An Empirical Examination of the Direct and Indirect Effects of Geographic Diversification on Stock Market and Financial Performances of Multinational Corporations

Purpose

Literature indicates that global geographic diversification has mixed effects on a multinational corporation's (MNC) performances. This study examines how an MNC's geographic diversification (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, we 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, our examination is implemented separately under two economic situations: financial crisis vs. without financial crisis.

Findings

Our 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. Our 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: *Geographic Diversification, Operational Performance, Mediating Effect, Financial Crisis*

Article Classification: Research paper

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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 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 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 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 geographic diversification 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 U.S. 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 U.S., fluctuations in foreign exchange rates, and concerns of intellectual property theft (Sirkin et al., 2011; Tate et al., 2014; Tate et al., 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).

Geographic Diversification 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 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 U.S. multinational manufacturing firms and found international investments reduce the downside risk levels at a decreasing rate. In line with existing literature, we hypothesize the direct effect of GD on the stock market performance as follows:

Hypothesis 1a: *GD has a positive direct effect on an MNC's stock market performance*

Geographic Diversification 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, 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:

Hypothesis 1b: *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 Panzails (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:

Hypothesis 2a: *GD has an indirect effect on an MNC's stock market performance via inventory levels*

Hypothesis 2b: *GD has an indirect effect on an MNC's financial performance via inventory levels*

Value of Geographic Diversification in the Presence of a Financial Crisis

The bursting of the U.S. 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*.

Hypothesis 3a: *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 Hypothesis 1b,

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:

Hypothesis 3b: *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.

< Insert Figure 1 about Here >

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: (1) stock-based market measures, including stock returns and Tobin's q; (2) accounting-based financial measures, including return on sales (ROS), return on assets (ROA), and return on equity (ROE) (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 U.S. 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).

- 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 Model 2-1 and Model 2-2 for the stock market performance model and those between Model 3-1 and Model 3-2 for the financial performance model as explained in Relationship 3.

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 (Model 2-1 and Model 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 (Model 3-1 and Model 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

$$INV_{ij} = a_0 + a_1\ GD_{ij} + a_2\ Firm\ Size_{ij} + a_3\ Capital\ Intensity_{ij} + a_4\ Profitability_{ij} + Time\ Fixed\ Effects + Industry\ Fixed\ Effects + \varepsilon_{ij} \quad \text{(Equation 1)}$$

whereas i represents year i and j represents firm j

Model 2: Stock Market Performance

Model 2-1 (excluding Inventory level)

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

Model 2-2 (including Inventory level)

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

Model 3: Financial Performance

Model 3-1 (excluding Inventory level)

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

Model 3-2 (including Inventory level)

$$\text{ROA}_{ij} = e0 + e_1 \text{ GD}_{ij} + e_2 \text{ INV} + e_3 \text{ INV\_SQ} + e_4 \text{ Last Year ROA}_{ij} + e_5 \text{ Firm Size}_{ij} + e_6 \text{ Debt to Asset Ratio}_{ij} + e_7 \text{ Advertising Intensity}_{ij} + \text{Time Fixed Effects} + \text{Industry Fixed Effects} + \varepsilon_{ij} \quad \text{(Equation 5)}$$

We summarized the measurements of our variables below.

< Insert Table 1 about Here >

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 to 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 U.S. subprime mortgage market in late 2007, subsequently resulting in a major economic downturn and a financial crisis in the U.S. and worldwide during 2008-2010. This study follows the Aruoba-Diebold-Scotti Business Conditions Index,[1] produced by the U.S. 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.

Regression Results

Sample Analysis

Table 2 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 U.S. 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

[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 the business condition was negatively affected during 2008~2010 (source: https://www.philadelphiafed.org/research-and-data/real-time-center/business-conditions-index/, accessed 12/30/2015.

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% in the non-financial crisis years to -359% in the financial crisis years.

< Insert Table 2 about Here >

Table 3 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 significantly 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 (VIF) tests show that none of the variables has high factors, indicating that multicollinearity may not be a serious concern for the current models.

< Insert Table 3 about Here >

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 1are presented in Table 4, 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.

< Insert Table 4 about Here >

Similarly, we present the results of the stock market performance models (Model 2-1 and Model 2-2) respectively for the three samples (pooled, Crisis and Ncrisis), resulting in six estimations (2 sub models x 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 Hypothesis 1a, 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.

< Insert Table 5 about Here >

Table 6 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 Hypothesis 1b that GD has a direct negative effect on an MNC's financial performance in addition to the increased inventory holdings.

< Insert Table 6 about Here >

By following the three-step processes to test the mediating effect in section 3, we employed regression results obtained from the pooled samples reported in both Tables 4 and 5 to

test Hypothesis 2a. We first note in Table 4 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 2-1_{Pooled} in Table 5 show that GD has a significant impact on stock market performance, meeting the requirement of Step 2. Lastly, we compare the coefficients of GD in Model 2-1_{Pooled} and in Model 2-2_{Pooled} as presented in the Pooled Sample section of Table 5. The coefficient of GD increases from 0.0403 in Model 2-1_{Pooled} to 0.0410 in Model 2-2_{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 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 Goodman test and Sobel test both show that the indirect effect is marginally significant at the 0.09 and 0.11 significance levels, respectively, which provides marginal support for Hypothesis 2a 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*0.0037), 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 4), which

subsequently leads to a negative indirect effect on Tobin's q by 0.0012 point (=0.0078*(-0.155) $+0.0078^2$*0.0037), *ceteris paribus*.

Following the same procedure, we examine the mediating effect of inventory between GD and financial performance to test Hypothesis 2b. Results for Model 1_{pooled} presented in Table 4 show that GD is positively associated inventory-to-sales ratio (coefficient of 0.0078 and significant at 0.01, Step1). In Table 6, the results for Model 3-1_{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 6, the coefficient of GD increases from -0.0049 in Model 3-1_{Pooled} to -0.0044 with the inclusion of the inventory, implying a partial mediating effect caused by inventory levels. The results of Goodman test and Sobel test both show that the indirect effect is significant at a 0.01 level, providing support for Hypothesis 2b, 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 4), resulting in a negative indirect effect on ROA by 0.0006 points (=0.0078*(-0.0832) + 0.0078^2*(0.0008)). The quantitative direct and indirect effects of GD on stock market and financial performances are summarized in Table 7. 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.

< Insert Table 7 about Here >

To estimate the direct effects of GD on stock market performance across two economic conditions, we compare the coefficients of GD in Model 2-2_{Crisis} and Model 2-$2_{Ncrisis}$ reported in Table 5. 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 Hypothesis 3a 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 Hypothesis 3b, we compare the coefficients of GD in Model 3-2_{Crisis} and in Model 3-$2_{Ncrisis}$ in Table 6. 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 Hypothesis 3b 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.

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 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% (=-0.0006/-0.0050) of the total effect for financial performance, as shown in Table 7. 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.

Geographic Diversification 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 demand uncertainty and disruptions are both 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 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% (=-0.0006/-0.0050) of the total effect for financial performance, as shown in Table 7. 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 (for example, 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 multidimensional 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 previous literature to control for the uniqueness of firms.

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Figure 1 Research Model

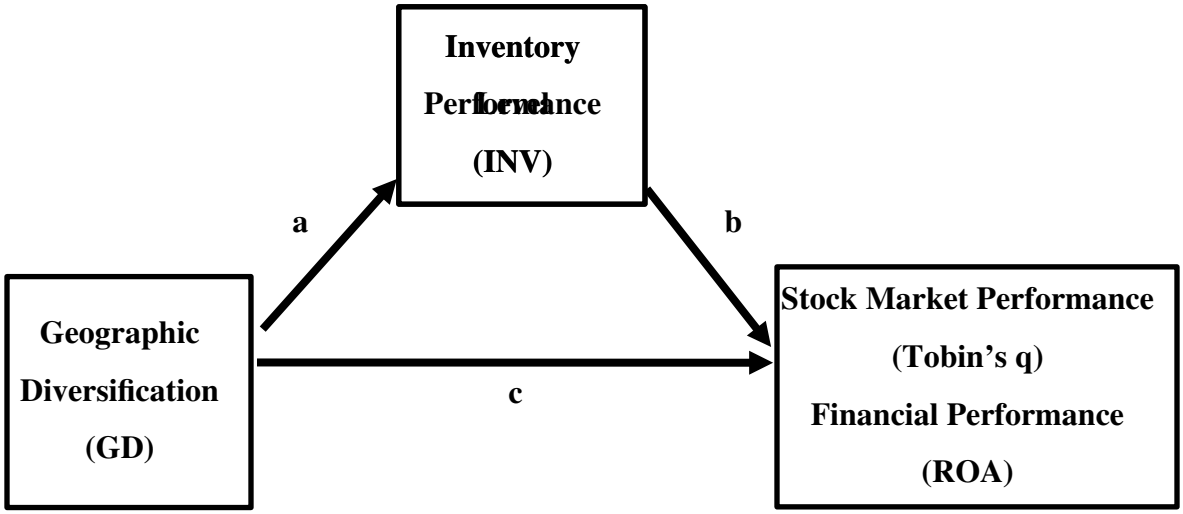

Table 1 Measurements of Variables

Variables	Measurements
GD	Number of global regions where an MNC operates and has capital investments. For example, the U.S. is classified as one region while the classification of international geographic regions outside the U.S. 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 2 Descriptive Statistics

Variable	Pooled Sample		Sample with Financial Crisis		Sample without Financial Crisis	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
GD	4.25	2.56	4.44	2.86	4.18	2.43
Tobin's q	1.1	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	0.5	-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 3 Correlation Table

	(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 4 Inventory Level Model Results

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

(Note: *** p<0.01. Value in the parenthesis is standard deviation)

Table 5 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	***	0.0410	***	0.1106	***	0.1136	***	0.0027		0.0049	
	(0.0104)		(0.0104)		(0.0299)		(0.0298)		(0.0073)		(0.0073)	
INV			-0.1550	*			-2.3600	***			-0.4175	***
			(0.0803)				(0.6726)				(0.0892)	
INV_SQ			0.0037	***			0.0357	***			-0.0256	***
			(0.0013)				(0.0098)				(0.0053)	
Last Year Tobin's q	0.6054	***	0.6053	***	0.9650	***	1.0046	***	0.4672	***	0.4658	***
	(0.0173)		(0.0173)		(0.0554)		(0.0563)		(0.0116)		(0.0115)	
Firm Size	-0.1080	***	-0.1099	***	-0.1879	***	-0.2087	***	-0.0716	***	-0.0792	**
	(0.0141)		(0.0142)		(0.0448)		(0.0452)		(0.0094)		(0.0095)	
Debt/Asset	-0.0752		-0.0763		-0.6627		-0.7170	***	0.1151		0.1257	
	(0.1312)		(0.1311)		(0.4315)		(0.4301)		(0.0871)		(0.0870)	
Advertising	0.5859	***	0.5839	***	0.4370		0.3962		1.3989	**	1.4082	**
	(0.1615)		(0.1614)		(0.2710)		(0.2702)		(0.6011)		(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-squared	0.1974		0.1990		0.1930		0.2001		0.3141		0.3175	

(Note: *** denotes p<0.01, ** p<0.05, and * p<0.1. Value in the parenthesis is standard deviation)

Table 6 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	**	-0.0044	**	-0.0102	***	-0.0102	***	-0.0020		-0.0010	
	(0.0020)		(0.0032)		(0.0032)		(0.0032)		(0.0023)		(0.0023)	
INV			-0.0832	***			0.0632				-0.1738	***
			(0.0156)				(0.0766)				(0.0280)	
INV_SQ			0.0008	***			-0.0012				0.0080	***
			(0.0003)				(0.0011)				(0.0017)	
Last Year ROA	-0.1382	***	-0.1425	***	0.5395	***	0.5429	***	-0.2977	***	-0.3003	***
	(0.0105)		(0.0104)		(0.0223)		(0.0240)		(0.0107)		(0.0106)	
Firm Size	0.0642	***	0.0623	***	0.0424	***	0.0421	***	0.0611	***	0.0577	***
	(0.0028)		(0.0028)		(0.0050)		(0.0050)		(0.0030)		(0.0030)	
Debt/Asset	-0.3494	***	-0.3506	***	-0.1583	***	-0.1559	***	-0.4185	***	-0.4163	***
	(0.0256)		(0.0255)		(0.0468)		(0.0467)		(0.0275)		(0.0274)	
Advertising	-0.1398	***	-0.1429	***	0.0043		0.0056		0.1710		0.1660	
	(0.0315)		(0.0313)		(0.0296)		(0.0297)		(0.1890)		(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-squared	0.1183		0.1256		0.3536		0.3591		0.2120		0.2191	

(Note: *** denotes p<0.01, ** p<0.05. Value in the parenthesis is standard deviation)

Table 7 Summary of Direct and Indirect Effects of GD

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.)