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The differing impacts of operational and financial slack on occupational safety in varying market conditions

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ABSTRACT

Operations management scholars have long debated the right level of slack resources required to optimize a production system. Recent research suggests that the right level of operational slack, typically in the form of inventory, is very little but not none. However, this conclusion was reached without considering the role of slack resources in occupational safety, which is a critical oversight since the safety literature predicts that the reduction of operational slack harms workers. To address this gap, secondary data from 3945 publically listed U.S. firms is used to explore the role of operational and financial slack as well as market factors in occupational safety. The results show that decreasing operational slack harms workers and that this effect is mitigated when firms hold higher levels of financial slack. Furthermore, the external market environment also plays a crucial role in the operational slack – safety relationship.

1. Introduction

The essence of operations management is transforming inputs into outputs in an efficient and effective manner. Being efficient and effective has traditionally meant managing an operation or supply chain with low levels of extra or slack resources and capacities (Eroglu and Hofer, 2011).

Slack is "*the pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output*" (Nohria and Gulati, 1996, p. 1246). Managers focus their efforts on finding the optimal level of slack, which for most firms means less slack. Modi and Mishra (2011) identified that at most 10% of firms would benefit from increasing their level of slack and operations management research on operational slack has generally concluded that reducing slack improves operational performance (to a point) when performance is operationalized as profits, cost, quality, delivery and flexibility (Eroglu and Hofer, 2011; Modi and Mishra, 2011; Kovach et al., 2015). In addition, the increased focus on creating more sustainable operations has highlighted that reducing slack is also associated with more efficient use of resources and less pollution (e.g., King and Lenox, 2001).

The discourse in operations on the optimal level of slack mirrors the long running debate on the relative merits of slack resources in the organizational literature (e.g., March and Simon, 1958; Sonenshein, 2014; Kovach et al., 2015). Slack can provide organizations with opportunities to develop new products and enter new markets or it can be a financial burden and indicative of inefficiencies (Tan and Peng, 2003). The arguments for slack posit that slack resources are a useful buffer (Bourgeois, 1981) that allow a firm to innovate (Nohria and Gulati, 1996), survive environmental changes or supply chain disruptions (Hendricks et al., 2009) and profit (Lawson, 2001). Agency theorists on the other hand argue that managers (i.e., agents) accrue and misuse slack resources because of agency problems (Jensen, 1993). In the operations management literature the debate has generally focused on the potential to reduce costs by removing slack (Eroglu and Hofer, 2011).

We enter this discourse from a different perspective by examining the role of operational slack in terms of the safety of operational workers. Safety regulations and safety management systems are designed to protect workers from harm in the form of injuries and occupational illnesses that occur at work (Pagell et al., 2014); a

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safe production system is one where workers are not harmed when producing goods or services. The recent focus on creating more sustainable operations has lead researchers to expand the conceptualization of operational performance to explicitly consider safety as a primary operational outcome (Brown et al., 2000; Pagell et al., 2015). Research on the linkages between safety and other operational outcomes suggests that quality and safety often move in tandem (e.g., Brown, 1996; Das et al., 2008) and that safety need not be traded off for other operational goals if appropriate managerial systems are in place (Lo et al., 2014; Pagell et al., 2015). However, industrial accidents are still very common and in many firms there is still a tension between creating a safe production system and achieving other operational goals, such as reducing waste (e.g., Pagell et al., 2015).

The operational literature concludes that slack, if not employed strategically to purposefully decouple processes, is inefficient. Yet, safety researchers have concluded that reducing operational slack harms workers (Das et al., 2008; Love et al., 2015). For instance, econometric research shows that a 1% increase in capacity utilization (a decrease in operational slack) in manufacturing firms in the USA is associated with a 0.69% increase in workplace injuries (Asfaw et al., 2011). Understanding slack's relationship with safety may help to explain why there is a tension between safety and other operational outcomes in many firms. Therefore, the critical managerial and policy issue this research addresses is that the literature suggests that the relationship between operational slack and safety could be different from the relationship between operational slack and other operational outcomes.

Safety is a primary metric of operational performance and a basic indicator of the social sustainability of a firm. Hence, efforts to become more operationally efficient may harm the workforce and hinder efforts to make an operation more socially sustainable. Much of the existing debate on slack addresses the question of if slack resources are good or bad for firm economic and operational performance. By considering safety as an operational outcome this research addresses the possibility that the level of slack creates trade-offs between various forms of operational performance. This suggests a more complex relationship between slack and various operational and firm outcomes.

Workers and communities are directly and negatively impacted by poor safety. Safety is then an important operational and societal outcome and if tradeoffs do exist they will matter to managers and a wide range of societal stakeholders. Therefore, this research takes a multi-stakeholder perspective and explores the relationship between slack and worker safety from both the firm's perspective and from the perspective of regulators as representatives for society.

The present discourse on slack is fragmented with managerial scholars focusing mainly on economic outcomes like quality or profits while safety researchers only examine worker outcomes. Few studies have considered the impact of having little or no slack on safety (Filer and Golbe, 2003). Slack resources can be used to respond to environmental uncertainty, supply chain disruptions, or engage in risky innovation projects (Bourgeois, 1981; Nohria and Gulati, 1996; Love and Nohria, 2005; Hendricks et al., 2009). "*Slack resources include excess inputs such as redundant employees, unused capacity, and unnecessary capital expenditures. They also include unexploited opportunities to increase outputs, such as increases in the margins and revenues that might be derived from customers and innovations that might push a firm closer to the technology frontier*" (Nohria and Gulati, 1996, p. 1246).

Slack then has two dimensions: Excess inputs or resources and unexploited opportunities (Nohria and Gulati, 1996). In this research we explore the input dimension of slack via operational slack and the opportunity dimension of slack via financial slack. "*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 … Excess capacity and inventory (each representing a form of operational slack) help firms effectively manage demand variation for their products*" (Kovach et al., 2015, p. 1). Financial slack is a form of Nohria and Gultai's (1996) unexploited opportunities in that the ability to take on further debt, deploy retained earnings or sell assets allows a firm to respond to threats and opportunities (Lungeanu et al., 2016).

We posit that one of the reasons for the divergent views of slack in the literature is that operational and financial slack have different organizational roles and lead to different outcomes. We base this contention on the coupling component of *Normal Accident Theory* (NAT) (Perrow, 1981). NAT suggests that in complex environments, a reduction in operational slack leads to higher levels of coupling and accidents. Financial slack might be used to offset the negative safety implications of coupling.

Globalization and a focus on efficiency have generally meant a reduction in operational slack and more tightly coupled operations. For instance, the inventory to shipment ratio for U.S. manufacturers declined from 1.46 in 1995 to 1.34 in Sep. 2016 (United States Census Bureau, 2012, 2016,[1]). Increasing coupling generally improves operational efficiency (e.g., Modi and Mishra, 2011). NAT and research in both the safety and operations domains (Babson, 1993; Love et al., 2015) predict that this increase in coupling will have negative implications for operational workers in the guise of increased stress or a greater likelihood of injury. This prediction is explored via the following research question: *(1) Does increasing coupling by reducing operational slack lead to higher levels of safety violations?*

Financial slack is a means to manage risk and uncertainties (Bourgeois, 1981, 1985). Firms with buffers of financial slack would have the resources to potentially mitigate the negative safety implications of tighter coupling. Increased financial slack would allow a firm to train operational workers, hire safety or ergonomic experts or develop innovative new processes. Hence, we propose that organizations can employ financial slack to counteract the increased coupling that results from reducing operational slack. Thus, we explore the following research question *(2) Can financial slack attenuate the impact of tightly coupled operations on safety violations?*

Regulators have typically examined the relative danger of a firm's operations to determine the likelihood that workers will be harmed; safety risks are higher in a mine than in a distribution center. Research questions one and two suggest that operational and financial slack may also predict how likely firms are to harm their workers. Previous research suggested that industry or market characteristics such as munificence, dynamism, and complexity are important factors when it comes to identifying optimum levels of slack for specific operational outcomes (Eroglu and Hofer, 2011; Modi and Mishra, 2011; Kovach et al., 2015). Eroglu and Hofer (2011) for example identified that the shape of the inventory-performance (i.e., ROS, ROA) relationship varies across industry. If the optimal level of slack from an economic perspective, is due to market conditions then it is possible that accounting for an industry's wider market characteristics may help regulators predict which workers are at risk, and design regulation accordingly. We test this notion by addressing the following research question: *(3) Can an industry's market characteristics intensify the impact of tightly coupled operations on safety violations?*

These research questions are addressed using longitudinal

[1] U.S. Census Bureau, Statistical Abstract of the United States: 2012, Table 1018; U.S. Census Bureau, Full Report on Manufacturers' Shipments, Inventories and Orders, Sep. 2016, Table 7.

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