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Firm performance in dynamic environments: The role of operational slack and operational scope

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ABSTRACT

This study examines the effects of operational scope (breadth of product offering, extent of geographical diversification, and extent to which production processes can effectively meet varying demand) and operational slack (resources in excess of what is required to fulfill expected demand) on firm performance, contingent on two components of a firm's dynamic environment, unpredictability and instability. We collate quarterly data on 3857 publicly traded firms in 19 industries from the years 1991 to 2013 (representing 99,559 firm-quarter observations). Using panel data analysis, we find that narrow product offerings, low geographical diversification, low levels of excess capacity, and low inventory slack are each positively associated with firm performance. More importantly though, we find that operational scope is associated with improved performance in unpredictable environments, whereas operational slack is associated with improved performance in unstable environments. These findings contribute to the research on operations strategy by identifying the industry-specific environmental conditions under which operational slack and operational scope are associated with firm performance.

1. Introduction

In order to remain successful in competitive markets, organizations must maintain a stable operational core under environmental variation (Thompson, 1967). Examples of exogenous variations include pricing and scheduling uncertainties from a firm's upstream supply of materials or the downstream demand uncertainties for a firm's finished goods (Lee and Billington, 1992; Bozarth et al., 2009). Variations are reflected in the environmental dynamism of an industry, such that firms in more dynamic environments will experience more variations than those in less dynamic environments. In this study, we investigate two operational strategies for managing the potential consequences arising from dynamic environments: maintaining operational slack and/or broadening operational scope (Boyer and Leong, 1996). Specifically, we investigate whether operational slack and operational scope moderate the relationships between two components of environmental dynamism – unpredictability and instability – and firm performance. Our study aims to address the question: How do operational slack and operational scope moderate the association between environmental dynamism (that is unpredictability and instability) and firm performance? Our empirical setting draws on 3857 publicly traded manufacturing firms, representing 99,559 quarterly observations from 1991 to 2013.

Operational slack represents the buffer resources available to support the operational activities of a firm and allows firms to better match variations between supply and demand. Insufficient operational slack leads to reduced responsiveness to demand variations and reduced reliability of product deliveries (Wefald et al., 2010). Excess capacity and inventory (each representing a form of operational slack) help firms effectively manage demand variation for their products (Sharfman et al., 1988; Palich et al., 2000). Operational scope represents a firm's breadth of product offering, geographic diversification, and the extent to which a firm can utilize its production technology to effectively meet varying demand (Tang and Tikoo, 1999; Vokurka and O'Leary-Kelly, 2000; Ramdas, 2003; Boyabatli and Toktay, 2004; Benito-Osorio et al., 2012). Diverse product offerings allow firms to better manage product-specific

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sales fluctuations while broadening their market reach through a larger product portfolio. Geographic diversification involves the establishment of manufacturing facilities and sales locales in different regions, which allows firms to hedge against demand variances across regions and countries (Boyabatli and Toktay, 2004; Linebaugh and Hagerty, 2011). Additionally, firms can implement production processes to lower the costs associated with altering their output, thus broadening their process scope. In summary, firms can leverage both operational scope and operational slack to minimize the potential consequences from dynamic environments.

Prior studies have separately found support for both positive and negative associations between operational scope and operational slack and performance (operationalized as profitability, innovation, or operational risk management initiatives). See Daniel et al. (2004), Vokurka and O'Leary-Kelly (2000), and Benito-Osorio et al. (2012) for excellent reviews of prior literature on operational scope and operational slack. Swamidass and Newell (1987) find that aspects of manufacturing flexibility such as broad product and process scope, two forms of operational scope in our study, are associated with increased performance in uncertain markets. Yet, Pagell and Krause (2004) later counter these results, indicating that the prior findings "might not generalize into today's business climate" (p. 630). Recent research continues to focus on better understanding the effects of narrow and broad operational scopes on firm performance (Mukherjee et al., 2000; Ketokivi and Jokinen, 2006; Goyal and Netessine, 2007). Similarly, through a meta-analysis of 66 studies, Daniel et al. (2004) conclude that slack resources are positively associated with firm performance, and the relationship is strengthened when industry-relative performance measures are employed. However, specific to the operations context, Modi and Mishra (2011) find evidence supporting the benefits from lean operations (low slack), such that more efficient firms (with respect to inventory and production resources) are positively associated with financial performance, but with diminishing returns. Overall, findings associating operational scope and operational slack with firm performance remain inconsistent.

We attempt to address the mixed findings in the literature in order to better understand the effects of operational scope and slack resources while considering two distinct components of a firm's dynamic environment, unpredictability and instability. Unpredictability is the "...lack of regularity in the pattern of change in an environment", while instability is "...the extent to which an environment exhibits change" (Miller et al., 2006, p. 99). Considering two distinct components of environmental dynamism, unpredictability and instability, we hypothesize that increased operational scope (as measured by the breadth of a firm's product offering, breadth of the geographical regions in which a firm operates, and the extent to which a firm's production processes can effectively meet varying demand) is positively associated with firm performance in unpredictable markets, whereas operational slack (as measured by plant capacity utilization, inventory levels, and cash-to-cash cycles) is positively associated with firm performance in unstable markets. Our analysis finds that unpredictability and instability are negatively associated with firm performance. However, we find that broader product and geographic scope are each associated with improved firm performance in unpredictable markets, whereas higher capacity slack is associated with improved performance in unstable markets. The consideration of a firm's environmental dimensions of instability and unpredictability bears importance, because it reveals that it may not always be beneficial to increase operational scope or operational slack to improve performance. This analysis offers guidance for managers to leverage operational scope or operational slack to mitigate the negative consequences arising from unpredictable or unstable environments.

In the next section, we review the prior literature on dynamism, operational scope, and slack and present hypotheses. Next, we describe the data, measures, and methods used to test the hypotheses. Last, we present the results from our study and then discuss theoretical contributions and managerial implications.

2. Theory and hypotheses

Operational scope and operational slack can both be utilized to manage operations in dynamic environments. In this section, we briefly describe the concept of environmental dynamism and two of its components: unpredictability and instability. Next, we elaborate on the two operational strategies of scope and slack, specifically highlighting their respective roles in the face of environmental dynamism. Last, we conceptualize how operational scope (slack) moderates the relationship between unpredictability (instability) and firm performance.

2.1. Environmental dynamism

Dess and Beard (1984) categorized the environment of organizations along three dimensions: munificence, dynamism, and complexity. Keats and Hitt (1988) attempted to further understand these three different dimensions of the environment and found that *environmental dynamism* is the "dominant influence" (p. 587) regarding firm decisions and performance. Dynamism, as defined by Dess and Beard (1984, p. 56), is "change that is hard to predict and that heightens uncertainty". In the presence of industry dynamism, a firm's resource allocation decisions largely influence its ability to outperform competitors (Sirmon et al., 2007). As such, it is well documented that it is more challenging to manage firms in highly dynamic environments, and therefore, performance is negatively associated with high levels of environmental dynamism (Keats and Hitt, 1988; Goll and Rasheed, 1997; Baum and Wally, 2003).

Recognizing that environmental dynamism is a multidimensional construct, Wholey and Brittain (1989) deconstructed environmental dynamism into four separate dimensions: amplitude, predictability, frequency, and instability. Their findings implied that three of these dimensions were unique, with amplitude and instability highly correlated to one another. Miller et al. (2006) later collapse these three components into two measures, instability and unpredictability. As noted by Wholey and Brittain (1989), "A considerable body of empirical work in organization theory relies on instability measures to capture unpredictability, an operational definition that may be misleading" (p. 878). In an attempt to better understand how scope and slack can be utilized to better manage dynamic environments; our analysis will concentrate on these two dimensions of environmental dynamism, unpredictability and instability.

2.2. Unpredictability and instability

Wholey and Brittain (1989) define predictability as "the degree to which the future can be anticipated solely on the basis of knowledge of the past" (p. 869). Therefore, *unpredictability* refers to the conditions where the future cannot accurately be forecast using historical information. This dimension of dynamism refers to deviations in the future demand from expected patterns, resulting in the inability to accurately forecast production. *Instability* refers to the overall volatility of demand (Wholey and Brittain, 1989).

Fig. 1 graphically illustrates the distinction between unpredictability and instability with aggregate industry sales data from our sample. Each of the four charts represents the quarterly sales from an industry given either, high or low, unpredictability and instability (as compared to the median values from all industries in our data). The *x*-axes represent 17 sequential time periods (quarters) beginning in the fourth quarter of 1993 and ending in the fourth quarter of 1997, and the *y*-axes represent the associated