Lean, leaner, too lean? The inventory-performance link revisited
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A B S T R A C T
While firms increasingly adopt lean inventory practices, there is limited evidence that inventory leanness leads to improved firm performance. This study reexamines this relationship in an attempt to overcome some shortcomings of previous research. To that end, a theory-based measure of inventory leanness, which takes into account industry-specific inventory management characteristics, is proposed. The analysis of a large panel data set of U.S. manufacturing companies reveals that the significance and shape of the inventory–performance relationship varies substantially across industries. This relationship is significant in two-thirds of the 54 industries studied. In most of these instances, the relationship is concave, suggesting that there is an optimum level of inventory leanness beyond which firm performance deteriorates. A post-hoc analysis is conducted to identify industry-level characteristics that may determine the nature the inventory–performance relationship. Managerial implications are discussed and several opportunities for future research are outlined.

1. Introduction

The lean production philosophy considers inventory a form of waste that should be minimized (Womack et al., 1990). In recent decades, as lean production has gained widespread adoption (IndustryWeek, 2008), lean inventory management has become synonymous with good inventory management (Hall, 1983; Zipkin, 1991; Chen et al., 2005; Cooper and Maskell, 2008). As a result, inventories have been decreasing in many industries (Chen et al., 2005, 2007). Yet evidence of improved firm performance is mixed (Rumyantsev and Netessine, 2007). The purpose of this research is to investigate the effect of inventory leanness on firm performance by analyzing empirical data from the U.S. manufacturing industry.

Specifically, this study aims to contribute to existing research on three accounts: first, the effect of inventory leanness on firm performance is explored on an industry-by-industry basis. The advantage of this approach is that it controls for industry-specific characteristics that may lead to different types of relationships between inventory leanness and firm performance in various industries. When data from multiple industries are pooled, as is the case in most previous studies, the dissimilar functional forms present in these industries may mask each other and yield insignificant estimation results. Hence, the analysis of data by narrowly defined industries creates a more comprehensive understanding of the relationship between inventory leanness and firm performance.

Second, the functional form of this relationship is explored. While previous empirical studies have assumed a linear relationship only, the use of a more flexible functional form affords a richer perspective on the inventory–performance relationship. For example, there may be industries in which inventory leanness increases firm performance up to a certain point beyond which the incremental effect becomes negative.

Third, an alternative measure of inventory leanness, the Empirical Leanness Indicator (ELI), is proposed. The distinguishing feature of the ELI, as compared to previously used measures, is that it takes into account the nonlinear relationship between firm size and inventory holdings. Prior research has often relied on metrics such as inventory turnover (Schonberger, 2007; Gaur et al., 2005) and average inventory levels (King and Lenox, 2001) to gauge inventory leanness. These measures ignore the effect of firm size on inventory holdings, i.e., economies of scale in inventory management, and can lead to bias in estimation results. Drawing on inventory theory, the ELI estimates a firm’s inventory leanness relative to industry-specific norms and takes into account economies of scale. Subsequently, the ELI and conventional inventory leanness measures are compared in terms of their explanatory power in describing the relationship between inventory leanness and firm performance.

The analyses of data from a large set of publicly traded U.S. manufacturing firms presented here provide detailed insights into the linkages between inventory leanness and firm performance, thereby contributing to both inventory theory and the theory of lean production. From a practical perspective, managers can use the methodology presented here as a new technique to benchmark their operational performance.

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Lean production is typically conceptualized as a multi-dimensional construct composed of multiple Lean practices such as total quality control, total productive maintenance, and just-in-time (White, 1993; Fullerton and McWatters, 2001; Cua et al., 2001; Shah and Ward, 2003). Prior studies not only indicate that these practices are widely implemented (White, 1993), but also present evidence that their implementation results in improved operational performance in terms of inventory management, process control, information flows, human factors, delivery, flexibility and quality (Norris et al., 1994; Fullerton and McWatters, 2001; Cua et al., 2001). Moreover, multiple studies find that financial performance is positively affected by the implementation of Lean production practices (Inman and Mehr, 1992; White, 1993; Callen et al., 2000; Fullerton et al., 2003). Jayaram et al. (2008), however, find no significant effects of Lean production on firm performance (profitability and ROA).

While most of the survey-based studies on Lean production present at least some evidence of a positive impact of Lean production practices on firm performance, there are several common weaknesses among these studies. First, nearly all of them rely on subjective assessments of firm performance in addition to subjective evaluations of Lean production. This approach may introduce systematic measurement error resulting in biased estimation results (Podsakoff et al., 2003). Second, none of these studies take into account the endogeneity in their data sets (Huson and White, 1993; Fullerton and McWatters, 2001; Cua et al., 2001; Shah and Ward, 2003). Prior studies not only indicate that these practices are widely implemented (White, 1993), but also present evidence that their implementation results in improved operational performance in terms of inventory management, process control, information flows, human factors, delivery, flexibility and quality (Norris et al., 1994; Fullerton and McWatters, 2001; Cua et al., 2001). Moreover, multiple studies find that financial performance is positively affected by the implementation of Lean production practices (Inman and Mehr, 1992; White, 1993; Callen et al., 2000; Fullerton and McWatters, 2001; Fullerton et al., 2003). Jayaram et al. (2008), however, find no significant effects of Lean production on firm performance (profitability and ROA).

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