Supply Chain Expansion and Integration

The last two decades have witnessed a radical movement from centrally-managed supply chains towards globally decentralized supply chains. With the advancements in information technologies and reduced barriers in global trade, supply chains are expanding so that retailers can buy products from a larger collection of suppliers, and suppliers can sell to a larger number of retailers in different regions of the world (Malhotra et al. 2007). These factors transform local supply chains where only a handful of firms transact into integrated supply chains where a multitude of firms transact. With more firms transacting, firms’ ability to influence prices (hereinafter, market power) changes. Considering firms’ market power, we examine the impact of supply chain expansion and integration on firms’ and supply chains’ profits.

Various factors stimulate the supply chain expansion and integration. For example, information technologies such as standard electronic business interfaces (SEBIs) facilitate the supply chain expansion by reducing transaction costs between firms (Malhotra et al. 2007). Similarly, economic unions such as the European Union (in short, EU) or trade agreements such as the EU Customs Union and North American Free Trade Agreement substantially reduce transaction costs (e.g., taxes on imports and exports) across countries. When transaction costs between two local supply chains decrease sufficiently, suppliers of each supply chain start transacting with retailers of the other supply chain, leading to an integrated supply chain. For example, since Turkey entered the EU Customs Union in 1995, Turkish-specialty-food (e.g., sausage and pastrami) suppliers such as Aytac and Baktat have started selling to retailers in different regions of Europe. Consequently, these Turkey-based suppliers have started competing with Europe-based suppliers such as Egeturk (based in Germany) and Gima (based in the United Kingdom (in short, UK)), expanding the European Turkish-specialty-food supply chain. More generally, after it is established in 1993, the EU Single Market Programme facilitated the integration of supply chains across Europe. As opposed to integration, we may also observe disintegration after the recent decision of the UK to leave the EU, popularly known as “Brexit.” If the UK leaves the EU Single Market after Brexit, supply chains that span both the UK and the rest of the EU may disintegrate. How this disintegration may affect the UK and the rest of the EU is an important open question.

The supply chain expansion that increases the number of suppliers or retailers in a supply chain reduces each supplier’s seller power or each retailer’s buyer power, respectively. In the supply
chain literature, most notably, Corbett and Karmarkar (2001) aim to study the impact of market power on supply chains by posing the following research question: “What is the effect of “buyer power” or “supplier power” on prices, quantities, and profits for contiguous and for noncontiguous tiers in the supply chain?” (page 967). Although their Cournot-competition model successfully captures suppliers’ seller power, it does not capture retailers’ buyer power because it treats retailers as price takers having no influence on the wholesale price retailers pay to suppliers. Yet, retailers’ influence on the wholesale price is not only intuitively appealing, but also empirically proven and frequently observed in practice. For example, Shea (1993) empirically proves the retailer’s impact on the wholesale price by using data from 26 manufacturing industries in the US, and OECD reports in 1998 and 2008 on buyer power and UK Competition Act in 1998 document the retailer’s impact on the wholesale price in the US, EU, and UK. Although several papers have followed the lead of Corbett and Karmarkar (2001) in studying supply chain competition, the impact of buyer power on prices, quantities, and profits is still an important open question.

In this paper, we examine the impact of the supply chain expansion and integration on firms’ and supply chains’ profits when multiple suppliers and multiple retailers compete in a wholesale market. In particular, we aim to answer the following research questions: (Q1) How does buyer power and seller power affect prices and quantities in a supply chain? How do these results differ from the results of the prior literature that considers only seller power? (Q2) How does the supply chain expansion to include more suppliers or more retailers affect the profit of each supplier, each retailer, and the supply chain as a whole? (Q3) How does the integration of two local supply chains affect the profit of each supplier and each retailer, and the total profit of firms in each local supply chain as well as the profit of the integrated supply chain?

To answer these questions, we propose a novel competition model based on a market-game mechanism (cf. Shapley and Shubik 1977). In our two-tier supply chain model, multiple suppliers compete to sell to multiple retailers through a wholesale market. Both suppliers and retailers make their decisions by considering their impact on the wholesale price. In this sense, our model captures both suppliers’ seller power and retailers’ buyer power. Our analysis indeed shows that a larger number of retailers raises the wholesale price because it reduces each retailer’s buyer power. Although this result is intuitive and consistent with practice, it could not be shown under Cournot competition. Thus, the competition model that captures both suppliers’ seller power and retailers’
buyer power is crucial in studying the supply chain expansion and integration.

The analysis of our market-game model provides the following insights into the supply chain expansion. First, we show that having more retailers in a supply chain raises the supplier profit because each retailer is willing to pay more for her order when her buyer power decreases. The increased payment from retailers leads to increased competition among suppliers and induces suppliers to produce more. Thus, somewhat surprisingly, having more retailers in a supply chain can increase the retailer profit, especially when the number of suppliers is large. In contrast, we show, intuitively, that having more suppliers in a supply chain reduces the supplier profit. Second, we show that the supply chain efficiency is increasing and concave in the number of suppliers and retailers. This result suggests that reducing barriers for expansion (e.g., by standardizing electronic business interfaces or by reducing trade barriers) is beneficial, especially to small supply chains.

In addition, we show that the profit of the integrated supply chain is greater than the sum of total profits of local supply chains prior to integration. This result suggests that the total profit of firms in European supply chains may have increased with the EU Single Market. However, we find that whether each local supply chain benefits from integration depends on whether these supply chains are supplier-oriented (i.e., with more suppliers than retailers) or retailer-oriented (i.e., with more retailers than suppliers). Specifically, when both local supply chains are retailer-oriented or supplier-oriented, their integration raises the total profit of firms in both supply chains. In contrast, the total profit of firms in a more retailer-oriented supply chain (than the other supply chain) may decrease after integration, and by the same reasoning, it may increase after disintegration.

We illustrate our result using data from the EU. According to the data, the UK is more retailer-oriented than the rest of the EU. This suggests that supply chains in the UK may enjoy larger profits after Brexit, although supply chains in the rest of the EU may lose profits.

References