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A Multi-Method Investigation of Overordering Behavior in Supply Chains

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Misperception of feedback (MOF) hypothesis, a central theory in dynamic decision making, posits that decision makers are incapable of being cognizant of feedback delays and underweight the supply line of inventories and capacities. This paper reconsiders this assumption. Field studies of manufacturing supply chains in India revealed an alternative mechanism of overordering, which I call *supply line discounting*. The weak institutional structures, capacity shortages, and polychronic cultures that characterize emerging economies engender *deliberate* order inflation by buyers, which triggers *supply line discounting* and undersupply by suppliers. An eye tracking experiment helps flesh out and validate this behavior.

KEYWORDS: Case study; Eye tracking experiment; Misperception of feedback (MOF); Overreaction; Order inflation; Supply line discounting.

INTRODUCTION

Dynamic decision-making involves making a series of decisions under conditions in which the state of the world changes, both autonomously and as a consequence of the decision maker's actions, thereby conditioning future decisions. Feedback delays and nonlinearities make tasks dynamically complex; a long line of experimental and theoretical research highlights the challenges of learning in such settings (Sterman, 1989a; Paich & Sterman, 1993; Diehl & Sterman, 1995; Sterman, 2000; Cronin, Gonzalez, & Sterman, 2009; Rahmandad & Repenning, 2016). First, according to the *supply line underweighting* or *misperception of feedback* (MOF) hypothesis (Sterman, 1989b; a; Sterman, 2000), subjects ignore the time lag between initiation of a control action and its full effect. Second, they are overly aggressive in correcting the discrepancies between the desired and actual state of the variable of interest. "It is as if the subject purchases a car, but has to wait for delivery. The next day, the garage still empty, the subject goes to the dealer and orders another one." (Sterman, 1989a).

MOF hypothesis has found empirical support in a wide range of settings, including firefighting (Brehmer, 1992), workforce planning (Größler & Zock, 2010), management of renewable resources (Moxnes, 1998) and software development projects (Sengupta & Abdel-Hamid, 1993; Rahmandad & Repenning, 2016), capacity management (Sterman, 1989a), inventory management (Diehl & Sterman, 1995), and supply chain management (SCM) (Sterman, 1989b). Participants misperceive the supply line and "produce wildly oscillating production rates, allow their fire-fighting headquarters to burn down, and find their fleets idled after overexploiting their fisheries." (Repenning & Sterman, 2002). MOF hypothesis is thus central to dynamic decision making literature,

Despite broad agreement regarding the MOF, Niranjan, Wagner, and Bode (2011) highlight the missing link between the MOF hypothesis and its theoretical foundation viz. *anchoring & adjustment* and leave the accumulated empirical evidence open to alternative interpretations. Furthermore, the extant literature views MOF as a characteristic of individual behavior. This view rests on the empirical evidence that the *supply line underweighting* factor β , which is the relative weight of the supply line (orders already placed and yet to be delivered)

relative to in-hand stock, is less than the normative value of 1 (e.g. Sterman, 1989b; Croson & Donohue, 2006; Croson, Donohue, Katok, & Sterman, 2014; Narayanan & Moritz, 2015). The evidence is potentially misleading because it is based on aggregate averages across participants, a methodological approach that Lau, Hasija, and Bearden (2014) find questionable. If a sample comprises 50% famished persons weighing 100 pounds and 50% obese persons weighing 300 pounds, the average weight is 200 pounds. However, this average is not representative of the sample and describes a type of participant that does not exist (this is derived from an example in Savage (2009) cited in Lau et al. (2014)). Niranjan et al. (2011) identified similar concerns regarding empirical support for MOF: the coefficient β held values in the hypothesized direction (positive) for only approximately half of the participants; for the rest, the values were negative. This empirical anomaly warrants further study.

Furthermore, the bulk of the empirical evidence for MOF has emanated from the SCM literature (Forrester, 1961; Sterman, 1989b), which is based on the Western context. “Most of our paradigms originated from North America in the 1950s to the 1980s, inspired by the empirical phenomena and cultural, philosophical, and research traditions of the time” (Barkema, Chen, George, Luo, & Tsui, 2015). The prevailing institutional environment fundamentally alters the way buyer-supplier transactions occur because supply chains are embedded in the macro-social context in which they operate (McFarland, Bloodgood, & Payan, 2008). One of the tenets of SCM is contracting to align conflicting goals amongst the constituent members (Lariviere, 2016). In developed countries, legal institutions operate silently and invisibly to the extent that they are seldom noticed (Meyer, Estrin, Bhaumik, & Peng, 2009; Bai, Sheng, & Li, 2016), whereas emerging economies are characterized by weak legal institutions and poor contract enforceability (Hoskisson, Eden, Lau, & Wright, 2000; Mesquita & Lazzarini, 2008; Zhou & Poppo, 2010). For example, it would take the Indian courts at least 450 years to clear the backlog of over 30 million cases (Biswas, 2013), or 35 years “if the nation’s judges attacked their backlog nonstop—with no breaks for eating or sleeping—and closed 100 cases every hour, according to *Bloomberg Businessweek* calculations” (Lasseter, 2015). Despite such starkly different institutional environments, an institutional contingency perspective is missing in the literature (Bai et al., 2016).

Juxtaposition of these gaps leads to the question of *how overreaction manifests in emerging economies like India, with the concomitant legal inefficiencies and cultural issues*. In addressing this question, a case study (Study 1) uncovered an idiosyncratic *supply line discounting* behavior and the subsequent actions the firm took to mitigate it. The second case study analytically replicates that behavior (Study 2). Study 3 reports the eye tracking experiment inspired by the case studies, which explicates and validates the emergent behavior.

Note: the full, peer-reviewed paper can be obtained from the author.