

Managing Supply Risks for Low-cost Country Sourcing: The Mediating Role of Purchasing Teams and Implications for Firm Performance

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Drawing on agency theory and using a combination of a survey of large U.S. firms and archival data, this research examines how low-cost country sourcing and supply risk (supplier operations risk and market risk) impact the use of purchasing teams and affect firm performance. Results indicate that purchasing team use fully mediates the relationship between supply risk and firm performance, representing a behavior-based risk management strategy that improves firm financial performance when confronted with supply risk. The recent Covid-19 outbreak has highlighted the need for greater insights towards risk management and this paper fills a gap in the global sourcing literature by examining approaches to mitigate supply risk. From a managerial perspective, while low-cost country sourcing can improve firm performance, firms engaging in low-cost country sourcing, or contemplating doing so, should consider complementing traditional sourcing practices with capabilities to implement behavior-based risk management strategies to address supply risk.

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I. INTRODUCTION

The last three decades have seen an expansion of global sourcing, as firms are no longer satisfied that local suppliers necessarily offer the best value in terms of cost, technology, innovation, quality, and on-time delivery. One of the fastest areas of growth in global sourcing has been low-cost country sourcing (Kusaba et al., 2011). For example, A.T. Kearney reported that U.S. imports from low-cost countries as a percentage of domestic manufacturing gross output increased for the fifth consecutive year in 2018 (Van den Bossche et al. 2019).

While the globalization of supply has been enabled by a number of factors, including e-commerce, liberalization of trade agreements, investments in transportation infrastructure, improved methods of international communication and advances in transportation technology, it increases the complexity of the supply chains for most organizations (Christopher et al., 2011). Supply chain managers must deal with issues that include longer lead times, currency fluctuations, and multiple modes of transportation (Mwangola and Bridges, 2018). Meanwhile, increased competition motivates firms to maintain supply chains

that are lean and efficient, striving to keep lead times short and inventories as low as possible. The result is that supply chains today are more vulnerable to disruptions than in the past (Bode and Wagner, 2015). The recent Covid-19 outbreak has exposed vulnerabilities, where increased demand coupled with labor shortages and disruptions to distribution networks has caused supply shortages, including medical supplies, food and consumer products (Carlsson-Szlezak et al., 2020; Hobbs, 2020). In contrast to a geographically-centered, singular disruption from a natural disaster, the Covid-19 pandemic affected multiple segments and tiers of supply chains, thus paralyzing entire markets (Ivanov and Das, 2020). These events reinforce the primary responsibility of the supply function to ensure reliable on-time delivery of goods and services at the right quality and cost (Johnson, 2020). Therefore, the management of supply risk is receiving increased attention from both practitioners and academics.

Previous research has explored two broad approaches used by firms to mitigate supply risk (Zsidisin and Ellram, 2003; Giunipero and Aly Eltantawy, 2004). The first is buffer-oriented risk management strategies, which include carrying safety stock inventory and dual sourcing. While relatively straightforward to implement, these tactical strategies have the disadvantage of increasing costs and reducing supply chain efficiencies. The second approach identified in the literature is behavior-based risk management strategies, which aims to reduce the probability of the occurrence and impact of the risk. This approach includes supply strategies such as early supplier involvement (Zsidisin and Smith, 2005), external integration (Chaudhuri et al., 2018), and reduction of supply chain complexity (Bode and Wagner, 2015).

This research focuses on the behavior-based risk management strategies used by firms to manage supply risk for low-cost country sourcing and the implications for firm performance. Specifically, the research question for this study is: How do supplier operations risk and market risk impact purchasing team use and firm performance when sourcing from low-cost regions? In doing so, this paper makes three contributions to the extant literature. First, previous research has examined classifications of supply risks (e.g., Wagner and Bode, 2008) approaches to reduce supply risks (e.g., Christopher et al. 2011) and the impact of the effects of supply disruptions (e.g., Manuj and Mentzer, 2008). Drawing on agency theory, this study helps to address a gap in the supply risk management literature by examining the role of purchasing teams as a means of mitigating supply risk. Findings indicate that firms sourcing from low-cost countries perceive disruptions from market risks to be significantly greater than supplier operations risks, and that purchasing teams represent an effective mechanism to manage the complexities associated with market risks.

Second, there has been limited research examining the linkage between supply risk and firm financial performance. Using data from archival sources and a survey of large U.S. firms, this research investigates the mediating role of purchasing teams on the relationship between supply risk and firm performance. Findings indicate that purchasing teams can be used as an effective behavior-based risk management strategy that improves firm financial performance when confronted with supply risk. Finally, this research assesses the performance implications of low-cost country sourcing while providing an improved understanding of how low-cost country sourcing influences supply risk.

The rest of the paper is organized as follows. Section 2 outlines the extant literature on low-cost country sourcing, supply risk, and firm performance. Drawing on agency theory, the hypotheses are developed to link low-cost country sourcing to supply risk, the use of purchasing teams, and firm performance. Section 3 describes the methodology followed by results in Section 4. Section 5 and 6 provide the discussion of the findings and conclusions,

respectively. Section 6 also lists the limitations of the study and opportunities for future research.

II. CONCEPTUAL DEVELOPMENT

Figure 1 provides the proposed theoretical model for the research, which is developed in the following sections.

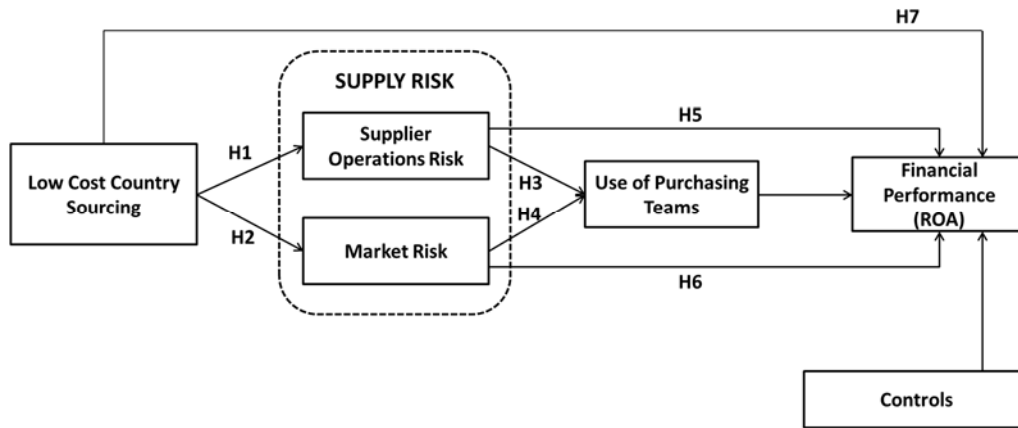


FIGURE 1: THEORETICAL MODEL

1.1. Supply Risk

Risk has been studied extensively in a variety of disciplines, including economics, finance, strategy, and marketing, and its definition varies, depending on the context. For example, research in finance has examined risk in terms of the probability and potential magnitude of loss (Yates, 1992). In the finance and strategy literatures, risk can represent both a danger and an opportunity, having a potential downside and upside (Mitchell, 1995). In contrast, research on supply risk has focused mainly on the potential negative consequences from events that disrupt the normal flow of goods and services from upstream in the supply chain (Wagner and Bode, 2008). For the purposes

of this research, supply risk is present in a commercial transaction with a supplier that has material consequences to the buyer (exposure), and the outcome cannot be predicted (uncertainty) (Hult et al., 2010). Research in supply chain management has focused on identifying categories of risk drivers and mitigation strategies (Mwangola and Bridges, 2018) (Haleem et al., 2018) (Christopher et al., 2011). Kleindorfer and Saad, (2005) identified two broad categories of supply chain risks: normal problems of coordinating supply and demand and major disruptions that represent a serious threat to business operations. The latter category, supply chain disruptions, generally includes one-time events such as natural disasters, supplier bankruptcies, strikes, and terrorism (Kleindorfer and Saad, 2005; Bode and

Wagner, 2015). Kraljic, (1988) was among the first to highlight risk as a key factor in supply strategy, identifying the need for firms to assess their supplier portfolio and develop strategies to address supply market complexity and the importance of the purchase. However, empirical research on supply chain risk only began to develop in the past 20 years (Zsidisin and Smith, 2005). Research by Hendricks and Singhal, (2003) demonstrated the importance of supply risk management to the business enterprise, finding that supply chain disruptions can negatively affect shareholder value.

Most research has included frameworks that categorize broad drivers of supply chain risks. For example, Wagner and Bode, (2008) classified supply chain risk into five categories: demand-side, supply-side, regulatory, legal and bureaucratic; infrastructure; and, catastrophic. Within this categorization, supply-side risks included supplier business risks, supply market capacity constraints, quality problems, and changes in technology and product design. In their literature review, Ellis et al., (2011) developed a conceptual framework of supply disruption risk that included three broad categories: geopolitical, supply, and product factors. Supply risk factors involved supplier, supply network, and supply market subcategories. Ellis et al., (2011) found that the drivers of supply risk included distance from suppliers, supply network complexity, and supply market thinness and dynamism. Other studies have focused on specific forms of supply risk, such as global sourcing (Christopher et al., 2011), purchase prices (Fischl et al., 2014) and commodity pricing (Gaudenzi et al., 2018).

Given the breadth of supply risks facing organizations documented in the literature, it was necessary for the purposes of this research to narrow the scope. Therefore, this research focuses on the two categories of

supplier operations risk and *market risk*, identified in the research of Zsidisin, (2003). Supplier operations risk consists of supply disruptions due to capacity, cost competitiveness, on-time delivery, and lead times, while market risk includes market capacity, supply assurance, commodity market price volatility, foreign exchange rates, and market price fluctuations. Additional details on items that make up these constructs are provided in Section 3.3.

1.2. Low-cost Country Sourcing

Motivated by global competitive pressures, organizations have been striving to reduce costs by outsourcing, resulting in an increased reliance on suppliers for critical products and services, and for support services such as R&D. Consequently, global sourcing is an inevitable outcome for most firms exploring opportunities to improve their competitive position, as they scour the world for the suppliers best able to meet their long-term needs. The trends of increased outsourcing and global sourcing have increased supply risk for organizations, in terms of both the exposure and uncertainty aspects of risk.

Trent and Monczka (2005) define global sourcing as the integration and coordination of common items, materials, processes, technologies, designs and suppliers across worldwide buying, design and operating locations. For the purposes of our research we adopted the definition of low-cost sourcing used by Kusaba et al. (2011), representing a subset of global sourcing that focuses on countries with relatively lower production costs and a culturally and/or substantial geographic distance from the buyer's location. An example would include an organization located in a developed region, such as European or the U.S., procuring products or

services from suppliers in an emerging market, such as China, India, Brazil, or Vietnam.

Low-cost country sourcing creates complexity that leads to increased supply risk (Manuj and Mentzer, 2008; Christopher et al., 2011). Global supply chains are longer and involve a greater number of intermediaries, creating variability for lead times and on-time delivery performance. There are also greater risks of disruptions, such as natural disasters, political instability, trade disputes, and terrorism, which can interrupt supply. Finally, dealing with suppliers in low-cost regions subjects the buyer to exchange rate and costs risks, through currency fluctuations and changes in input and transportation costs. As a result, we propose that:

H1: Low-cost country sourcing is positively related to supplier operations risk.

H2: Low-cost country sourcing is positively related to market risk.

1.3. Supply Risk and the Use of Purchasing Teams

Agency theory has been used as the theoretical foundation to investigate several supply chain management topics, including supply risk (Fayezi et al., 2012). Agency theory is concerned with the study of problems that can arise between two parties that cooperate and engage in a relationship where one entity (the principal) delegates work to another party (the agent) (Eisenhardt, 1989; Rungtusanatham et al., 2007). The two potential problems in the principal-agent relationship are the agency problem and the risk-sharing problem. The agency problem occurs when there is information asymmetry between the principal and agent, and differences in goals exist between the two parties. Problems are created by the inability of the principal to verify whether the agent

has performed the delegated task properly (moral hazard) and/or whether the agent has the expertise to perform the delegated work (adverse selection). For the purposes of our research, the buying firm is the principal and the supplier is the agent. The problem of risk sharing is created from different perspectives towards risks by the principal and agent (Rungtusanatham et al., 2007). Typically, the principal is motivated to minimize agency costs, while the agent will strive to maximize rewards, which may be suboptimal for the principal. Agency theory prescribes two types of contracts to govern the principal-agent relationship: outcome-based contracts and behavior-based contracts. The type of contract used should reflect the trade-offs of monitoring agent behavior versus the costs of measuring the outcome (Eisenhardt, 1989).

Research by Zsidisin and Ellram, (2003) and Zsidisin and Smith, (2005) identify two strategies, in line with agency theory prescription, to manage supply risk in a principal-agent relationship. Buffer-oriented strategies—such as safety stock inventory, multiple sourcing, and vendor managed inventories—focus on managing outcomes and minimizes the involvement of supply in the operations of suppliers. The second approach, behavior-based strategies, focuses on efforts to reduce the probability and magnitude of the occurrence of a negative event by managing processes and activities. This research found that when supply risk becomes significant, firms are more likely to embrace behavior-based strategies. Examples identified include supplier development, implementation of quality management programs, and development of supplier target costing programs. For example, Zsidisin and Smith, (2005) found that early supplier involvement in new product development represented a behavior-based strategy that reduced supply risk.

Purchasing teams represent one method to support the implementation of behavior-based supply risk management strategies. Previous research has identified that internal integration (i.e., cross-functional collaboration) and external integration (i.e., inter-firm collaboration) provide opportunities to improve firm performance (Frohlich and Westbrook, 2001; Chaudhuri et al., 2018). Internal and external integration improves supply chain coordination and resource utilization, while supporting alignment of goals and objectives among stakeholders in the supply chain (Horn et al., 2014). Purchasing teams are commonly employed to achieve internal and external integration in the supply chain. Depending on the circumstances, purchasing teams can include representation from other functions (e.g., sales, operations, and finance) and from suppliers and customers (Johnson et al., 2007). Purchasing teams can be used for a broad range of supply chain initiatives, including cost reduction programs, quality improvement programs, and new product development and technology adoption (Johnson et al., 2007; Horn et al., 2014). Research has also explored the purchasing team use in global sourcing (Trent and Monczka, 2003) and supply risk management (Chaudhuri et al., 2018).

Examples of purchasing teams include commodity teams, cross-functional teams, purchasing councils, and supplier councils (Johnson et al. 2002; Johnson et al. 2007). Cross-functional purchasing teams consist of representatives within the organization, but outside the procurement function, such as sales/marketing, operations, and finance/accounting, and represent a means of enhancing internal integration and improving decision-making (Driedonks et al., 2010). Purchasing councils consist of procurement personnel only and represent a mechanism to share information among

decentralized plants, departments or business units (Johnson, 2020). In contrast, commodity teams are created to manage purchase categories that represent a significant annual cost, and the acquisition process is considered complex. Examples include the procurement of raw commodities and information technology systems (Monczka et al., 2015). While commodity teams can include procurement personnel only, frequently they are cross-functional. Thus, cross-functional purchasing teams, supplier councils, and commodity teams represent approaches to improve internal integration. In contrast, supplier councils are created to achieve external integration. Consisting of senior purchasing executives from the buying firm and 10-15 senior executives from key suppliers, supplier councils provide a forum to improve communication with suppliers and obtain support and feedback on major initiatives (Johnson, 2020). Thus, purchasing teams engage internal and external stakeholders, with the objective of improving procurement activities.

In the case of low-cost country sourcing, firms face problems of cultural differences, geographic separation and organizational distance (e.g., the number of tiers in the supply chain), adding complexity and contributing to risk (Awaysheh and Klassen, 2010). A single individual or function in the organization is unlikely to possess the capabilities to necessary manage risks associated low-cost country sourcing. Purchasing teams represent one approach to address the multifaceted issues of low-cost country sourcing risks, providing a mechanism to engage non-procurement personnel and suppliers.

In addition, many suppliers operating in low-cost regions lack the sophistication to manage operations and market risks (Stanczyk et al., 2017). For example, supplier

operations risk requires coordination of logistics (e.g., lead times and on-time delivery), forecasting, and planning (e.g., capacity) and raw material sourcing (e.g., cost). Similarly, expertise in managing market risk factors, such as foreign exchange rates and commodity price hedging, often reside outside the supply function. Therefore, purchasing teams can also be used as a mechanism to leverage cross-functional expertise for market risks. Therefore, we propose that as the threat of occurrence and magnitude of the supply risk increases, firms are more likely to search for opportunities for internal and external integration as a means to adopt behavior-based strategies, and thus:

H3: Supplier operations risk is positively related to the use of purchasing teams.

H4: Market risk will be positively related to the use of purchasing teams.

1.4. Purchasing Teams, Supply Risk and Firm Performance

Previous research has found that supply disruptions can reduce operational performance and negatively affect profitability and shareholder value (Hendricks and Singhal, 2003). As discussed in the previous section, agency theory suggests that as the magnitude of supply risk increases, firms will embrace behavior-based strategies aimed at reducing the probability and/or magnitude of the supply risk (Zsidisin and Smith, 2005). Kwak et al., (2018) suggests that for firms to quickly recover from disruptions and return to their normal level of performance, they should develop resilient supply chains capable of reducing the magnitude of the impact of the risk by shrinking the duration of disruptions. Therefore, while supply risks can originate from a variety of sources, the adoption of particular strategies may enable the firm to

reduce the impact on performance (Wagner and Bode, 2008).

In the context of low-cost country sourcing, issues such as communication problems, long distances, and foreign exchange rate fluctuations, can increase the buying firm's exposure to supply risk. Investing in capabilities to manage supplier operational risks and market risks can reduce both the exposure and uncertainty elements of supply risk. As established earlier, the use of purchasing teams represents a behavior-based approach that provides a mechanism to achieve internal and external integration (Enz and Lambert, 2015) aimed at reducing the magnitude and probability of the occurrence of a supply disruption through the management of processes and activities. Furthermore, research in organizational behavior has identified several benefits from using cross-functional teams, including the ability to manage complex tasks over extended periods of time (Lovelace et al., 2001). Thus, our expectation is that purchasing teams will mediate the relationship between supply risk and performance, and the use of purchasing teams will reduce the negative impact of supply risk on firm performance. Hence, we propose:

H5: Use of purchasing teams mediate the relationship between supply risk and firm performance.

H6: Use of purchasing teams mediate the relationship between market risk and firm performance.

1.5. Low-cost Country Sourcing and Firm Performance

The previous sections identified several significant challenges associated with low-cost country sourcing. Consequently, the expectation of improved performance from low-cost region sourcing initiatives does not always materialize. For example, Horn et al.,

(2013) found that the majority of China sourcing projects in their study failed to provide the anticipated benefits, and Vos et al., (2016), in their examination of five years of data from a European automotive equipment manufacturer, found that low-cost country sourcing did not lead to cost reductions. Weber et al., (2010) found that although low-cost country sourcing may appear to be financially attractive from a purchase price perspective, additional cost factors, such as quality, language barriers, and intercultural communication, increased total costs of ownership. Research by Stanczyk et al., (2017) on the challenges of global sourcing identified decision-making bias and internal factors, including insufficient cross-functional integration, as two barriers influencing the performance of global sourcing initiatives. Therefore, operational execution represents one of the significant challenges to deliver performance benefits of low-cost country sourcing initiatives (Kusaba et al., 2011).

Notwithstanding the potential negative aspects of low-cost country sourcing, research has also identified several benefits. While cost competitiveness, as a result of low wage rates, has been identified most frequently (Kusaba et al., 2011), other potential benefits include access to products and services not available locally, additional supplier capacity, improved quality and new technology (Haleem et al., 2018). In addition, companies with a long-term perspective can view investments in supply relationships with suppliers low-cost regions as an opportunity to gain knowledge concerning the ability to sell products or services in the region (Raghavendran et al., 2012; Lee et al., 2016). Business relationships established in the region can provide valuable insights on distribution channels, government regulations, local language and customs, and business practices.

Consequently, although literature has identified both advantages and disadvantages of global sourcing, a growing body of research has demonstrated global sourcing can result in improved financial performance (e.g., Trent and Monczka, 2003). For example, research by Schiele et al. (2011) found that the average savings from global sourcing projects identified by the participants in their study averaged 3.4 percent. Other recent studies have linked improved performance with low-cost country sourcing initiatives (e.g. Moser et al., 2018). Thus, we propose that:

H7: Low-cost country sourcing is positively related to firm performance.

III. METHODOLOGY

3.1. Data collection and Sample

This research derives its data from a larger research project that focused on current purchasing-related issues and challenges, such as supply risk assessments, expectations on environmental and social sustainability, and delivering on financial goals. The sampling frame consisted of large North American manufacturing and services (excluding the retail and wholesale sector) firms from 18 industry groups. Generally, issues related to low-cost country sourcing and supply risk management are more prevalent in larger organizations, hence providing the required sampling frame for this study. This study used a combination of a survey and performance-related data from secondary sources (i.e., COMPUSTAT) to investigate the relationships between low-cost country sourcing, supplier operations risk, market risk, the use of purchasing teams, and firm performance.

In order to identify potential respondents, the CAPS Research membership directory and the Institute of

Supply Management (ISM) lists were acquired. The membership lists were filtered for respondents, who worked for the Fortune 1000 firms, carried senior supply executive titles, and were identifiable by name and address, resulting in a final sampling frame of 643 firms. The target respondent at each firm was a senior supply chain or purchasing executive, who is responsible for the overall purchasing of materials and services in his or her organization. The survey, along with a cover letter and stamped return envelope, was sent to all the 643 firms. From the initial sample frame of 643 firms, 20 firms were dropped because the surveys could not be delivered, resulting in an effective sampling frame of 623 firms.

A modified Dillman, (2007) approach was followed to increase the response rate in which respondents were given four options to respond: postal mail, fax, email, webpage. In addition, following Dillman, (2007) recommendation, all non-respondents were sent two reminders two weeks and four weeks after the initial mailing. Finally, six weeks after the initial mailing, a telephone call was made to each non-respondent requesting a response. A total of 183 completed surveys were returned out of a total of 623, resulting in a response rate of 29.4 percent. In order to link the survey data for respondent firms to their financial performance data from COMPUSTAT, another 47 responses had to be dropped from the sample, resulting in a final sample size of 136 firms, providing an effective response rate of 21.8 percent. The final sample had 96% of responses from firms exceeding annual revenue of \$1 billion and 94% of respondents had upper management titles including directors, general managers and vice presidents.

3.2. Method Bias

Since the data was gathered from single respondents using a survey that is cross-sectional in nature, both non-response bias and common method bias may cause measurement error (Podsakoff et al., 2003). To examine whether non-response bias is significant in the data collected, early respondents were compared to late respondents in terms of annual revenue for the firms and their industry membership (Lessler and Kalsbeek, 1992). The results of the independent-sample t-test showed no significant difference between early and late respondents for revenue [$t(134) = 0.816$, $p=0.416$] and industry membership [$t(134) = 0.664$, $p=0.508$], thereby providing statistical evidence that the non-response bias (NRB) does not impact the results of the study.

Common method bias (CMB) could also be a source of error in the results, and Podsakoff et al. (2003) recommends using procedural remedies before data collection to reduce the impact of CMB. In this study, such remedies consisted of obtaining performance-related outcome variable (i.e., firm financial performance) from archival sources (details in the section on secondary data), assuring respondents complete anonymity, and by collecting data from a second respondent for some firms. Collecting data from multiple respondents from the same firm minimizes the impact of single respondent bias. For assuring that single respondent bias is not a major concern, data was gathered from second respondents from approximately 20 percent of randomly selected respondent firms. A total of 35 surveys were sent, and 31 were completed and returned. The inter-rater reliability (IRR) coefficient for dual respondents was calculated for all the constructs in the study. All IRR coefficients at the construct level were found to be significant at the $p < 0.001$ level. Podsakoff et al. (2003) also recommends statistical tests to check whether

CMB is a major concern. Employing Harman's single-factor approach indicated that a single factor does not explain a significant variance for all the constructs in the study. Thus, it is reasonable to conclude that CMB is not a concern for the data.

3.3. Measures

The theoretical model provided in Figure 1 has constructs related to low-cost country sourcing, supplier operations risk, market risk, and the use of purchasing teams. The low-cost country sourcing construct was derived by gathering data from respondents about the percentage of their firm's annual purchase spend from eight geographic regions of the world. The eight regions were grouped into two broad categories representing four developed regions (United States, Canada, Europe, and Japan) and four low-cost regions [Latin America, China, Africa, and all other Asia (including India and Russia)]. Thus, in this study, the low-cost country sourcing construct represents an aggregation of a firm's purchase spend from the low-cost regions of the world. Such an operationalization helps the validity of the results, as the respondents were not directly asked to provide the data on their purchase spend from low-cost regions. Also, an indirect measure for the low-cost country sourcing construct helps reduce the consistency motif of respondents (Podsakoff et al., 2003).

As outlined earlier, given the breadth of supply risks facing organizations, it was necessary to narrow the scope. Based on the research of Zsidisin, (2003), we focused on the two categories of *supplier operations risk* and *market risk*. While Zsidisin, (2003) listed nine forms of supplier risk, we limited the number of supplier operations risk variables to capacity, cost competitiveness, on-time delivery, and lead times. These variables

have also been identified as supply risks in other research (e.g. Wagner and Bode, 2008). Market risk consists of the variables of market capacity and commodity and market price volatility from Zsidisin, (2003), and supply assurance from Manuj and Mentzer, (2008). Because this research examined supply risks from low-cost region suppliers, foreign exchange rate risk (Christopher et al., 2011) was also included as a market risk variable.

Lastly, the construct purchase team use is also an established scale in the literature. Johnson et al., (2002) initially proposed the items, and the construct was further refined by Johnson et al. (2007). Appendix A provides the psychometric properties of the constructs and their respective items.

3.4. Measurement Model

Before analyzing the structural model, we examined the relationships between the constructs and their respective items by running a measurement model. Confirmatory factor analysis (CFA) was conducted using AMOS v26 as the software platform to establish the psychometric properties of the constructs (Anderson and Gerbing, 1988). The fit statistics for the measurement model indicate good fit ($\chi^2 = 74.65$, $df = 50$, $p = 0.013$; $\chi^2/df = 1.493$; CFI = 0.962; PGFI = 0.592; RMSEA = 0.060) (Kline, 2011).

The first psychometric property that we evaluated was the composite reliability of the constructs in the study. Appendix A provides the details of psychometric properties. The construct of supplier operations risk had a composite reliability score of 0.826, market risk had a reliability score of 0.843, and the use of purchasing teams had a reliability score of 0.619. Generally, a score of 0.7 or higher is indicative of sound composite reliability

(Fornell and Larcker, 1981). All the constructs in the study exhibited sufficient reliability, with the exception of the construct of the use of purchasing teams. However, since the construct has been adopted from previous research (Johnson et al., 2002, 2007), the use of the construct for the empirical model was considered appropriate.

In addition to composite reliability, the convergent validity of the constructs was assessed by computing the average variance extracted (AVE) (DeVellis, 2012). Average variance extracted (AVE) indicates how much of the variance is captured by the construct as compared to the variance caused by measurement error (Fornell and Larcker, 1981). The construct of supplier operations risk had an AVE score of 0.620, market risk had an AVE score of 0.531, and the use of purchasing teams had an AVE score of 0.351. Another method for assessing the convergent validity is to observe the magnitude and sign of the factor loadings of all measurement items and compare them to the anticipated direction. All construct items in the study were found to be positively related to the respective constructs, and the loadings were statistically significant, indicating sufficient convergent reliability.

3.5. Secondary Data

As outlined earlier, this study links survey data on supply risk and the use of purchasing teams of a firm to its financial performance. One of the measures for capturing a firm's financial performance from an operations perspective is return-on-assets (ROA). ROA is net income divided by total assets (Tang et al., 2012), and it signifies how efficiently a firm uses its assets to deliver profits (Azadegan et al., 2013). Previous operations management research has also used return-on-assets (ROA) and return-on-sales (ROS) as measures of

financial performance when using secondary archival sources (e.g., Tang et al., 2012; Azadegan et al., 2013).

A challenge when using an archival measure of firm performance is to add appropriate control variables, so that spurious effects of independent variables on the dependent variable (ROA in this study) can be nullified (Surroca et al., 2010). To address this concern, control variables were added at the firm- and at the industry-level to control for both firm and industry effects, respectively. Similar to previous studies, this study used control variables of firm size and past financial performance to control for firm-level effects (Azadegan et al., 2013). For firm size, data on the number of employees was extracted from the COMPUSTAT database. For the past financial performance of a firm, this study used two-year lagged ROA data for analysis.

To control of industry-level effects, the strategy literature commonly uses three metrics of environmental munificence, environmental dynamism, and environmental complexity (Fernhaber and Patel, 2012). Environmental munificence is an indicator of the level of growth in an industry. The variable was derived by aggregating sales data at the three-digit North American Industrial Classification System (NAICS) level for five years and running a regression to calculate the growth coefficient. The growth coefficient divided by the average industry sales provides the value for the environmental munificence of that industry (Keats and Hitt, 1988). Environmental dynamism, as the name indicates, measures how much volatility exists in an industry. The standard error of the growth coefficient divided by the average industry sales provided the value for the environmental dynamism of that industry (Keats and Hitt, 1988). Environmental complexity measures the extent of rivalry in an industry. The

variable is derived by aggregating the revenues of the four largest firms in an industry and dividing the sum by the total aggregated revenue of that industry. Hence, the value of environmental complexity can vary between '0' and '1', where values closer to '1' represent less complex industries and values closer to '0' represent highly complex industries, where intense rivalry could be expected.

IV. RESULTS

Path analysis was used to test hypotheses in the study and AMOS 26 was the software platform. Path analysis has an advantage of assessing multiple predictions of multiple variables in a model. In addition, since the focus in this study was on the relationships, the average composite scores of each construct was used in the analysis. The use of average composite scores has been employed in earlier operations management studies (e.g., Keats and Hitt, 1988; Shafiq et al., 2017), where the reliability of constructs is high, as is the case in our study. This method is also appropriate, given the number of constructs, hypothesized relationships, and sample size.

The results of the structural model indicate excellent model fit ($\chi^2 = 15.30$, $df = 14$, $p = 0.358$; $\chi^2/df = 1.093$; $CFI = 0.998$; $RMSEA = 0.026$) (Kline, 2011). Table 1 contains the correlations among composite scores of all constructs in this study and Table 2 outlines the results of the path analysis.

Hypotheses 1 and 2 focused on the association between low-cost country sourcing and supplier operations risk (H1) and market risk (H2), respectively. The

results indicated a marginally significant relationship between low-cost country sourcing and supplier operations risk (H1: $\beta = 0.145$, $p = 0.09$) and a statistically significant relationship between low-cost country sourcing and market risk (H2: $\beta = 0.237$, $p = 0.005$), signifying that firms with a higher percentage of purchase spend from low-cost regions associated higher risks from such economies. In support of Hypotheses 3 and 4, we found a statistically significant relationship between supplier operations risk and the use of purchasing teams (H3: $\beta = 0.208$, $p = 0.026$) and between market risk and the use of purchasing teams (H4: $\beta = 0.196$, $p = 0.036$).

In addition to analyzing the direct relationships between constructs, we also hypothesized for the mediating effects of the use of purchasing teams in the theoretical model. Specifically, we proposed in Hypothesis 5 that the use of purchasing teams will mediate the relationship between supplier operations risk and firm financial performance. Mediation, which can be either full or partial, refers to a process that underlies an observed relationship between an independent variable and a dependent variable through the inclusion of an intervening variable (James and Brett, 1984). A full mediation signifies that there is no direct effect of independent variable onto the dependent variable, and the only effect of the independent variable is through the mediating variable. Alternatively, a partial mediation does not eliminate the direct effect. However, in a partial mediation, the magnitude of the direct effect reduces when a mediating variable is added to the model.

TABLE 1: DESCRIPTIVE STATISTICS

		Mean	S.D.	Min.	Max.	Correlations			
						1	2	3	4
1	Low Cost Country Sourcing	16.96 ^a	18.12	0.00	95.00	-			
2	Supplier Operations Risk	3.84	0.45	0.82	2.88	0.145	-		
3	Market Risk	3.56	0.69	1.75	4.75	0.237**	0.536**	-	
4	Purchasing Teams	3.39	0.76	1.50	5.00	0.189*	0.299**	0.308**	-
5	Return on Assets (ROA)	0.057	0.066	-0.274	0.334	0.243**	-0.071	-0.004	0.190*

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

TABLE 2: PATH MODEL RESULTS

	Variables			Std. β	S.E.	C.R.	p-value
H1	Low Cost Country Sourcing	--->	Supplier Operations Risk	0.145	0.005	1.698	0.09
H2	Low Cost Country Sourcing	--->	Market Risk	0.237	0.005	2.835	0.005
H3	Supplier Operations Risk	--->	Purchasing Teams	0.208	0.071	2.23	0.026
H4	Market Risk	--->	Purchasing Teams	0.196	0.071	2.102	0.036
H5 & H6	Purchasing Teams	--->	ROA	0.18	0.007	2.075	0.038
(Mediation)	Supplier Operations Risk	--->	ROA	-0.12	0.006	-1.252	0.211
	Market Risk	--->	ROA	-0.049	0.006	-0.502	0.616
H7	Low Cost Country Sourcing	--->	ROA	0.247	0	2.95	0.003
Controls							
Firm-Level	Size (Sales)	--->	Purchasing Teams	0.109	0.061	1.38	0.168
	Leverage	--->	Purchasing Teams	0.158	0.007	2.003	0.045
	Size (Sales)	--->	ROA	-0.127	0.005	-1.553	0.12
	Leverage	--->	ROA	0.11	0.001	1.335	0.182
Industry-Level	Munificence	--->	ROA	-0.667	0	-1.615	0.106
	Dynamism	--->	ROA	0.55	0	1.335	0.182
	Complexity	--->	ROA	0.026	0.032	0.324	0.746

The two most common methods for conducting a mediation analysis are the Sobel, (1982) test and the Baron and Kenny, (1986) approach. Using the Baron and Kenny, (1986) approach, we first analyzed the direct relationship between supplier operations risk and firm financial performance, without the purchasing team construct in the model. A non-significant direct relationship was found between supplier operations risk and firm performance ($\beta = -0.082$, $p = 0.390$). Even in the absence of a significant direct effect, there is consensus, based on previous research, that the direct effect should not be used as a 'gatekeeper' for tests of mediation (Shrout

and Bolger, 2002; Hayes, 2017). Second, we ran the mediated model and the results indicated a significant relationship between supplier operations risk and the use of purchasing teams (refer to H3 results) and between the use of purchasing teams and financial performance ($\beta = 0.180$, $p = 0.038$), while the direct effect of supplier operations risk on firm performance was still found to be non-significant ($\beta = -0.12$, $p = 0.211$). As per the Baron and Kenny, (1986) approach, the results indicate that the use of purchasing teams act as a full mediator between supplier operations risk and firm performance, providing support for H5. The total effect,

which is the sum of direct and indirect effects, of supplier operations risk on firm performance, is -0.083. Table 3 has the

details of the total effects of independent variables.

TABLE 3: STANDARDIZED TOTAL (DIRECT + INDIRECT) EFFECTS

Total Effects		Independent Variables			
		Emerging Economy Sourcing	Supplier Operations Risk	Market Risk	Purchasing Teams
Dependent Variables	Supplier Operations Risk	0.145	0	0	0
	Market Risk	0.237	0	0	0
	Purchasing Teams	0.077	0.208	0.196	0
	Firm Performance	0.232	-0.083	-0.014	0.18

Similar to Hypothesis 5, we proposed in Hypothesis 6 that the use of purchasing teams would also mediate the relationship between market risk and firm financial performance. Employing the Baron and Kenny, (1986) approach, the direct relationship between market risk and firm financial performance, without the purchasing team construct, was found to be non-significant ($\beta = -0.020$, $p = 0.840$). However, a mediated model indicated a significant relationship between market risk and the use of purchasing teams (refer to H4 results) and between the use of purchasing teams and financial performance ($\beta = 0.180$, $p = 0.038$), while the direct effect of market risk on firm performance was still found to be non-significant ($\beta = -0.049$, $p = 0.616$). Therefore, the use of purchasing teams also acts as a full mediator between market risk and firm performance and the total effect of

market risk on firm performance is -0.014 (refer to Table 3), providing support for H6.

Finally, for H7, a significant relationship was found between low-cost country sourcing and firm performance ($\beta = 0.247$, $p = 0.003$) signifying the performance benefits of low-cost country sourcing. As discussed in Section 3.4 on secondary measures, previous studies have also identified return-on-sales (ROS) as an indicator of firm performance. ROS is net income before interest and tax divided by annual revenue (Azadegan et al., 2013) and it represents how efficiently a firm can convert its sales into profits. The path model was run with ROS as a performance measure for the robustness check of the empirical model in the study. The results of the structural model with ROS indicate excellent model fit ($\chi^2 = 15.29$, $df = 14$, $p = 0.358$; $\chi^2/df = 1.093$; CFI = 0.998; RMSEA = 0.026) (Kline, 2011) and Table 4 below provides the detailed results.

**TABLE 4: PATH MODEL RESULTS
 (WITH ROS AS THE PERFORMANCE VARIABLE)**

	Variables		Std. β	S.E.	C.R.	p-value
H1	Low Cost Country Sourcing	---> Supplier Operations Risk	0.145	0.005	1.698	0.09
H2	Low Cost Country Sourcing	---> Market Risk	0.237	0.005	2.835	0.005
H3	Supplier Operations Risk	---> Purchasing Teams	0.208	0.071	2.23	0.026
H4	Market Risk	---> Purchasing Teams	0.196	0.071	2.102	0.036
H5 & H6 (Mediation)	Purchasing Teams	---> ROS	0.134	0.009	1.609	0.108
	Supplier Operations Risk	---> ROS	-0.142	0.008	-1.547	0.122
	Market Risk	---> ROS	-0.173	0.008	-1.855	0.064
H7	Low Cost Country Sourcing	---> ROS	0.117	0	1.46	0.144
Controls						
Firm-Level	Size (Sales)	---> Purchasing Teams	0.109	0.061	1.38	0.168
	Leverage	---> Purchasing Teams	0.158	0.007	2.003	0.045
	Size (Sales)	---> ROS	-0.102	0.007	-1.308	0.191
	Leverage	---> ROS	0.024	0.001	0.309	0.757
Industry-Level	Munificence	---> ROS	-1.303	0	-3.298	***
	Dynamism	---> ROS	1.133	0	2.873	0.004
	Complexity	---> ROS	0.244	0.041	3.163	0.002

V. DISCUSSION

Using a combination of a survey from large U.S. firms and archival data, this research investigated the mediating role of purchasing teams on the relationship between low-cost country sourcing, supply risk, and firm performance. The empirical results provide several important findings that contribute to a better understanding of the approaches used by firms to manage supply risk when sourcing from low-cost regions and the implications for firm performance.

Supply risk was represented by two separate dimensions of supplier operations risk and market risk. Low-cost country sourcing was found to be positively related to market risk (H1). Factors such as market price volatility, market capacity, and foreign exchange rates, can be major sources of risk when sourcing from low-cost regions. However, only partial support was found for the relationship between low-cost country sourcing and supplier operations risk (H2). Several possible explanations exist for this

finding. It could be that firms see some suppliers as replaceable, and procurement organizations have alternative sources available if current suppliers create concerns in areas such as on-time delivery and cost performance. Alternatively, buffer-oriented risk management strategies, such as dual sourcing and safety stock inventory, could be in place to minimize the potential effects of supplier operations risks. Exploring the relationship between low-cost country sourcing and supplier operations risk represents an opportunity for future research.

Drawing on agency theory, this research contributes to the supply risk management literature by investigating the role of purchasing teams as a method to mitigate supply risk. Agency theory proposes that when supply risk becomes significant, firms are more likely to embrace behavior-based strategies, which focus on efforts to reduce the probability and magnitude of the occurrence of a negative event by managing processes and activities. Our findings indicate that firms increase the use of purchasing teams as supply risk increases

(H3 and H4). The effectiveness of behavior-based approaches has also been highlighted by some studies in the wake of the Covid-19 pandemic. For example, Ivanov and Das, (2020) point out that the traditional supply chain practice of holding risk mitigation inventory should change in favor of proactive measures, such as behavior-based approaches of integration and real-time collaboration to reduce the magnitude of future supply risk disruptions.

An interesting insight provided from the findings was that the use of purchasing teams was found to fully mediate the relationship between the two categories of supply risk and firm performance (H5 and H6). To further clarify the role of purchasing teams as a mediator, it is important to examine the individual relationships that make up the mediating model. The results indicate that direct effect of purchasing teams on firm performance is positive (Table 2: $\beta = 0.180$), but both supplier operations risk (Table 2: $\beta = -0.120$) and market risk (Table 2: $\beta = -0.049$) have a negative direct effect on firm performance. In comparison, as indicated in Table 3, the total standardized effect of supplier operations risk on firm performance is -0.083 , and the total standardized effect of market risk on firm performance is -0.014 . Thus, there is a reduction in the negative impact of supply risk on performance due to the use of purchasing teams. To confirm whether this reduction in the magnitude of supply risk is significant, we employed the online tool developed by Soper, (2019) to compare the magnitudes of the relationships. The results indicate that reduction is significant for supplier operations risk (t-value = 4.36; df = 268; $p < 0.001$) and for market risk (t-value = 4.12; df = 268; $p < 0.001$).

Our explanation is that purchasing teams provide opportunities for internal and external integration, which support the

creation of capabilities that allow firms to cope with the challenges of low-cost country sourcing. Such integration helps reduce the negative impact of supply risk on firm performance. Global sourcing is complex, and it is unlikely that the expertise required to effectively manage all the associated challenges resides within the procurement function.

5.1. Implications for Management Practice

Results from this study also provide important managerial implications. First, this research empirically investigates the relationship between low-cost country sourcing and firm financial performance (Stanczyk et al., 2017). While the literature on the performance implications of global sourcing has been a matter of debate, our results indicate that on average, low-cost country sourcing was associated with a significant improvement in ROA for the firms in our study (H7).

However, not identified in this research is the underlying reasons for the improvement in performance. An obvious hypothesis is that lower labor costs is a major contributing factor. However, other explanations are also possible, including access to suppliers with better technology, scarce raw materials, or superior quality (Haleem et al., 2018). Alternatively, perhaps the effects of less burdensome regulations in low-cost regions result in lower costs. If so, the potential for increased labor costs and more stringent regulations in the medium- or long-term may erode the future financial benefits of low-cost country sourcing.

Our study used archival data to measure firm performance (ROA) but did not examine the specific total cost of ownership factors to evaluate the relative costs and benefits of low-cost country sourcing

initiatives. Previous research has identified operational execution as one of the significant challenges to deliver the performance benefits from low-cost country sourcing initiatives (Kusaba et al., 2011). Therefore, while our findings indicate that low-cost country sourcing can improve firm performance, identifying the underlying reasons and capabilities required represents an opportunity for future research.

Second, this research demonstrates the effectiveness of purchasing teams as a mechanism to curb the probability and magnitude of the occurrence of a supply disruption. Although buffer-oriented strategies are easier to implement than behavior-based strategies, buffer-oriented strategies increase costs (e.g., higher inventories) and fail to address the underlying problems that create the supply risk.

Moreover, the results of the research demonstrate that firms sourcing from low-cost countries perceive disruptions from market risk (H2) to be significantly higher than supplier operations risk (H1). While supplier operations risk can be partially mitigated using buffer-oriented strategies, such as holding safety stock inventory, the elements that comprise market risk (e.g. commodity market price volatility, foreign exchange rates and market price fluctuations) are more complex and mostly beyond the direct control of most organizations. Our findings demonstrate that purchasing teams represent a means of enhancing internal and external integration, thereby providing an effective mechanism for improved decision-making when firms are faced with the complexities of managing market risks.

Overall, firms engaging in low-cost country sourcing, or contemplating doing so, should consider complementing traditional sourcing practices with capabilities to implement behavior-based risk management

strategies. While, this research examined the role of purchasing teams as a method to improve external (e.g., suppliers) and internal (e.g., cross-functional) integration, managers should recognize that in addition to purchasing teams, there are other behavior-oriented approaches available to address supply risk. These include early supplier involvement in new product development, quality management programs, and target costing initiatives (Zsidisin and Smith, 2005). Additional research can help to clarify the appropriate use of these behavior-oriented strategies, including the context.

VI. CONCLUSION

The primary responsibility of the procurement function is to identify suppliers that can provide their organization with the best combination of quality, cost, delivery, and sustainability performance. The result has been an expansion of global sourcing, including low-cost regions, as firms search the world in a quest to identify sources of supply that provide optimum value for their organization. However, globalization of supply chains has created supply risks for the procurement function. Uncertain lead times, communication difficulties, and exposure to currency fluctuations are but a few examples. Meanwhile, competitive pressures force firms to keep supply chains lean and responsive. The combination of these two factors makes supply chains more vulnerable today to disruptions.

This research focused on approaches by firms to manage supply risk when sourcing from low-cost regions and explored the implications for firm performance. In doing so, this paper contributes to research on global sourcing and supply risk management. Drawing on agency theory, we examined the role of purchasing teams as a method of mitigating supply risk. Findings indicate that purchasing team use represents a behavior-

based risk management strategy that can mediate the relationship between supply risk and firm performance. This study also explored how low-cost country sourcing influences supply risk and the performance implications of sourcing from low-cost regions.

As with most research, this study has limitations. First, due to our small sample size, statistical power may be insufficient to detect direct effects in mediation testing. While evaluating the mediation effect of the use of purchasing teams, the causal step approach (Baron and Kenny, 1986) was used, but the approach is contingent on multiple significance tests making it less powerful to detect small effects, especially when the sample size is small. Second, the sample was limited to large North American firms, limiting the generalizability of the findings. Additional research can explore the impact of supply risk and the use of purchasing teams among firms from Asia or Europe, or at medium-sized enterprises (SMEs). Finally, the values for the Composite Reliability (CR) and the Average Variance Extracted (AVE) for the purchasing teams construct were lower than the standard values and future studies should consider expanding the construct to parse the sub-dimensions.

Several interesting opportunities for future research also exist. First, this research focused on a behavior-based strategy to manage supply risk. A study comparing the effectiveness of buffer-oriented strategies, including carrying safety stock inventory or multiple sourcing, in combination with behavior-based strategies, such as purchasing teams, would provide insights regarding the performance implications, and identify how and when firms should deploy either of these strategies. In addition, investigating the associations between different elements of supply risk and types of purchasing teams

would help establish the efficacy of various purchasing teams in dealing with such risks.

As stated previously, there is considerable debate in the literature regarding the performance implications of global sourcing. While our findings indicate low-cost country sourcing was positively related to firm performance, these results are based on ROA for the firms in our sample. As with other large sample surveys, these results do not explain how or why performance improved through low-cost country sourcing. A case-based research study could provide a more detailed examination of low-cost country sourcing practices with the objective of identifying the total cost of ownership drivers. For example, a case-based research study could provide improved clarity to the sources of potential cost savings and identify areas where low-cost country sourcing may increase costs.

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APPENDIX A

Items ^a	Factor Loading (std.)	Mean ^b	S.E. ^c
Risk Management			
To what extent have the following risks affected your firm's purchasing and supply decisions in the last two years:			
Operations Risk (Composite Reliability = 0.829^c, AVE = 0.557^d)			
Supplier capacity	0.69	3.87	0.22
Supplier cost competitiveness	0.60	4.19	-
Supplier lead times	0.87	3.60	0.24
Supplier on-time delivery	0.83	3.71	0.23
Market Risk (Composite Reliability = 0.854^c, AVE = 0.643^d)			
Market capacity	0.87	3.50	-
Supply assurance	0.89	3.60	0.08
Commodity market price volatility	0.68	4.01	0.082
Foreign exchange rates	0.50	3.01	0.104
Market price fluctuations	0.71	3.67	0.078
Purchasing Teams			
In performing the purchasing/supply function, to what extent does your firm make use of the following:			
Purchasing Teams (Composite Reliability = 0.619^c, AVE = 0.351^d)			
Purchasing councils (purchasing personnel only)	0.59	3.09	0.16
Supplier councils (primarily key suppliers)	0.62	2.40	0.13
Commodity teams (purchasing personnel only)	0.56	3.66	-
Cross-functional teams	0.42	4.10	0.10

^a All items were measured on a 5-point Likert scale, ranging from 1(None) to 5(Extensive)

^b Represents mean score of all respondents.

^c Composite reliability values equal or exceeding .70 indicate strong scale reliability.

^d Average variance extracted values exceeding .50 indicate that the measures are reflective of the construct

^e This regression weight was fixed at 1.0. The S.E. was not estimated in these cases. However, by fixing a different parameter, we determined that the estimates of these scaled values are also statistically significant with $p < .01$.

Low-cost Country Sourcing

Please indicate the approximate percentage of your firm's total purchases from each of the following geographic regions:

Category	Region	Mean	Std. Dev
Developed Economy Sourcing	United States	54.72	27.91
	Canada	15.11	26.08
	Europe	10.73	12.72
	Japan	2.48	4.65
Emerging Economy Sourcing	China	7.71	10.53
	Latin American (including Mexico)	3.93	7.31
	All other Asia (e.g. India)	4.98	8.53
	Africa	0.34	1.3