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Managing operational disruptions through capital adequacy and process improvement

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ABSTRACT

Firms maintain a capital charge to manage the risk of low-frequency, high-impact operational disruptions. The loss distribution approach (LDA) measures the capital charge using two inputs: the frequency and severity of operational disruptions. In this study, we investigate whether or not capital charge could be combined with process improvement, an approach predominantly employed for managing high-frequency, low-impact operational disruptions. Using the categorization of events defined by the Basel Accord for different types of operational risk events, we verify three propositions. First, we test whether classification of operational disruptions is warranted to manage the risk. Second, we posit that classification of operational disruptions will display different statistical properties in manufacturing and in the financial services sector. Finally, we test whether risk of operational disruptions can be managed through a combination of process improvement and capital adequacy. We obtained data on 5442 operational disruptions and ran Monte Carlo simulations spanning both these sectors and seven event types. The results reveal that process improvement can be a first line of defense to manage certain types of operational risk events.

1. Introduction

The impact of operational disruptions for a firm includes high costs, quality failure, delay in delivery and reduced customer service levels. All of these factors may negatively influence the firms' operating and financial performance (Hendricks & Singhal, 2005; Wagner & Bode, 2008). Examples include external events such as the 2011 earthquake in Japan that disrupted global supply chains of large firms (e.g., Toyota) and internal events like the implementation failure of an ERP system that delayed shipments at Nestle (Barker & Frolick, 2003). The risk of such operational disruptions, formally termed "operational risk" has been defined by the Basel Committee as "the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events" (BCBS, 2001). Fig. 1 elaborates on this definition and shows a simplified linkage between triggers, events and impact of operational risk. As noted in the definition of operational risk, the triggers are associated with raw materials, people, technology or external events. These triggers can create operational disruptions which can cause large operational losses.

At the outset, firms can improve processes to mitigate the negative impact of operational disruptions (Wang, Gilland, & Tomlin, 2010). However, since most of these operational disruptions are infrequent and since some firms may not have experienced such failures first-hand, process improvement can occur by collecting data on operational disruptions from other firms in the industry. Alternatively, firms can also maintain a capital charge to cover losses arising from potential operational disruptions. Such a strategy involves the use of loss distribution approaches (LDAs) to measure operational risk within a certain confidence level. A common approach is the parametric LDA. Two inputs in LDA are the frequency with which operational disruptions occur and the severity of the operational disruption (i.e., the monetary amount of loss suffered). Firms can also choose to employ either one or both strategies—improving their processes (*process improvement*) or maintaining a capital charge (*capital adequacy*). However, it is unclear under what event types of operational disruptions, firms would resort to one or both of these strategies. Thus, the research objective of this paper is to examine the event types and provide insights into which event types of operational disruptions should be mitigated and diversified through process improvement and for which event types firms should keep a capital charge.

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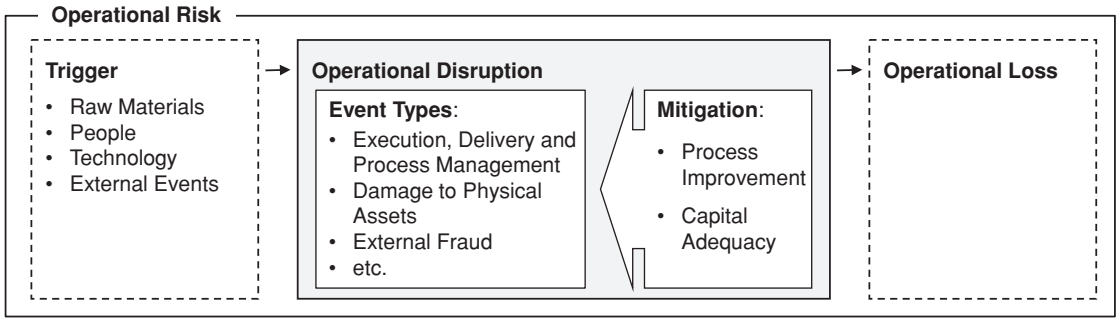

Fig. 1. Operational risk: losses from operational disruptions.

Table 1
Management of operational disruptions through process improvement or capital adequacy (examples).

	Event type	Execution, Delivery and Process Management		External Fraud	
	Action type	Process improvement	Capital adequacy	Process improvement	Capital adequacy
Firm 1		High	Low	Low	High
Firm 2		Low	High	High	Low
Firm 3		High	High	High	High

To explicate this research objective, please reconsider Fig. 1. We focus on operational disruptions, specifically on event types highlighting whether a firm should keep a capital charge and/or invest in process improvement to mitigate the impact of the operational loss. Table 1 provides simple examples of three firms (*Firm 1, Firm 2, Firm 3*) undergoing two types of operational disruptions: (i) a failure resulting from inadequate or failed internal processes that falls under the event type *Execution, Delivery and Process Management* and (ii) fraudulent action carried out by customers or external parties that falls under the event type *External Fraud*. We have used the classification of event types of operational disruptions as prescribed by the BCBS. In Appendix A we elaborate on each event type.

To manage the event type Execution, Delivery and Process Management in banks, Firm 1 can invest in process improvement and keep a low capital charge in case operational losses still occur. Such investments may involve costs such as cost of implementing new systems, hiring additional employees or using quality control processes (Wang, Plante, & Tang, 2013). Conversely, rather than investing in process improvement, Firm 2 can keep a capital charge aside in case a loss occurs from such type of operational disruption. Moreover, Firm 3 can invest in process improvement as its first line of defense and also keep a high capital charge in case operational losses still occur. We speculate that for this type of operational disruption, process improvement, the strategy adopted by Firm 1 as a first step will ensure better management of operational risk.

The second type of disruption, External Fraud, consists of fraudulent action carried out by customers or external parties, for example trying to obtain wrongful benefit through providing fake information. To manage this type of operational disruption, Firm 1 focuses on capital adequacy and keeps a capital charge, Firm 2 on process improvement and Firm 3 on both. We speculate that for External Fraud, the strategy adopted by Firm 3 of combining both process improvement and capital adequacy as a first step will ensure better management of operational risk. In this instance, we speculate that firms should keep a capital charge or have other contingency plans in case the risks of such operational disruptions materialize since the benefits of internal process improvements may be minimal in mitigating External Fraud. Given both these examples, our study shows the appropriate strategy, that is, process improvement and/or capital adequacy given different event types of operational disruptions.

We also contend that the cost invested in process improvement (for mitigation and diversification) for the relevant event type (Execution, Delivery and Process Management) should be lower than the reduction in expected loss. Similarly, for event types where keeping a capital charge would be the appropriate strategy (External Fraud), we conclude that the cost of raising capital for that particular charge should be lower than the reduction in expected loss. In this regard, our research aims at providing answers as to why a firm should choose one strategy or both. Since the investments in process improvement should translate into lower costs and/or higher revenue, we postulate that events with relatively higher frequency and lower impact lend themselves to process improvement. Conversely, event types that display random occurrence and/or higher impact should be considered in the firm's capital planning process. More technically, the mean value of the distribution of the losses can be reduced by investments in process improvement and be viewed as a mechanism for long-term cost reduction and revenue enhancement. For the remaining unexpected losses, firms should estimate a capital charge. We propose a methodology to identify event types that can be managed through either strategy or a combination of process improvement and capital adequacy strategies.

Moreover, research identifying whether or not firms in the manufacturing sector and service sector would choose different strategies for the same event type remains sparse. Our study answers this question and contributes to the literature in at least three ways. First, we elaborate on empirical loss distributions by examining different categories of operational disruptions. We employ the event type classification of operational disruptions as prescribed by the BCBS. Second, we not only examine these distributions in the service industries in the finance, insurance and real estate (FIRE) sector but also include industries in the manufacturing sector. By examining the two distinct sectors, FIRE and manufacturing, our findings suggest if the strategy adopted for process improvement or maintaining a capital charge differs in these sectors. We fit actual loss data spanning over 13 years for every event type to the theoretical distributions (Frachot, Moudoulaud, & Roncalli, 2007). The frequency of the occurrence of the hazard events can be modeled as a Poisson or negative binomial distribution. The stochastic loss amount (the severity) of a hazard event can be modeled as a lognormal or a combined lognormal and generalized Pareto distribution (GPD, see Vanini & Leippold, 2005). We estimate parameters of these distributions and compare the results with respect to different model specifications. Third, research has delineated operational disruptions that occur with high frequency but have low impact from disruptions that occur with low frequency but have high impact. This distinction is understandable since the strategies to manage both types of disruptions are inherently different. This