



Inventory trends in emerging market supply chains: Evidence from the Indian automotive industry

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Available online 25 February 2015

KEYWORDS

Inventory management;
Supply chain management;
Emerging markets;
Panel studies;
Regression analysis

Abstract In the current paper, using a sample data of 58 firms consisting of automakers and auto component suppliers across a 14-year period, we study the factors contributing to efficient inventory management in the Indian automotive Industry. We use fixed effects regression models to document trends in inventory holdings over time and how this varies across inventory types and across tiers in the supply chain. Our results show that inventory holdings have declined differentially across tiers and across different types of inventories. We find tier-1 suppliers reduced all components of their inventories with the help of TQM and lean efforts.

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Introduction

In the last decade, emerging economies have attracted large investments from manufacturing industries as a result of which 27 percent of the current manufacturing in the world occurs in the four emerging countries Brazil, Russia, India and China (the BRIC nations) (Marsh, 2011). Given the current downturn in the global economy, especially in developed

economies such as the United States and Europe, this focus on emerging markets is likely to continue. Entry of multinational enterprise (MNE) firms often introduces innovative inventory and production management practices to create responsive and efficient supply chains; this is particularly true for the automotive supply chains across the world (Iyer, Saranga & Seshadri, 2013; McDermott & Corredoira, 2010; Vanichchinchai & Igel, 2011). With inventory holdings occupying a strategic and cost-bearing position in any supply chain, their improved management is expected to lead to better performance (Chen, Frank & Wu, 2005; Lieberman & Demeester, 1999). Yet, there is little empirical work to show the extent of operational gains that have been achieved when large investments and entry of MNE firms occur in manufacturing sectors of emerging markets.

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Peer-review under responsibility of Indian Institute of Management Bangalore.

<http://dx.doi.org/10.1016/j.iimb.2015.01.002>

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Most empirical studies on inventory holdings have focussed only on average inventories and have failed to capture the behaviour of inventory at the component level within firms and across supply chains. As manufacturing supply chains continue to spread across the globe, the efficiency of a supply chain will increasingly depend on the inventory holdings across the chain and the weakest links in a supply chain tend to be the lower tier suppliers from emerging markets such as India and China. Even though more and more assemblers today mandate just-in-time (JIT) supplies, unless the best practices are adapted by their vendors, the raw material inventory of assemblers simply gets transferred to upstream supply chain and is held in the form of finished goods inventory by the suppliers. Therefore it is important to understand and document the behaviour of various components of inventory, such as raw material (RM), work-in-process (WIP) and finished goods (FG) across the supply chains, and identify the factors driving the inventory management practices of emerging market firms (EMFs).

Literature on transaction costs, operations and supply chain management unearthed a variety of factors that influence the type and level of inventories carried by firms (Cachon & Fisher, 2000; Ellram, 1999; Petersen, Ragatz & Monczka, 2005). For example, transaction cost economics explains the reasons for holding RM stocks (Ellram, Tate, & Billington, 2008; Emery & Marques, 2011), while the WIP inventory levels are typically attributed to operational inefficiency, information asymmetry, poor quality of processes, and long production lead times (Deming, 1982; Womack, Jones & Roos, 1990). Higher levels of FG inventories on the other hand are attributed to the high product variety, product complexity, intensified competition, inflexible production technologies and higher buyer power (Cachon & Fisher, 2000; Cachon & Olivares, 2010; Emery & Marques, 2011). A vast array of process and operational improvement initiatives, such as total quality management (TQM), total productive maintenance (TPM), lean manufacturing, flexible manufacturing systems (FMS) and Six Sigma have been invented and adopted by firms in more advanced economies such as Japan, the United States, and Europe, in order to improve quality of products and reduce the level of inventories in their plants and supply chains.

However, these findings do not investigate if the environment in emerging economies, where institutional and manufacturing networks have historically functioned differently (Gulyani, 2001; Quadros, 2004; Ruamsook, Russel & Thomchick, 2007), is conducive to global best practices that result in operational excellence. Emerging economies are also plagued with delays due to customs clearances, lack of proper road and rail infrastructure, and inadequate enforcement of contractual agreements, and so on, which can create major obstacles to adoption of global best practices to manage emerging market supply chains.

We endeavour to fill this gap by conducting an empirical study on inventory holdings and their driving factors in the Indian automotive industry after the liberalization in 1991. For our empirical analysis, we use secondary data on 58 firms belonging to the Indian automotive industry, which includes automakers and auto component suppliers, during the period 1992 to 2005 to capture long-term trends in inventory holdings. We also carried out a "tierization" exercise to classify

our sample firms into automakers (tier-0), their immediate suppliers (tier-1 suppliers) and the suppliers of tier-1 suppliers (tier-2 suppliers), thus identifying the entire supply chain. In addition, we also carried out qualitative studies and case studies of some of the sample firms (by going through industry reports and conducting personal interviews with senior executives at these firms). Our findings indicate that after liberalization of the Indian economy, reduction in transaction costs and adoption of quality and process improvement initiatives have led to important gains in average inventory reduction in the Indian automotive sector.

Our empirical results however also show that these gains tend to vary by the location in the supply chain where the inventory is held (i.e., tier), and the type of inventory being held (i.e., RM, WIP and FG). We, therefore, further analyzed this nuanced evidence obtained from data, through qualitative insights garnered from our expert interviews. The data analysis showed that tier-1 suppliers are the best performers and managed to reduce all components of inventories significantly. Qualitative analysis indicates that quality and process upgrades through adoption of global best practices facilitated by the new MNE entrants have paved the way towards more efficient inventory management in these firms. Automakers (tier-0) have also significantly reduced their RM and WIP inventories but failed to reduce FG inventories. Increased product variety, intensified competition and poor transportation networks are causing the failure in FG reduction, as per the expert opinions. Tier-2 firms on the other hand managed to reduce only RM inventories significantly. Again, our qualitative analysis indicates multiple reasons for failure of these upstream suppliers. While the higher buyer power of tier-1 and tier-0 firms seems to be forcing the tier-2 suppliers to hold higher FG stocks, the batch production practices and lack of exposure to global best practices seem to have hampered tier-2 firms' efforts towards WIP reduction.

Theoretical background and literature review

Role of transaction cost economics on inventory management

It is well-established in the field of supply chain management (SCM) that a firm can reduce its RM and WIP stocks by outsourcing some of their production to suppliers and by making suppliers hold it in the form of their FG inventory. The popularity of JIT supplies can be attributed to this factor. However, for this strategy to work, one needs (a) capable suppliers and (b) outsourcing to be more cost-effective than in-house production. According to transaction cost economics (TCE), vertically integrated firms incur production and governance costs for manufacturing components, while outsourcing firms incur production and transaction costs while buying components (Emery & Marques, 2011). Costs of production for general purpose components of vertically integrated firms are likely to be higher than for firms that outsource to a third party supplier, as suppliers can exploit economies of scale by pooling demand from various customers. However for special purpose components, due to asset specificity, production costs remain the same in both cases (Williamson, 1981).

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