452)	−0.0716*** (0.0094)	−0.0792** (0.0095)
Debt/Asset	−0.0752 (0.1312)	−0.0763 (0.1311)	−0.6627 (0.4315)	−0.7170*** (0.4301)	0.1151 (0.0871)	0.1257 (0.0870)
Advertising	0.5859*** (0.1615)	0.5839*** (0.1614)	0.4370 (0.2710)	0.3962 (0.2702)	1.3989** (0.6011)	1.4082** (0.5998)
Industry fixed effects	Included	Included	Included	Included	Included	Included
Time fixed effects	Included	Included	Included	Included	Included	Included
Number of Obs.	6,565	6.565	1,764	1,764	4,801	4,801
R^2	0.1974	0.1990	0.1930	0.2001	0.3141	0.3175

Notes: Value in the parenthesis is standard deviation. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

direct effect of GD is stronger than the total effect, including direct and indirect effect, of GD when the indirect effect of GD is negative. The results of both Goodman test and Sobel test show that the indirect effect is marginally significant at the 0.09 and 0.11 significance levels, respectively, which provides marginal support for *H2a* that GD has affected stock market performance via two paths: the direct effect and the indirect effect through inventory. GD directly increases stock market performance while higher GD leads to more inventory holdings, which subsequently leads to lower stock market performance, suggesting an offsetting effect on stock market performance via inventory. Note that the coefficients of INV and INV_SQ imply a U-shape relationship between inventory levels and stock market performance. However, the tipping point is at 20.945 ($=0.1550/(2\times0.0037)$, based on the coefficients of INV and INV_SQ and the first derivative of Tobin's q with respect to INV) and the average inventory-to-sales ratio is 0.18, suggesting that a higher inventory-to-sales ratio is associated with lower stock market performance at a diminishing rate within our samples. One more global region leads to higher inventory-to-sales ratio by 0.0078 (Table IV), which subsequently leads to a negative indirect effect on Tobin's q by 0.0012 point ($=0.0078\times(-0.155)+0.0078^2\times0.0037$), *ceteris paribus*.

Following the same procedure, we examine the mediating effect of inventory between GD and financial performance to test *H2b*. Results for Model 1_{pooled} presented in Table IV show that GD is positively associated inventory-to-sales ratio (coefficient of 0.0078 and significant at 0.01, Step 1). In Table VI, the results for Model $3\text{-}1_{Pooled}$ indicate that GD has a negative impact on financial performance at a significance level of 0.05 (coefficient of −0.0049, Step 2). In Table VI, the coefficient of GD increases from −0.0049 in Model $3\text{-}1_{Pooled}$ to −0.0044 with the inclusion of the inventory, implying a partial mediating effect caused by inventory levels. The results of both Goodman test and Sobel test show that the indirect effect is significant at a 0.01 level, providing support for *H2b*, suggesting both direct and indirect effects of GD on firm financial performances. One more global region where an MNC operates leads to a reduced ROA by 0.0049 points and a higher inventory-to-sales ratio by 0.0078 (Table IV), resulting in a negative indirect effect on ROA by 0.0006 points ($=0.0078\times(-0.0832)+0.0078^2\times(0.0008)$). The quantitative direct and indirect effects of GD on stock market and financial performances are summarized in Table VII. The findings provide evidence to the mediating effect of inventory levels between GD and firm stock market and financial performances. The oversight of indirect effects will lead to underestimate the impact of GD on stock market performance and overestimate that on financial performance.

To estimate the direct effects of GD on stock market performance across two economic conditions, we compare the coefficients of GD in Models $2\text{-}2_{Crisis}$ and $2\text{-}2_{Ncrisis}$ reported in Table V. The comparison shows that GD has a significant direct effect on the stock market performance (0.1136, significant at 0.01) during the financial crisis period, but no effect at all during the period without financial crisis, lending strong support for *H3a* that GD has a stronger positive effect on stock market performance in the presence of financial crisis than the period without financial crisis.

To test *H3b*, we compare the coefficients of GD in Model $3\text{-}2_{Crisis}$ and in Model $3\text{-}2_{Ncrisis}$ in Table VI. The comparison shows that GD has a significant, negative effect (−0.0102, significant at 0.01) on firm financial performance during the financial crisis period, but no effect at all during non-financial crisis period, supporting *H3b* that the negative direct impact of GD is stronger on an MNC's financial performance in the presence of financial crisis than without financial crisis. The findings reveal the distinct values of GD through direct and indirect effects during different economic situations. While the positive direct effect of GD on stock market performance and the negative direct effect on financial performance are dominant during financial crisis, the negative indirect effects on both stock market and financial performances are more prominent during the non-financial crisis period.

Table VI. Financial performance model results

DV = ROA	Model 3-1$_{Pooled}$	Model 3-2$_{Pooled}$	Model 3-1$_{Crisis}$	Model 3-2$_{Crisis}$	Model 3-1$_{Ncrisis}$	Model 3-2$_{Ncrisis}$
GD	−0.0049** (0.0020)	−0.0044** (0.0032)	−0.0102*** (0.0032)	−0.0102*** (0.0032)	−0.0020 (0.0023)	−0.0010 (0.0023)
INV		−0.0832*** (0.0156)		0.0632 (0.0766)		−0.1738*** (0.0280)
INV_SQ		0.0008*** (0.0003)		−0.0012 (0.0011)		0.0080*** (0.0017)
Last year ROA	−0.1382*** (0.0105)	−0.1425*** (0.0104)	0.5395*** (0.0223)	0.5429*** (0.0240)	−0.2977*** (0.0107)	−0.3003*** (0.0106)
Firm size	0.0642*** (0.0028)	0.0623*** (0.0028)	0.0424*** (0.0050)	0.0421*** (0.0050)	0.0611*** (0.0030)	0.0577*** (0.0030)
Debt/Asset	−0.3494*** (0.0256)	−0.3506*** (0.0255)	−0.1583*** (0.0468)	−0.1559*** (0.0467)	−0.4185*** (0.0275)	−0.4163*** (0.0274)
Advertising	−0.1398*** (0.0315)	−0.1429*** (0.0313)	0.0043 (0.0296)	0.0056 (0.0297)	0.1710 (0.1890)	0.1660 (0.1882)
Industry fixed effects	Included	Included	Included	Included	Included	Included
Year fixed effect	Included	Included	Included	Included	Included	Included
Number of Obs.	6,565	6,565	1,764	1,764	4,801	4,801
R^2	0.1183	0.1256	0.3536	0.3591	0.2120	0.2191

Notes: Values in the parentheses are standard deviation. $*p < 0.1$; $**p < 0.05$; $***p < 0.001$

Discussion

The negative effects of GD on financial performance

The regression results show that GD has exerted negative effects on an MNC's financial performance, both directly and indirectly, suggesting that an MNC's global flexibility and market responsiveness may be obtained at a short-term financial cost primarily due to increasing coordination costs as explained in the previous literature (Makino and Neupert, 2000; Rosenfeld, 1996; Belderbos *et al.*, 2014). Note that without showing the indirect path via inventory levels, the extant literature may have overestimated the direct negative effect of GD on an MNC's financial performance. Overall, the indirect effect of GD accounts for about 12 percent (= −0.0006/−0.0050) of the total effect for financial performance, as shown in Table VII. Interestingly, we find that the negative indirect effect of GD on financial performance is dominant during the non-financial crisis periods, while the negative direct effect is more prominent during the financial crisis periods. It shows that effective inventory management among multiple locations during the non-financial period is essential to enhance an MNC's financial performance.

GD as a risk management mechanism

In contrast with the significant positive effect on an MNC's stock market performance in the presence of financial crisis, GD seems to have little direct effect on an MNC's stock market performance in the absence of financial crisis (*H3a*). This contrasting result indicates that GD is more appreciated by the market investors as a risk management mechanism in mitigating the consequences of a financial crisis. Our finding is consistent with a recent study showing that a decentralized network is optimal because risk-diversification effect strongly dominates risk-pooling effect when both demand uncertainty and disruptions are present (Schmitt *et al.*, 2015).

Note that GD is no longer limited to production location decisions but includes overall supply chain design, supply chain flexibility, and supply base diversification. Indeed, supply chain design with flexibility is key for firms to address the supply chain risks facing more volatile and turbulent markets (Christopher and Holweg, 2017). With a global supply chain network, MNCs may be less vulnerable to financial crisis because they may be able to better manage their transshipments and distribution under uncertainty (Dong *et al.*, 2012) and their geographically diversified supply base may allow for a wider pool of suppliers with more competitive pricing and more sustainable supply (Tan *et al.*, 1998; Choi and Krause, 2006; Jüttner and Maklan, 2011).

The mediating effect of operational performance

Our results echo the strategic importance of tighter inventory management for MNCs, which may be able to mitigate the indirect, negative impacts of GD on firm performances. In this study, the results for the mediating effect models suggest that the positive effect of GD on stock market performance may be somewhat offset by the negative indirect effect via

Performance	Effect	Pooled	Financial crisis	Non-financial crisis
Stock market (Tobin's *q*)	Direct	0.041	0.1136	Insignificant
	Indirect	−0.0012	Insignificant	−0.0035
	Total	0.0398		
Financial (ROA)	Direct	−0.0044	−0.0102	Insignificant
	Indirect	−0.0006	Insignificant	−0.0015
	Total	−0.005		

Note: The effects are estimated based on a one-unit increase in the number of GD

Table VII.
Summary of direct and indirect effects of GD

inventory (*H2a*). Without showing the indirect path via inventory, the extant literature may have underestimated the direct positive effect of GD on an MNC's stock market value. Similarly, GD leads to higher inventory levels and may penalize an MNC financial performance as inventory levels increase beyond the optimum point (*H2b*). Overall, the indirect effect of GD accounts for about 12 percent (= −0.0006/−0.0050) of the total effect for financial performance, as shown in Table VII. Additionally, the presence of a curvilinear indirect effect may partially account for the mixed findings of previous studies with regard to the total effect of GD on the stock market performance.

Our results also show that the net effects of GD on firm performance may vary depending on how MNCs mitigate the consequences of increased inventory associated with GD. Inventory research suggests the use of more incentives for better coordination in decentralization systems (Duan and Liao, 2013) and transshipments of inventory across multiple production locations (Evers, 1999; Paterson *et al.*, 2011) may help contain inventory levels. Further, different skill sets and knowledge of geographically diversified supply bases may contribute to a firm's long-term growth and innovation capability (Handfield, 1994). Most recent research on offshoring has found that innovation performance for firms with diversified global offshoring may be sacrificed due to increased complexity but will improve over time with experience in dealing with complexity (Lin *et al.*, 2017).

Conclusion

Empirical studies have documented the relationship between an MNC's multi-location strategy and its financial and stock market performances. However, extant studies (e.g. Allen and Pantzalis, 1996; Tang and Tikoo, 1999; Tong and Reuer, 2007; Lee and Makhija, 2009) have not considered the mediating effects of changes in inventory levels, thus, the estimated net effects of GD on an MNC's financial and stock market performances may be inaccurate and misleading to practitioners. This study shows that GD directly affects two important performance indicators: Tobin's q for stock market performance and ROA for financial performance. While controlling the inventory mediating effect model, our study shows that GD has a direct positive impact on Tobin's q and a negative direct impact on ROA. Our findings also show that GD leads to a negative indirect effect on financial and stock market performances through increased inventory levels.

To the best of our knowledge, this paper is among the first empirical studies to examine both direct and indirect effects of GD via operational performance in the operations literature and highlights the significance of inclusion of operational performance in the estimation models. Further, we bridge a theoretical gap in the extant literature using segmented samples based on economic conditions. In contrast with the extant literature showing that GD contributes to an MNC's stock market value (Tobin's q) during the financial crisis years, this study finds that GD no longer directly increases Tobin's q during the non-financial crisis years. Similarly, GD reduces a financial performance (ROA) during the financial crisis years, but appears to not be directly associated with financial performance during the non-financial crisis period. During the periods without financial crisis, inventory significantly mediates the impact of GD and negatively affects firm performance. Our findings help clarify the mixed effects of GD on an MNC's stock market and financial performances, and emphasize the contingency perspective of multi-location strategy and the value of GD.

As far as managerial implications are concerned, this study suggests that MNCs need to carefully weigh the benefits and costs of multi-location global strategy in terms of greater GD. The finding that the value of GD as a risk management mechanism on the stock market performance increases in the presence of a financial crisis has profound managerial implications. Indeed, investors highly value MNCs with a high level of GD facing a turbulent economic environment. We also acknowledge that the stock market

performance benefit may be obtained at the cost of financial performance, and hence tighter cost control is more critical.

A major limitation of this study is the measurement of GD, which is only based on the number of global regions with capital investment. GD may be measured by various dimensions, including geographic concentration, cultural distance, and the contract or affiliation types of production facilities. Data limitation prevents this study from including a multi-dimensional measurement of GD despite that the number of global regions in which an MNC operates may be the dominant indicator for GD. Another limitation related to the measurement of GD is that our data set only allows us to focus on diversification of production facilities. Research has suggested that GD has evolved to include supply base diversification, decentralized purchasing, and supply chain network redesign for greater flexibility. Diversified supply base helps MNCs reach out to suppliers across different regions that own heterogeneous assets, knowledge, and skill sets. Decentralized purchasing allows MNCs to utilize theses supply resources more effectively for innovation, often resulting in competitive product differentiations (Hitt *et al.*, 1997; Tan *et al.*, 1998; Sturgeon and Lester, 2004). Therefore, future research using multi-dimensional measures for GD, especially supply base diversification and logistic network redesign, will surely enhance our understanding of the true value of GD. While the use of inventory level as a mediator in our research models is effective, we admit that operational performance may include production optimization, product innovation, quality, customer service, on-time delivery, market share, working capital, and other firm operating indicators. To obtain a full picture of the mediating effects of operational performance on stock market and firm financial performance, we call for the use of other operational variables in the future studies.

As previously noted, an MNC's performance can significantly vary by various managerial characteristics (e.g. innovation, supplier base, etc.) of each individual firm, which are not captured in this study due to data limitation. We call for future research to collect additional data to address this issue. Future studies are also needed to investigate how market investors respond to changes in GD of each company and its foreign subsidiaries. In addition, we used Tobin's q and ROA to measure stock market and financial performances of MNCs. However, each company may vary across regions, ownership structures, and product linkages. Due to the data unavailability, we were not able to include all variables. We have included the industry dummy variables and most important variables used in the previous literature to control for the uniqueness of firms.

Note

1. In order to objectively define the period that is affected by the financial crisis, we use Aruoba-Diebold-Scotti Business Conditions Index (US Federal Reserve Bank). The index is produced by collectively using multiple economic performance (weekly initial jobless claims; monthly payroll employment, industrial production, personal income less transfer payments, manufacturing and trade sales; and quarterly real GDP). The index clearly shows that the business condition was negatively affected during 2008-2010 (www.philadelphiafed.org/research-and-data/real-time-center/business-conditions-index/ (accessed December 30, 2015)).

References

Allen, L. and Pantzalis, C. (1996), "Valuation of the operating flexibility of multinational corporations", *Journal of International Business Studies*, Vol. 27 No. 4, pp. 633-653.

Andersen, T.J. (2012), "Multinational risk and performance outcomes: effects of knowledge intensity and industry context", *International Business Review*, Vol. 21 No. 2, pp. 239-252.

Baker, H.K. and Riddick, L.A. (2013), *International Finance: A Survey*, Oxford University Press, Oxford.

Barber, B.M. and Lyon, J.D. (1996), "Detecting abnormal operating performance: the empirical power and specification of test statistics", *Journal of Financial Economics*, Vol. 41 No. 3, pp. 359-399.

Baron, R.M. and Kenny, D.A. (1986), "The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psychology*, Vol. 51 No. 6, pp. 1173-1182.

Belderbos, R. and Zou, J. (2009), "Real options and foreign affiliate divestments: a portfolio perspective", *Journal of International Business Studies*, Vol. 40 No. 4, pp. 600-620.

Belderbos, R., Tong, T.W. and Wu, S. (2014), "Multinationality and downside risk: the roles of option portfolio and organization", *Strategic Management Journal*, Vol. 35 No. 1, pp. 88-106.

Ben-Zvi, N. and Gerchak, Y. (2012), "Inventory centralization in a single period setting when shortage costs differ: priority and costs allocation", in Choi, J. (Ed.), *Handbook of Newsvendor Problems: Models, Extensions and Applications*, Chapter 11, Springer, New York, NY.

Birkinshaw, J.M. and Morrison, A.J. (1995), "Configurations of strategy and structure in subsidiaries of multinational corporations", *Journal of International Business Studies*, Vol. 26 No. 4, pp. 729-753.

Business Wire (2009), "Three top economists agree 2009 worst financial crisis since great depression; risks increase if right steps are not taken", February 13, available at: www.businesswire.com/news/home/20090213005161/en/Top-Economists-Agree-2009-Worst-Financial-Crisis (accessed December 4, 2015).

Cantwell, J. (2009), "Location and the multinational enterprise", *Journal of International Business Studies*, Vol. 40 No. 1, pp. 35-41.

Capkun, V., Hameri, A.-P. and Weiss, L.A. (2009), "On the relationship between inventory and financial performance in manufacturing companies", *International Journal of Operations & Production Management*, Vol. 29 No. 8, pp. 789-806.

Chauvin, K.W. and Hirschey, M. (1993), "Advertising, R&D expenditures and the market value of the firm", *Financial Management*, Vol. 22 No. 4, pp. 128-140.

Chen, H., Frank, M.Z. and Wu, O.Q. (2005), "What actually happened to the inventories of American companies between 1981 and 2000?", *Management Science*, Vol. 51 No. 7, pp. 1015-1031.

Choi, T.Y. and Krause, D.R. (2006), "The supply base and its complexity: implications for transaction costs, risks, responsiveness, and innovation", *Journal of Operations Management*, Vol. 24 No. 5, pp. 637-652.

Christopher, M. and Holweg, M. (2017), "Supply chain 2.0 revisited: a framework for managing volatility-induced risk in the supply chain", *International Journal of Physical Distribution & Logistics Management*, Vol. 47 No. 1, pp. 2-17.

Chung, C.C., Lee, S.-H., Beamish, P.W., Southam, C. and Nam, D.D. (2013), "Pitting real options theory against risk diversification theory: international diversification and joint ownership control in economic crisis", *Journal of World Business*, Vol. 48 No. 1, pp. 122-136.

Çömez-Dolgan, N. and Tanyeri, B. (2015), "Inventory performance with pooling: evidence from mergers and acquisitions", *International Journal of Production Economics*, Vol. 168, October, pp. 331-339.

Danese, P., Romano, P. and Formentini, M. (2013), "The impact of supply chain integration on responsiveness: the moderating effect of using an international supplier network", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 49 No. 1, pp. 125-140.

Dickler, J. (2008), "Consumer credit limit crackdown", CNNMoney, September 26, available at: http://money.cnn.com/2008/09/25/pf/credit_limit_pullback/ (accessed December 4, 2015).

Dong, Y., Xu, K. and Evers, P.T. (2012), "Transshipment incentive contracts in a multi-level supply chain", *European Journal of Operational Research*, Vol. 223 No. 2, pp. 430-440.

Dos Santos, B.L., Peffers, K. and Mauer, D.C. (1993), "The impact of information technology investment announcements on the market value of the firm", *Information Systems Research*, Vol. 4 No. 1, pp. 1-23.

Douma, S., George, R. and Kabir, R. (2006), "Foreign and domestic ownership, business groups, and firm performance: evidence from a large emerging market", *Strategic Management Journal*, Vol. 27 No. 7, pp. 637-657.

Duan, Q. and Liao, T.W. (2013), "Optimization of replenishment policies for decentralized and centralized capacitated supply chains under various demands", *International Journal of Production Economics*, Vol. 142 No. 1, pp. 194-204.

Dunning, J.H. (1998), "Location and the multinational enterprise: a neglected factor?", *Journal of International Business Studies*, Vol. 40 No. 1, pp. 45-66.

Ellram, L.M., Tate, W.L. and Petersen, K.J. (2013), "Offshoring and reshoring: an update on the manufacturing location decision", *Journal of Supply Chain Management*, Vol. 49 No. 2, pp. 14-22.

Eroglu, C. and Hofer, C. (2011), "Lean, leaner, too lean? The inventory-performance link revisited", *Journal of Operations Management*, Vol. 29 No. 4, pp. 356-369.

Eroglu, C. and Hofer, C. (2014), "The effect of environmental dynamism on returns to inventory leanness", *Journal of Operations Management*, Vol. 32 No. 6, pp. 347-356.

Evers, P.T. (1999), "Filling customer orders from multiple locations: a comparison of pooling methods", *Journal of Business Logistics*, Vol. 20 No. 1, pp. 121-139.

Federal Reserve Bank of Philadelphia (2015), "Aruoba-Diebold-Scotti business conditions index", Federal Reserve Bank of Philadelphia, available at: www.philadelphiafed.org/research-and-data/real-time-center/business-conditions-index/ (accessed December 4, 2015).

Ferreira, J. and Prokopets, L. (2009), "Does offshoring still make sense?", *Supply Chain Management Review*, Vol. 13 No. 1, pp. 20-27.

Fullerton, R.R., McWatters, C.S. and Fawson, C. (2003), "An examination of the relationships between JIT and financial performance", *Journal of Operations Management*, Vol. 21 No. 4, pp. 383-404.

Gaur, V., Fisher, M.L. and Raman, A. (2005), "An econometric analysis of inventory turnover performance in retail services", *Management Science*, Vol. 51 No. 2, pp. 181-194.

Gerwin, D. (1993), "Manufacturing flexibility: a strategic perspective", *Management Science*, Vol. 39 No. 4, pp. 395-410.

Gray, J.V., Skowronski, K., Esenduran, G. and Johnny Rungtusanatham, M. (2013), "The reshoring phenomenon: what supply chain academics ought to know and should do", *Journal of Supply Chain Management*, Vol. 49 No. 2, pp. 27-33.

Gutierrez, G.J. and Kouvelis, P. (1995), "A robustness approach to international sourcing", *Annals of Operations Research*, Vol. 59 No. 1, pp. 165-193.

Han, C., Dong, Y. and Dresner, M. (2013), "Emerging market penetration, inventory supply, and financial performance", *Production and Operations Management*, Vol. 22 No. 2, pp. 335-347.

Han, C., Dresner, M. and Windle, R.J. (2008), "Impact of global sourcing and exports on US manufacturing inventories", *International Journal of Physical Distribution & Logistics Management*, Vol. 38 No. 6, pp. 475-494.

Handfield, R.B. (1994), "US global sourcing: patterns of development", *International Journal of Operations & Production Management*, Vol. 14 No. 6, pp. 40-51.

Hartman, P.L., Hartman, P.L., Ogden, J.A., Ogden, J.A., Hazen, B.T. and Hazen, B.T. (2017), "Bring it back? An examination of the insourcing decision", *International Journal of Physical Distribution & Logistics Management*, Vol. 47 Nos 2/3, pp. 198-221.

Hendricks, K.B. and Singhal, V.R. (2009), "Demand-supply mismatches and stock market reaction: evidence from excess inventory announcements", *Manufacturing & Service Operations Management*, Vol. 11 No. 3, pp. 509-524.

Hitt, M.A., Hoskisson, R.E. and Kim, H. (1997), "International diversification: effects on innovation and firm performance in product-diversified firms", *Academy of Management Journal*, Vol. 40 No. 4, pp. 767-798.

Hofer, C., Eroglu, C. and Hofer, A.R. (2012), "The effect of lean production on financial performance: the mediating role of inventory leanness", *International Journal of Production Economics*, Vol. 138 No. 2, pp. 242-253.

Huang, M., Li, P., Meschke, F. and Guthrie, J.P. (2015), "Family firms, employee satisfaction, and corporate performance", *Journal of Corporate Finance*, Vol. 34, October, pp. 108-127.

Huchzermeier, A. and Cohen, M.A. (1996), "Valuing operational flexibility under exchange rate risk", *Operations Research*, Vol. 44 No. 1, pp. 100-113.

Huson, M. and Nanda, D. (1995), "The impact of just-in-time manufacturing on firm performance in the US", *Journal of Operations Management*, Vol. 12 No. 3, pp. 297-310.

Jüttner, U. and Maklan, S. (2011), "Supply chain resilience in the global financial crisis: an empirical study", *Supply Chain Management: An International Journal*, Vol. 16 No. 4, pp. 246-259.

Kleindorfer, P.R. and Saad, G.H. (2005), "Managing disruption risks in supply chains", *Production and Operations Management*, Vol. 14 No. 1, pp. 53-68.

Kogut, B. and Kulatilaka, N. (1994), "Operating flexibility, global manufacturing, and the option value of a multinational network", *Management Science*, Vol. 40 No. 1, pp. 123-139.

Kroes, J.R. and Manikas, A.S. (2014), "Cash flow management and manufacturing firm financial performance: a longitudinal perspective", *International Journal of Production Economics*, Vol. 148, February, pp. 37-50.

Lee, S.H. and Makhija, M. (2009), "Flexibility in internationalization: is it valuable during an economic crisis?", *Strategic Management Journal*, Vol. 30 No. 5, pp. 537-555.

Lin, N., Tan, H. and Chen, S. (2017), "Global offshoring portfolio diversity and performance implications", *International Journal of Physical Distribution & Logistics Management*, Vol. 47 Nos 2/3, pp. 114-136.

Luo, Y. and Park, S.H. (2001), "Strategic alignment and performance of market-seeking MNCs in China", *Strategic Management Journal*, Vol. 22 No. 2, pp. 141-155.

Maister, D.H. (1976), "Centralisation of inventories and the 'Square Root Law' ", *International Journal of Physical Distribution*, Vol. 6 No. 3, pp. 124-134.

Makino, S. and Neupert, K.E. (2000), "National culture, transaction costs, and the choice between joint venture and wholly owned subsidiary", *Journal of International Business Studies*, Vol. 31 No. 4, pp. 705-713.

Meixell, M.J. and Gargeya, V.B. (2005), "Global supply chain design: a literature review and critique", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 41 No. 6, pp. 531-550.

Mello, A.S., Parsons, J.E. and Triantis, A.J. (1995), "An integrated model of multinational flexibility and financial hedging", *Journal of International Economics*, Vol. 39 No. 1, pp. 27-51.

Mishra, S., Modi, S.B. and Animesh, A. (2013), "The relationship between information technology capability, inventory efficiency, and shareholder wealth: a firm-level empirical analysis", *Journal of Operations Management*, Vol. 31 No. 6, pp. 298-312.

Modi, S.B. and Mishra, S. (2011), "What drives financial performance-resource efficiency or resource slack?: Evidence from US based manufacturing firms from 1991 to 2006", *Journal of Operations Management*, Vol. 29 No. 3, pp. 254-273.

Paterson, C., Kiesmüller, G., Teunter, R. and Glazebrook, K. (2011), "Inventory models with lateral transshipments: a review", *European Journal of Operational Research*, Vol. 210 No. 2, pp. 125-136.

Qian, G., Khoury, T.A., Peng, M.W. and Qian, Z. (2010), "The performance implications of intra-and inter-regional geographic diversification", *Strategic Management Journal*, Vol. 31 No. 9, pp. 1018-1030.

Rai, A., Arikan, I., Pye, J. and Tiwana, A. (2015), "Fit and misfit of plural sourcing strategies and IT-enabled process integration capabilities: consequences of firm performance in the US electric utility industry", *MIS Quarterly*, Vol. 39 No. 4, pp. 865-885.

Rajagopalan, S. and Malhotra, A. (2001), "Have US manufacturing inventories really decreased? An empirical study", *Manufacturing & Service Operations Management*, Vol. 3 No. 1, pp. 14-24.

Rosenfeld, S.A. (1996), "Does cooperation enhance competitiveness? Assessing the impacts of inter-firm collaboration", *Research Policy*, Vol. 25 No. 2, pp. 247-263.

Schmitt, A.J., Sun, S.A., Snyder, L.V. and Shen, Z.-J.M. (2015), "Centralization versus decentralization: risk pooling, risk diversification, and supply chain disruptions", *Omega*, Vol. 52, April, pp. 201-212.

Shah, R. and Shin, H. (2007), "Relationships among information technology, inventory, and profitability: an investigation of level invariance using sector level data", *Journal of Operations Management*, Vol. 25 No. 4, pp. 768-784.

Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E. (2008), "Designing and managing the supply chain", *Concepts, Strategies and Case Studies*, 3rd ed., McGraw Hill, Boston, MA, pp. 43-45.

Sirkin, H.L., Zinser, M. and Hohner, D. (2011), *Made in America, Again*, The Boston Consulting Group, Boston, MA.

Sturgeon, T. and Lester, R.K. (2004), "The new global supply-base: new challenges for local suppliers in East Asia", in Yusuf, S., Altaf, M.A. and Nabeshima, K. (Eds), *Global Production Networking and Technological Change in East Asia*, World Bank, Washington, DC, pp. 35-87.

Suarez, F.F., Cusumano, M.A and Fine, C.H. (1995), "An empirical study of flexibility in manufacturing", *MIT Sloan Management Review*, Vol. 37 No. 1, pp. 25-32.

Tan, K.C., Handfield, R.B. and Krause, D. (1998), "Enhancing the firm's performance through quality and supply base management: an empirical study", *International Journal of Production Research*, Vol. 36 No. 10, pp. 2813-2837.

Tang, C.S. (2006), "Robust strategies for mitigating supply chain disruptions", *International Journal of Logistics: Research and Applications*, Vol. 9 No. 1, pp. 33-45.

Tang, C.Y. and Tikoo, S. (1999), "Operational flexibility and market valuation of earnings", *Strategic Managemetn Journal*, Vol. 20 No. 8, pp. 749-761.

Tate, W.L. and Bals, L. (2017), "Outsourcing/offshoring insights: going beyond reshoring to rightshoring", *International Journal of Physical Distribution & Logistics Management*, Vol. 47 Nos 2/3, pp. 106-113.

Tate, W.L., Ellram, L.M., Schoenherr, T. and Petersen, K.J. (2014), "Global competitive conditions driving the manufacturing location decision", *Business Horizons*, Vol. 57 No. 3, pp. 381-390.

Tong, T.W. and Reuer, J.J. (2007), "Real options in multinational corporations: organizational challenges and risk implications", *Journal of International Business Studies*, Vol. 38 No. 2, pp. 215-230.

Zinn, W., Levy, M. and Bowersox, D.J. (1989), "Measuring the effect of inventory centralization/decentralization", *Journal of Business Logistics*, Vol. 10 No. 1, pp. 1-4.

About the authors

Woohyun Cho, PhD, is a Richard Stillman's Assistant Professor at the Department of Management and Marketing at the University of New Orleans. He received his PhD degree in Supply Chain Management from the University of Maryland, College Park, MD and an MBLE (Master of Business Logistics and Engineering) degree from the Fisher College of Business, the Ohio State University. His recent studies focus on operations, supply chain management and transportation, and are published in *Transportation Research Part (E): Logistics and Transportation Review*, *Transportation Research Part (A): Policy and Practice and Transportation Journal*.

Jian-yu Fisher Ke, PhD, is an Assistant Professor at the Department of Information Systems & Operations Management at the California State University Dominguez Hills. He received his PhD degree in Supply Chain Management from the University of Maryland, College Park, MD and an MBA degree from the Lehigh University, Bethlehem, PA and was a Fellow of the Advanced Study Program at MIT, Cambridge, MA. He had worked for DHL as a Research and Planning Manager for seven years.

His recent studies were published by *International Journal of Physical Distribution and Logistics Management* and *Transportation Journal*. His research interests have focused on the impact of macroeconomic factors such as fuel costs and globalization on supply chains. Jian-yu Fisher Ke is the corresponding author and can be contacted at: jke@csudh.edu

Dr Chaodong Han is an Associate Professor of e-Business and Technology Management at the College of Business and Economics, Towson University. Dr Han received his PhD degree in Logistics and Supply Chain Management from the Robert H. Smith School of Business, University of Maryland, College Park. Focused on globalization, IT in supply chain management, and manufacturing industries, Dr Han's research has been published in *Production and Operations Management*, *International Journal of Production Economics*, *Journal of Computer Information Systems*, *International Journal of Physical Distribution and Logistics Management*, *Transportation Journal*, *Journal of Manufacturing Technology Management* among others.