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DISRUPTION COORDINATION OF CLOSED-LOOP SUPPLY CHAIN NETWORK (I) – MODELS AND THEOREMS –

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Abstract. *To investigate how to coordinate the complicated supply chain, a closed-loop supply chain network is studied, which consists of a single supplier and multiple demand markets. Further detailed, in every market, there exist many retailers and one third party logistics (TPL) entity. Three kinds of situations are considered, theoretically, when the supply chain network is disrupted by sudden, disruptive events. Firstly, in the case of the deviation of a market's demand scale being negative and great, it has been proved not optimal for the supply chain network that the retail price be raised blindly to reduce the demand, so the buyback contract is feasible for coordination so that the TPL can buy the remaining products back from the local market and then sell these products to the supplier. Secondly, while the deviation is positive and also great, that is to say the quantity of current products in sales cannot satisfy the increased demand, then, with a quantity discount policy, more products should be replenished by the TPL from the supplier to the disrupted market. And finally, when the deviation is smaller and smaller, neither the buy-back contract nor the quantity discount policy is necessary, but it would be possible to coordinate the supply chain network so that the retail price could be altered appropriately.*
Keywords: Closed-loop supply chain, Quantity discount, Buy-back contract, Disruption coordination

1. **Introduction.** With the development of economic globalization, more and more indeterminate factors affect the supply chain, such as improvements in technology and intense competition. Besides, emergency events occur frequently, which make predetermined contract plans lose effectiveness and even threaten the subsistence and development of supply chain partners, e.g. the 9/11 terrorist event, SARS, avian influenza, and so on.

Prior related research works were made in References [1-4]. The papers mentioned above depend on the assumptions that demand is deterministic and that the supplier has perfect information regarding the price-demand relationship. However, perfect market information is rarely available in practice. Moreover, for the coordination of a closed-loop supply chain, in general, previous literature has always considered that the market demand for a retailer only depends on his own price, not on the other retailers' price such as [5,6]. Only some of the literature has considered the case with competing retailers, which can be found in [7-10].

Disruption management was first proposed by Clausen et al. in 2001, and then it has been developed quickly [11]. [12,13] considered a two-stage production and inventory system with raw material supply disruptions that result in fluctuations in production cost. Reference [14] applied the disruption management to the supply chain management. A lot of work has been done in [15-18], who studied the coordination of the supply chain with demand disruption and considered a price-subsidy rate contract to coordinate the