



Production, Manufacturing and Logistics

Modeling and analysis of the multiperiod effects of social relationship on supply chain networks

Jose M. Cruz ^{a,*}, Zungang Liu ^b^a Department of Operations and Information Management, School of Business, University of Connecticut, Storrs, CT 06269-2041, USA^b Department of Business and Economics, Pennsylvania State University, Hazleton, PA 18202, USA

ARTICLE INFO

Article history:

Received 4 April 2010

Accepted 23 March 2011

Available online 29 March 2011

Keywords:

Supply chain management

Social relationship

Risk management

Network equilibrium

Pricing

Multicriteria decision-making

ABSTRACT

In this paper, we analyze the effects of levels of social relationship on a multiperiod supply chain network with multiple decision-makers (suppliers, manufacturers, and retailers) associated at different tiers. The model incorporates the individual attitudes towards disruption and opportunism risks and allows us to investigate the interplay of the heterogeneous decision-makers and to compute the resultant network equilibrium pattern of production, transactions, prices, and levels of social relationship over the multiperiod planning horizon. In our analysis, we focus on the following questions: (1) how do the evolving relationships affect the profitability and risks of supply chain firms as well as the prices and demands of the product in the market? (2) how do the relationships with the upstream supply chain firms affect the relationships with the downstream firms, and how these relationships influence the profitability and risks of the supply chain firms? (3) how do the supply disruption risks interact with the opportunism risks through supply chain relationships, and how these risks influence the profitability of the firms? The results show that high levels of relationship can lead to lower supply chain overall cost, lower risk, lower prices, higher product transaction and therefore higher profit.

© 2011 Elsevier B.V. All rights reserved.

1. Introduction

In recent years supply chain partnerships and alliance relationships have become increasingly important, as companies need to minimize their costs and maximize their opportunities on the market. Supply chains are embedded in a complex network of relationships with suppliers, customers as well as a number of other stakeholders. According to Croom et al. (2000), without a foundation of effective supply chain organizational relationships, any effort to manage the flow of information or materials across the supply chain is likely to be unsuccessful. To help the understanding of the issue of relationship in supply chain, in this paper, we analyze the effects of levels of social relationship on a multiperiod supply chain network in the presence of disruption risk and opportunism risk. In our analysis, we focus on the following questions: (1) how do the evolving relationships affect the profitability and risks of supply chain firms as well as the prices and demands of the product in the market? (2) how do the relationships with the upstream supply chain firms affect the relationships with the downstream firms, and how these relationships influence the profitability and risks of the supply chain firms? (3) how do the supply

disruption risks interact with the opportunism risks through supply chain relationships, and how these risks influence the profitability of the firms?

Relationship issues surrounding supply chains have been a topic of high interest in the disciplines of sociology, marketing; specifically, relationship marketing, and economics. For example, embeddedness theory (cf. Granovetter, 1985; Uzzi, 1996 among others) attempts to explain the effects that relationships play in different economic actions, including financial transactions (see, e.g., Uzzi, 1998). Uzzi (1997) suggest that the most important features of companies' embedded ties are trust, information exchange and joint problem-solving arrangements. Jones et al. (1997), in turn, stressed that it is necessary to further concretize the results of the embeddedness theory. They described the conditions under which interfirm coordination can emerge by integrating transaction cost economics and social network theory. In the context of relationship marketing (cf. Ganesan, 1994; Bagozzi, 1995), on the other hand, researchers have tried to illuminate the motivation of sellers and buyers who actively seek relationships in the context of B2B (see, e.g., Wilson, 1995) or B2C commerce (see, e.g., Sheth and Parvatiyar, 1995). Different attempts to classify relationship structures have been made (see, e.g., Donaldson and Toole, 2000). Economists are especially concerned about determining the importance of the economic characteristics that characterize specific buyer and seller relationships and the role of transaction costs in

* Corresponding author. Tel.: +1 860 486 2317; fax: +1 860 486 4839.

E-mail addresses: jcruz@business.uconn.edu, jose.cruz@business.uconn.edu (J.M. Cruz), zungangliu@psu.edu (Z. Liu).

determining the cost-minimizing governance structure for exchange (Joskow, 1988).

The value of relationship is not only economical but also technical and social (Gadde and Snehota, 2000). Strong supply chain relationships enable firms to react to changes in the market, create customer value and loyalty, which lead to improve profit margins (Flint, 2004). The benefits are reduction of production, transportation and administrative costs. On the technical development the greatest benefit is the possibility of sharing the resources of suppliers and shortening the lead-times. Spekman and Davis, 2004 found that supply chain networks that exhibit collaborative behaviors tend to be more responsive and that supply chain-wide costs are, hence, reduced. These results are also supported by Dyer, 2000 who demonstrated empirically that a higher level of trust (relationship) lowers transaction costs (costs associated with negotiating, monitoring, and enforcing contracts). Baker and Faulkner, 2004 present an overview of papers by economic sociologists that show the important role of relationships due to their potential to reduce risk and uncertainty. Uzzi, 1997 and Gadde and Snehota, 2000 suggest that multiple relationships can help companies deal with the negative consequences related to dependence on supply chain partners. Krause et al., 2007 found that buyer commitment and social capital accumulation with key suppliers can improve buying company performance. However, Christopher and Jüttner, 2000 indicate that the value of the relationship depends on the substitutability of the buyers or sellers, the indispensability of goods, savings resulting from partner's practices and the degree of common interest. In this paper we analyze the effects of relationships on a multitiered, multiperiod supply chain network in the presence of disruption risk and opportunism risk.

Supply chain disruptions and the associated risk are major topics in theoretical and applied research, as well as in practice, since this risk can affect the entire supply chain network. Craighead et al., 2007 have argued that supply chain disruptions and the associated operational and financial risks are the most pressing issue faced by firms in today's competitive global environment. The results of Hendricks and Singhal, 2005 analysis of 800 instances of supply chain disruptions illustrated the impact of supply chain disruptions. They found that the companies that suffered supply chain disruptions experienced share price returns 33 percent to 40 percent lower than the industry and the general market benchmarks. Furthermore, share price volatility was 13.5 percent higher in these companies in the year following a disruption than in the prior year. Indeed, supply chain disruptions may have impacts that propagate not only locally but globally and, hence, a holistic, system-wide approach to supply chain network modeling and analysis is essential in order to be able to capture the complex interactions among decision-makers. To-date, however, most supply disruption studies have focused on a local point of view, in the form of a single-supplier problem (see, e.g., Gupta, 1996; Parlar, 1997) or a two-supplier problem (see, e.g., Parlar and Perry, 1996). Very few papers have examined supply chain disruption risk management in an environment with multiple decision-makers (cf. Tomlin, 2006) while taking in consideration relationship issues. For a comprehensive review of supply chain risk management models to that date, please refer to Tang, 2006. We believe that it is imperative to study how the supply disruption risks interact with the opportunism risks through supply chain relationships, and how these risks influence the profitability of the firms. Towards that end, in this paper, we take an entirely different perspective, and we consider, for the first time, supply chain disruptions risk and opportunism risk in the context of multiple period, multi-tiered supply chain networks with multiple decision-makers under equilibrium conditions.

In terms of opportunism risk, according to Vandenbosch and Sapp, 2010 today's complex supply chains are vulnerable to oppor-

tunistic behavior. They point out that supply chain decision makers far from the end consumers tend to optimize their local goals rather than the entire supply chain. They conclude that that the longer the supply chain, the higher is the risk of opportunism. Wathne and Heide, 2000 suggested that opportunism behavior include falsification of expense reports (Phillips 1982), breach of distribution contracts (Dutta et al., 1994), bait-and-switch tactics (Wilkie et al., 1998), quality shirking (Hadfield, 1990), and violation of promotion agreements (Murry and Heide, 1998). For example, opportunism in the form of quality shirking means that a party is withholding efforts, or passively failing to honor an agreement (Wathne and Heide, 2000). According to Williamson, 1985, Williamson, 1996, if the risk of opportunism in a particular relationship is sufficiently high, considerable resources must be spent on control and monitoring, resources that could have been deployed more productively for other purposes. In addition, the risk of opportunism may produce substantial opportunity costs in the form of "valuable deals that won't be done" (p.164 Calfee and Rubin, 1993). Moreover, Wathne and Heide, 2000 suggested that risk of opportunism between exchange partners creates trading difficulties. In this paper we focus on opportunism risks through supply chain relationships and how these risks influence the profitability of the firms.

This paper models the multicriteria decision-making behavior of the various decision-makers in a multiperiod supply chain network, which includes the maximization of profit and the minimization of risk through the inclusion of the social relationship, in the presence of both business-to-business (B2B) and business-to-consumer (B2C) transactions. Wakolbinger and Nagurney, 2004 and Cruz et al., 2006 developed a framework for the modeling and analysis of supply chains networks that included the role that relationships play. Their contribution was apparently the first to introduce relationship levels in terms of flows on networks, along with logistical flows in terms of product transactions, combined with pricing. However, their models were a single period models and hence did not consider multiple period effects of relationship levels on supply chains network and their disruption and opportunism risks. In terms of multiple period supply chain network models and single period supply chain dynamics Cruz and Wakolbinger, 2008 and Cruz, 2008, Cruz, 2009, respectively, studied the effects of corporate social responsibility on risk. Nagurney et al., 2005 develop a single period supply chain networks model with supply side and demand side risk. However, these preview published research did not consider multiple period effects of relationship on supply chain network opportunism and disruption risks.

We describes the role of relationships in supply chain networks over time. We assume that the firms in the same tier (e.g. all manufacturers in the second tier) compete in a non-cooperative manner. The firms in different tiers (e.g. suppliers in the first tier and manufacturers in the second tier) need to cooperate in order to complete transactions and establish relationship. Decision-makers in a given tier of the network can decide on the relationship levels that they want to achieve with decision-makers associated with the other tiers of the network in order to maximize profit and minimize risk. Establishing/maintaining a certain relationship level induces some costs, but may also lower the risk. We explicitly describe the role of relationships in influencing risk. Both the risk functions and the relationship cost functions are allowed to depend on the relationship levels. Hence, we truly capture the timing and location of investments in social relationships, and their impact on product flows, price, risk and profit.

This paper is organized as follows. In Section 2, we develop the multitiered, multiperiod supply chain network model. We describe decision-makers' optimizing behavior and establish the governing equilibrium conditions along with the corresponding variational inequality formulation. We conclude the paper with Section 4 in

Download English Version:

<https://daneshyari.com/en/article/478490>

Download Persian Version:

<https://daneshyari.com/article/478490>

[Daneshyari.com](https://daneshyari.com)